# Currency Mismatches, Balance Sheet Effects and Hedging in Chilean Non-Financial Corporations[1]

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# 1 Introduction

After the Tequila crisis in 1994-95 and the East Asian crisis in 1997, many observers have raised questions on the role of exchange rate and monetary policies in the context of crisis management in emerging market economies (Goldstein and Turner, 2004).

In conventional open economy models a la Mundell-Fleming, exchange rate depreciations are assumed to have an expansionary effect on domestic output. A decline in the value of the peso, reduces the marginal production costs of domestic firms in dollars, improves their competitiveness against foreign firms therefore increasing profits, output and, if sustained, installed capacity. In the face of a contraction of foreign demand or a reduction of international liquidity, monetary authorities should reduce domestic interest rates and let the exchange depreciate in order to stabilize output and inflation.

However, the conventional result of exchange rate depreciations may be reversed when domestic firms carry substantial amounts of un-hedged dollar debt in their balance sheets. This "new" view of depreciations is centered on the micro level and pays particular attention to the (changing) credit constraints facing firms during periods of exchange rate instability. The main assumption is that the cost of external funds is decreasing in firm net worth. A depreciation, therefore, not only has the usual effects on aggregate demand but also deteriorates net worth by inflating the domestic-currency value of debt. Holding all else fixed, we expect that the higher indebtedness leads to an increase in the cost of external finance and to a reduction in investment[1].

The key mechanism, therefore, is that a depreciation inflates the peso value of dollar debt and the resulting weakening of balance sheet positions prevents firms from investing and expanding. Consequently, the expansionary effect which a depreciation is typically assumed to have, may be attenuated or even reversed because of the behavior of firms that are highly leveraged in dollars. Indeed, many of the results derived in this literature rely not only on the existence of this particular net-worth effect, but also require it to be large enough for depreciations to be contractionary. For example, in the work of both Krugman (1999a, 1999b) and Aghion, Bacchetta, and Banerjee (2001), it is the strongly *negative* relationship between investment and depreciation that generates multiple equilibria, and hence the potential for an expectations-driven crisis. Not surprisingly, the policy implications of this literature also depend crucially on the net effect of depreciations on firm investment. A tight monetary policy and dogged defense of the currency, for example, is the recommended response to a negative external shock only if a depreciation will further reduce output.

Given their potential implications for aggregate vulnerability and optimal monetary policy, measuring the size and effects of these mismatches should be a priority for policy makers in emerging market economies. A second priority should be to understand the micro and macroeconomic determinants of these mismatches. The role of monetary and exchange rate policy is particularly relevant. On the one hand, by changing domestic interest rates, monetary policy alters the relative costs of domestic and foreign debt. On the other, by changing the perceived risk on foreign currency debt, exchange rate policy alters the relative risks of foreign currency borrowing.

What do we know so far regarding the level and **effects** of currency mismatches?

[1] Krugman (1999a) presents a stylized version of this effect, while Aghion, Bacchetta, and Banerjee (2001) and Céspedes, Chang, and Velasco (2000) incorporate this mechanism into more fully articulated models.

At the macro level ,there is a substantial literature that documents the high levels of foreign currency debt in those countries in East Asia that experienced a financial crisis in the late 90s (see for example McKinnon and Pill (1998)). In addition, recent papers have attempted to identify the effects of aggregate measures of dollar debt on the likelihood of financial crisis or on the response of output and investment to currency depreciations. On the one hand, Arteta (2003) fails to find a significant correlation between dollarization in the domestic banking system and the likelihood of a banking crisis. On the other hand, Céspedes (2004) finds that depreciations become increasingly contractionary as the level of foreign debt increases and Levy-Yeyati (2003) finds that domestic financial dollarization is positively correlated with volatility of output growth.

There is a also growing empirical literature that focuses on the determinants and effects of currency mismatches using firm level data. The existing evidence on the effects of holding foreign currency debt in a depreciation in this literature is mixed (see Bleakley and Cowan (2002), Galindo, Panizza and Schiantarelli (2003), Luengnaruemitchai (2004) and table 1). Although for some countries there is evidence that firms that hold more foreign currency debt suffer relatively more at times of devaluation, in many other countries the differential effect is mixed, non significant or even positive.

Two possible explanations have been advanced for these ambiguous results.

The first is that the balance sheet effect is alive and kicking, but that the existing literature is simply not measuring it adequately because of an omitted variable bias. The cause of this bias is firm matching. If firms holding dollar debt are also those whose income is positively correlated with the exchange rate then there is no reason to believe that these firms will fare any worse in a depreciation than their counterparts. Indeed, most firm level studies find that firms match the currency composition of their incomes with that if their liabilities. The main exceptions to this are Argentina, Peru and Mexico prior to the 1995 crisis. In other countries, firms holding higher shares of dollar debt are also firms whose income we would expect a-priori to be more positively correlated with the real exchange rate - be it because they operate in a tradeable sector, or because the directly export a share of their sales[2].

If firms are actively hedging their currency exposures, balance sheet estimates obtained from dollar debt as a proxy for currency mismatches will be biased upwards, as this variable will be positively correlated with unobserved variables that explain the sensitivity of the firm´s net revenues, assets or derivatives to the exchange rate. The size of the bias will depend on the extent of currency hedging across firms. Therefore, in those countries in which firms match, having detailed data on the currency composition of assets, liabilities, income streams and (potentially) derivative positions, becomes crucial if we are to adequately measure either the level of currency mismatch or the effects of this exposure on output and investment.

The second explanation for the weak results for balance sheet effects is that for those firms who choose to be exposed to currency mismatches, balance sheets are simply not relevant. This would be the case if those firms taking on higher exposure are less credit constrained, or have no future investment opportunities. This issue is addressed in detail in the corporate finance literature on hedging of aggregate risks.

Absent financial market imperfections, the structure of corporate liabilities has no effect on firm

[2] A series of studies have also found that (even after controlling for export share and sector) the profits (or stock prices) of those firms holding dollar debt are more correlated with the real exchange rate

production decisions or valuation[3]. Research on corporate finance, however, suggests that several capital market imperfections can create incentives for firms to hedge their risk exposures, including foreign currency risk. Following the taxonomy by Geczy, Minton, and Schrand (1997), incentives for hedging come from some concavity on the profit function that can arise at the level of managers, equity holders or debt-holders.[4] Most important for our purposes, exogenous bankruptcy costs can lead to a positive relationship between the cost of external debt and the variance of a firm's cash flow.

Froot, Sharfstein, and Stein (1993) endogenize the cost of financial distress as lost investment opportunities. Consequently, firms that have either greater growth opportunities or are more likely to become financially distressed have more to gain from reducing the volatility of their cash flow. Therefore, all else equal, a firm's exposure to foreign currency risk should decrease with variables that proxy for investment opportunities (the market to book value ratio, lagged values of capital expenditures etc.) with variables positively correlated with liquidity risk (the debt leverage ratio, and the inverse of the interest coverage ratio and liquidity ratios). This being the case, we would expectd the effects of a currency mismatch of firm investment to be smaller for those firms holding more dollar debt, as it is thse firms that have "less to loose" from exchange rate exposure.

On the whole existing studies for firms in the US find evidence supporting the theories discussed above. On the other hand, the only empirical study that concentrates exclusively on hedging by emerging market firms, finds very limited support for any of the above explanations.

Most of the existing literature is for US corporations. Gezcy et al (1997) examine currency derivative use for 372 of the fortune 500 non-financial corporations. They find that derivative use is positively correlated with investment opportunities (measured by R&D expenditure) firm size and an interaction between firm leverage and the market to book ratio (investment opportunities), and negatively related with firm liquidity (quick ratio). The authors also find a positive relationship between the decision to use currency derivatives and currency exposure (as measured by foreign sales or direct trade). Allayanis and Ofek (1998) use a similar sample (the entire fortune 500 corporations) to analyze currency hedging decisions of US corporations. They find that firms use either derivatives or foreign debt to hedge income exposure (as measured by foreign sales). They also find that the decision to hedge (but not the level of hedging) is correlated with firm size and R&D expenditures. A more recent paper by Graham and Rogers (2002) investigates tax incentives for hedging in 442 non-financial US firms with foreign currency exposure (foreign currency assets, sales or debt). They estimate the derivative and leverage decisions of firms simultaneously, and find

[3]The theoretical corporate finance literature does not provide clear cut answers on why and how much should firms hedge their foreign currency exposure. If the CAPM and Modigliani-Miller propositions hold, there would be no value for firms in reducing the variability of their net income or net worth. Under these conditions, the firm's choice of their currency debt will be only driven by the differences in the cost of borrowing in domestic or foreign currency. If uncovered interest parity holds and macroeconomic interest rate differentials are fully compensated by market expectations on the exchange rate, the choice of foreign currency debt will be related only to firm specific factors that determine the relative cost of borrowing at home or abroad: size relative to local banks and other intermediaries; foreign ownership; availability of suppliers credit.

[4]At the managerial level, risk-averse managers who allocate a significant portion of their wealth to hold firm's shares will choose to hedge the foreign currency risk or any other market risk at the firm level when it is less costly than doing it at his own account If managers are paid through stock options, their expected utility may increase on the variabiliy of firms expected cash flows. (Smith and Stulz, 1985). At the equityholder level, tax credits may create a progressive tax schedule for corporates (ie. a concavity on the expected profit function of the firm) and thus create incentives for hedging different types of risk. (Smith and Stulz, 1985)Also if managers have private information about an unobservable risk that affects the firm's payoffs, Hedging may help to devise an optimal incentive structure. (De Marzo and Duffie, 1991)

that the net derivative position of firms subject to ex-ante currency or interest rate risk is positively correlated with leverage, the market to book ratio, and the interaction of these two variables.

We are aware of two cross country studies that explore derivative use in non financial firms. Bartram et al (2002), use data on over 7000 firms from 48 countries for currency, interest rate and commodity derivatives[5]. In line with previous results, they find that the likelihood that a firm uses currency derivatives is higher if the firm has forex exposure from foreign sales,is cross listed or has foreign debt. Unlike results for the US, this last coefficient suggests that foreign debt (on average) creates rather than reduces exposure. Firms with higher leverage and lower quick ratios are also more likely to use derivatives - lending support to the liquidity theories of hedging. Moreover, the investment opportunities view receives some support: the interaction between market to book and leverage is positive. The only cross country study that focuses exclusively on emerging markets is Allayanis et al (2001) which studies the currency hedging practices of non-financial firms from 8 East Asian countries over the period 1996-1998. In contrast to the US studies, they find limited support for existing theories of derivative use: liquidity constrained firms with higher investment opportunities do not hedge significantly more in their sample. They also document that firms in East Asia use foreign cash incomes as a substitute for derivative hedging. At the country level, they argue that firms hedge selectively: in countries with a large interest rate differential hedging is lower, suggesting that firms trade off the risks of currency exposure with the benefits of cheap foreign credit.

Several recent papers have also examined the impact of derivatives on risk, investment and value. On the one hand, Guay (2003) and Allayanis and Ofek (1998), find that derivatives reduce exchange rate risk (as measured by the sensitivity of firm stock returns to changes in the exchange rate). Along similar lines, Allayanis and Mozumbdar (2001) find that derivatives reduce the sensitivity of firm investment to cash flow. On the other hand, Allayanis et al (2001) find that East Asian corporations that hedged exchange rate risk fared just as poorly as the non-hedgers during and after the crisis. Finally, another approach looks at the effects of derivatives on firm value. Allayanis and Weston (2001) argue that derivative use increases firm value as measured by alternative specifications of tobin's q, while Bartram el at (2003) find similar results only for interest rate derivatives.

Taken face-value, the relationship between hedging and the costs of financial distress, implies that, even if we are able to come up with a better measure of currency exposure at the firm level, balance sheet effects may remain hard to find empirically. The endogeneity of hedging behavior across firms will create an additional bias towards zero in the estimation of the average balance sheet effects across firms. Those firms that are relatively more exposed to a depreciation of the local currency will also be less vulnerable to financial distress, and therefore less likely to face negative balance sheet effects at the time of a depreciation.

The overall discussion so far suggests that, if firms in emerging markets internalize the risk of a currency mismatches, then the empirical relevance of dollar debt may be smaller than expected. First of all, firms will match the currency composition of their liabilities with that of their income, effectively hedging a substantial component of their debt. Second, those firms choosing to carry higher currency mismatches on their balance sheet will be firms whose investment or output decisions are less vulnerable to fluctuations in their net worth.

What do we know so far regarding the **determinants** of currency mismatches?

[5] Note however that most of the sample is OECD economies - so that results are mainly driven by these.

There is much less empirical work on the cross country determinants of currency mismatches. At the micro level, there is only one paper that explicitly looks at the effects of macro policy (specifically exchange rate policy) on the level and distribution of dollar debt in emerging markets. Using firm level data from Mexico, Martinez and Werner (2001) analyze how floating the exchange rate in 1995 impacted the debt composition decision of Mexican firms. The find, that post float matching between exports and foreign currency debt increases significantly.

At the macro level, a series of recent papers have looked at the effect of domestic dollar debt on the exchange rate policy. The main finding of this literature is that financial dollarization leads to exchange rate rigidity[6]. Although this "fear of floating" literature argues that it is dollarized debt (and implicitly mismatches) that conditions optimal exchange rate policy, the empirical results presented are correlations, and therefore can equally well be interpreted as the effect of exchange rate regimes on dollar debt holdings. Looked at this way this literature finds that countries with more rigid exchange rate regimes have higher levels of dollarization in the domestic banking system. Finally, using data on bank loans and deposits for a broad sample of countries, Arteta (2002) finds that flexible exchange rate regimes are correlated with lower loan and deposit dollarization.

This paper contributes to the existing empirical literature in three ways. First of all, we assemble a database which allows us to build more comprehensive measures of currency exposure. In addition to data on foreign currency debt our dataset also incorporates data on firm level exports, foreign currency assets and foreign currency derivative positions. This data should allow us to correct for the omitted variables discussed above. Second, we explicitly look at differences in exposure across variables that the corporate finance literature has argued (or shown) to be correlated with firm level risk aversion. Finally, by looking at firm level data for Chile over the period 1995 to 2003 we identify changes in the level and distribution of dollar debt across two distinct policy regimes. Pre 1999 Chile had an exchange rate band and therefore an explicit commitment to exchange rate stability. Post 1999, the Central Bank has allowed the exchange rate to float freely.

What do we find?

As in previous studies for Chile, we find that in periods following a depreciation firms with higher dollar debt do not underperform their peso counterparts. However, once we adequately control for differences in the currency composition of assets and income, and net derivative positions, we find a significant balance sheet effect. In other words, we find that when correctly measured currency mismatches matter. In addition, we find that derivatives play a role in insulating firm level investment from exchange rate shocks and that the balance sheet effects are (weakly) smaller for firms we categorize a-piori as less credit constrained.

In line with previous studies, we also find evidence of currency matching in Chilean corporates. Firms in Chile are aware of the risks associated with open currency positions and choose the currency composition of their debt and their derivative positions accordingly. They do this by matching the currency composition of their debt with that of their income and assets, and by taking on derivatives if no "real" hedge is available. This last result (that firms use derivatives as substitute for real hedges) is in line with previous results for Asia by Allayanis et al (2001).

[6] There is a related literature on financial dollarization, that has looked at determinants of domestic financial dollarization. (see Levy-Yeyati 2003, De Nicolo et al 2003) Broadly speaking this literature concentrates on the impact of monetary policy credibility (via the relative variances or inflation and the real exchange rates) on financial dollarization in the domestic banking system. In countries in which inflation is volatile vis-a-vis the real exchange rate, contracts tend to be written in dollars to reduce ex-post price risk.

We also find that "exposure" – as measured by deviations of dollar-debt net of derivatives from the levels predicted by a simple regression between debt, assets and exports– is positively correlated with measures of credit constraints (or firm risk aversion) and a measure of investment opportunities. We fail to find a positive correlation between exposure and liquidity risk. Our results on exposure, suggest that those firms most exposed to currency risk, are also those better prepared to take this risk.

Finally, we find significant changes in the level of currency exposure after the exchange rate was floated in 1999. This drop is significant even after controlling for a measure of interest rate differentials. We argue that one possible interpretation of these results is due to the effect of higher exchange rate variance on the relative risk of domestic and foreign debt. This being the case, floating exchange rate regimes would reduce exposure, by eliminating an implicit exchange rate insurance and forcing firms to correctly internalize exchange rate risk.

# 2 Currency mismatches, balance sheet effects and hedging in non financial firms

## 2.1 Empirical Strategy

The key equation in our framework is a hedging equation derived from a simple mean-variance framework:

$$\beta^* = \alpha + \frac{\tau + \varepsilon}{\mu \sigma_z} \tag{1}$$

where $\beta$ is the ratio of dollar debt to assets, $\alpha$ is the share of firm assets that produce foreign currency operational income. $\tau + \varepsilon$ is the expected interest rate differential between domestic and foreign currency debt, which we assume has a aggregate component $\tau$ and a firm level idiosyncratic component $\varepsilon$. Finally, $\mu$ is a measure of firm risk aversion and $\sigma_z$ is the variance of the real exchange rate.

In the absence of interest rate differentials ($\tau + \varepsilon = 0$) the firm will choose the currency composition of its debt to match that of its assets (net operational income). However, if there are differential costs between peso and dollar borrowing, they will choose to carry some foreign exchange exposure in their balance sheet in order to reduce their expected borrowing costs. In other words, if there is a gap between domestic and foreign borrowing costs adjusted for expectations ($\tau$) or if the firm has some idiosyncratic advantage that allows it cheaper access to foreign currency debt ($\varepsilon$) then there will be a currency mismatch. For a given interest rate differential, the size of this mismatch is decreasing in the expected volatility of the exchange rate $\sigma_z$ and the degree of "risk aversion" of the firm $\mu$.

We start by measuring the size and significance of balance sheet effects on investment in Chilean firms in section 4. Our specific empirical strategy is to assess whether firms with more dollar debt invest relatively less in the aftermath of a depreciation. We do so by estimating reduced-form equations for fixed-capital investment. The proposed mechanism centers on the interaction of alternative measures of currency mismatch with shifts in the exchange rate, and so the key variable in our analysis in this section is for firm $i$ in period $t$

$$(\text{Foreign debt})_{i,t-1} \times (\Delta \ln \text{Exchange Rate})_t.$$

It is obvious that if firms are behaving according to (1), foreign currency debt will be a bad measure of currency exposure in the balance sheet. If firms systematically match the currency composition of their assets and income $\alpha$ with that of their liabilities $\beta$ then empirical estimates of the balance sheet effects based on dollar debt alone will be biased upwards, as those firms holding higher shares of dollarized debt are also those firms that see the largest increases in profits following a depreciation. With this in mind we augment this basic specification with a series of controls for $\alpha$,using firm level data on exports, foreign assets and net derivative positions.

In section 5, we examine the extent of matching between foreign currency assets, income and liabilities within the cross section of firms in our sample directly. First, we check the relationship between foreign currency debt, net derivative usage and the currency composition of assets and net income at the firm level. Next, in section 5.1.3, we check whether variables that the corporate finance literature has argued are correlated with firm risk aversion ($\mu$) explain deviations in observed debt compositions levels from the "matching" composition. Of course we do not directly observe firm level $\alpha's$, we therefore look at the absolute value of deviations of $\beta$ from the level predicted by the matching equations estimated in the previous subsection and correlated these deviations with proxies for $\mu$.

Finally in section 6, we examine how the change in the macro policy regime that happened in Chile in the late 90´s affected foreign currency hedging by firms. As is evident from equation (1) monetary and exchange rate policy affects the extent of hedging in firms through their impact on the economy-wide interest rate differential $\tau$ and the exchange rate volatility $\sigma_z$. A key component of the new policy regime was the abandonment of the exchange rate band and the adoption of a floating regime for the exchange rate. Indeed, there was an increase in the exchange rate volatility **and** a compression of interest rate differentials. Therefore, we expect that the level of currency exposure of Chilean firms declined after the shift to the floating exchange rate regime in the late 90's. We examine this issue in section 6.2. Further we test whether the decline is be larger for those firms which are more likely to be "risk averse" because of capital market imperfections (work in progress). In the final section we attempt to separate the effects of changes in interest differential from changes in exchange rate volatility after 1999.

# 3 Database

This section describes our sample and main variables.

Our data consist of firm-level accounting information for non-financial corporations in Chile for the period 1995 to 2003. In addition, we have data on firm exports, sectors in which the firms operate and ownership. Our main source of information is the FECUS database of the *Superintendencia de Valores y Seguros* (SVS). The FECUS database has standardized accounting data for all firms categorized as *Sociedades Anonimas Abiertas.* By law these firms must disclose their accounting information using a standardized format (the *Ficha Estadistica Codificada y Uniforme* FECU). We use non consolidated data, so that investments in subsidiaries are reported in a separate account and not as a part of the aggregate stock of fixed assets.

Data on the currency composition of liabilities and assets is not recorded directly in the FECUS, but is reported in the notes attached to each firm's Annual Financial Statistics. These notes are not standardized nor available in an electronic format. Because of this, we start with the data on

foreign currency liabilities assembled by Benavente et al (2003)[7] We then input data on foreign currency assets and derivatives by hand from the notes mentioned above.

For our estimates, we use a sample restricted to the non-financial firms for which foreign-currency data are available. Table (2) shows the number of observations in the final sample per year as well as descriptive statistics for the main variables we use. The size of the sample changes as new firms are incorporated into the SVS database.

Our main measure of firm performance is *investment* in fixed capital, measured as the change in gross fixed assets. Accounting standards in Chile do not allow for revaluations of assets beyond adjustments for CPI, making it possible to separate investment from changes in the accounting valuation of capital goods.

Our main measure of currency exposure is *foreign currency debt* ($D^*$), the book value of foreign currency liabilities converted into local currency. In Chile, accounting standards dictate that conversion of debt from foreign to local currency values be carried out using the exchange rate for the period in which the balance sheet is reported. We augment this variable with a measure of *foreign currency assets* ($A^*$), which is the local currency value of assets indexed to a foreign currency, and the nominal value of outstanding currency derivatives contracts with domestic banks. To our knowledge, this is the first time a comprehensive dataset has been put together for emerging market firms with information on the currency composition of both sides of the Balance Sheet.

One of the main questions we seek to answer in this paper is whether firms match the currency composition of assets and liabilities. To answer this question we construct variables that proxy for $\alpha$. The first is a tradeable dummy, that takes on values of one for firms in agriculture, manufacturing and mining. Data on the sector composition of output is reported in the FECUS. In addition, we add firm level data on FOB export shipments collected from the *Direccion de Aduanas.* We convert the export data from dollars to pesos using the year end exchange rate.

To explore the relationship between investment and currency exposure, we control for additional determinants of investment. The first of these is *earnings*, defined as net operational earnings plus depreciation. Since we wish to identify the effects of leverage (and, in particular, leverage in dollars) on investment, we follow Lang, Ofek and Stulz (1996) and use a measure of earnings that does not depend on the firm's debt choice. This measure of cash flow also excludes gains (or losses) from exchange rate changes, allowing us to isolate the effects of exchange rate fluctuations on revenues and costs from its effects on the valuation of assets and liabilities.

In some specifications we include measures of the book to market value of assets and average q-ratios as control variables. Both of these require data on market capitalization. We obtain this data directly from the Chilean stock exchange. In all cases, the values we use correspond to closing prices and outstanding shares in December.

Data on the use of derivatives at the firm level is scarce in the literature in general, mostly because regulatory entities have imposed the obligation to report this kind of transactions only recently. Chile is no exception. Homogenous data on derivative use from the notes to the Financial Statements is only available since 2001[8]. To overcome this limitation, we obtained access to an

[7] This database is part of a broader effort by the IADB to put together data on firm level currency composition of liabilities. For more details see Galindo et al. (2003).

[8] In October 2000, the *SVS* modified the regulations that define how to report derivative transactions in the complementary notes to the Balance Sheet data. In the new norm, the *SVS* explicitly clarifies the obligation to report derivatives and which information to disclose. Before 2000, the norm was not clear enough to insure that every

additional source of derivative data: the register of notional values of foreign currency derivatives outstanding with Chilean banks ($F^*$). The main advantage of this series is that it is available since 1993. On the other hand, derivative transactions that do not include a domestic bank, are excluded. This seems to be a fairly minor problem in our sample. Differences in 2001 and 2002 between the nominal amounts reported by firms in the notes to their Financial Statements and the notional amounts reported by Banks are minimal.

Even though we use the longer derivatives series from the Central Bank of Chile in all of the regressions, there is interesting additional information on the use of currency derivatives in Chile in the notes to the financial statements. This is because the notes provide contract-by-contract information for all derivative transactions, covering all derivative instruments and underlying assets. Based on the data for the period 2001-2002, we observe three stylized facts we believe are worth mentioning:

1. In Chile derivatives contracts are used primarily to cover exchange rate exposure. In fact, 73% of the total number of contracts reported in the period (385) correspond to foreign currency contracts.
2. The most common instrument used to cover exchange rate risk is the forward. If we restrict our sample to foreign currency contracts, 86% of them are forwards contracts.
3. Derivatives contracts are established over relatively short time periods. The average duration of contracts is less than one year (10 months).

Finally, we build four indicator variables to control for differences in firm ownership. The variable *ADR* measures whether the firm's stock trades in a US stock exchange in the form of American Depository Receipts (ADRs) in any given year. The variable *grupo* is a dummy variable that indicates if a firm is part of an economic conglomerate as defined by the *SVS* in 2003. *AFP* is dummy variable that takes value of 1 if the Pension Funds may hold stock from the firm without restrictions. We construct the variable using information provided by *Superintencia de Administradores de Fondos de Pension (SAFP)*. Broadly speaking, a firm will be considered eligible for AFPs if the firm is a Corporation (*Sociedad Anonima Abierta*) registered in *SVS*. The main exceptions are stocks of: AFPs, insurance companies, mutual fund administrators, investment funds administrators an the stock exchange. The last of the ownership variables is *foreign*, a dummy variable for firms controlled by foreign multinationals. The variable is constructed in two steps. First, we pooled the most recent information from SVS, Economatica and Worldscope on shareholder composition. We then used Lexis Nexis, the corporate affiliations Database and the Mergers and Acquisitions Database to cross-check the nationality of the main shareholder or parent company. Of these four variables, all but *grupo* are time varying.

We modify all accounting variables in the followings ways:

1. We inflate/deflate our data to 1996 values using december-to-december changes in the consumer price index.
2. We drop all firm/year observations if the accounting data are not self-consistent. We do this because data on foreign currency liabilities and assets are inputted by hand. In particular,

single transaction would be informed, leaving this decision up to the firm. In this context, the data that comes from the complementary notes is trustworthy only since 2001.

we drop observations if the ratios of dollar debt over total liabilities, dollar assets over total assets, exports over total sales and short term liabilities over total liabilities are outside the range (-0.1, 1.1). Additionally, we drop observations if the ratio of forward position over total assets is outside of (-1.1, 1.1).

3. Finally, we drop outliers of our key left hand side and right hand side variables. To do so we construct a Z-score using the sample mean and standard deviation, and drop firm/year observations that have |z|>2.

Because we are interested in the effects of a devaluation on firms holding dollar debt, in the analysis below, we interact $D^*$, $A^*$and $F^*$ with changes in real exchange rate, $\Delta e$. Our definition of $e$ (nominal exchange rate against the U.S. dollar scaled by the local CPI) is consistent with the inflation adjustments described above. In all the specifications we report, we measure $\Delta e$ as the log change in the real exchange rate between Decembers of successive years. It is straightforward to show that using $e$ on inflation-adjusted values of debt is equivalent to using the nominal exchange rate on current values. Note that according to this definition, a devaluation leads to a higher value of $e$.

# 4 The Effects of Currency Exposure on Firm Performance

## 4.1 Empirical specification

Our empirical specification in this section can be motivated with a simple framework in which the optimal stock of capital is a function of the real exchange rate (due to the competitiveness effect) and the real value of previous period liabilities (due to a balance sheet effect). Specifically, assume that the optimal capital stock $k_t^*$ is given by

$$k_t^* = \alpha e_t - \theta P_{t-1}$$

where $\alpha$ measures the elasticity of $k^*$ to the real exchange rate, $\theta$ the elasticity of the optimal capital stock to leverage, and $P_{t-1}$is the real (inflation adjusted) value of previous period liabilities. $P_{t-1}$ proxies for the value of net worth $w_1$ in the model presented above. In the presence of quadratic adjustment costs, investment $I_t$ will be a fraction $\lambda$ of the gap between the frictionless capital stock and lagged capital, so that

$$I_t = \lambda(\alpha e_t - \theta P_{t-1} - k_{t-1}) \tag{2}$$

The key mechanism we wish to test is how a depreciation, by inflating the domestic-currency value of debt, alters investment. To incorporate this mechanism in the previous equation, consider that the real value of previous period liabilities will be given by

$$\tilde{P_t} \approx D_{t-1}^* \times \Delta e_t + P_{t-1} \tag{3}$$

where $D_{t-1}^*$ is lagged dollar debt, and $\Delta e_t$ the log change in the real exchange rate. The real value of the firm's debt rises if it holds foreign-currency debt and the exchange rate goes up faster than the domestic-price level. This is, of course, a purely mechanical effect.

Our basic empirical specification (for firm $i$ in year $t$) follows directly from (2) and (3):

$$I_{it} = -\gamma(D^*_{it-1} \times \Delta e_t) + \delta P_{it-1} + \lambda(\alpha_i e_t) - \lambda k_{it-1} + \phi D^*_{i,t-1} + y_t + \omega_i + \upsilon_{it} \quad (4)$$

We estimate versions of (4) on our sample of firms for the period 1995-2003. The key explanatory variable in our analysis is the interaction of lagged dollar debt, $D^*_{i,t-1}$, with the log change in the real exchange rate, $\Delta e_t$.

We can interpret the estimated coefficient on this interaction in two ways. The first follows directly from the framework presented in this section, and is the effect of exogenous changes in the real value of total liabilities on firm investment. The second follows from a difference in difference approach, in which the estimated coefficient on the $(D^*_{it-1} \times \Delta e_t)$ indicates whether firms holding dollar liabilities invest significantly less than their counterparts in periods following a devaluation.

In addition to the $(D^*_{it-1} \times \Delta e_t)$ interaction, we include lagged foreign-currency-denominated debt to absorb 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 expanding firms were more likely to issue dollar debt than stagnant ones. We also include sets of year and firm specific dummies $y_t$ and $\omega_i$.The year dummies capture aggregate shocks common to all firms in our sample, including changes in the real exchange rate. The firm level dummies capture time invariant differences across firms in the optimal level of capital. Finally, we include a series of proxies for $\alpha_i$, the elasticity of $k^*$ to the real exchange rate. We discuss these proxies, and additional controls below.

### 4.2 Main Results

Table (3) presents estimates of the reduced effect on investment of holding dollar debt during a depreciation. The key variable here is the interaction between lagged dollar debt and the change in the real exchange rate. This interaction will indicate whether firms holding dollar debt, invest relatively less that those holding peso debt in periods following a depreciation.

The sample covers the period 1995-2003. We have two "large" depreciations in this period: in 1999 and 2001 (both approx 10% in real terms) and a large appreciation in 2003. In addition, there is substantial cross firm variation in the levels of foreign currency debt, which allows us to identify differential responses of firms to a depreciation (or appreciation).

All specifications include firm fixed effects, to control for time invariant firm differences in the optimal capital stock, and year dummies to capture the shocks common to all firms. Following (4), we also include the lagged dollarization ratio to control for previous period differences in firms with higher/lower dollar debt, and lagged total leverage.

Column 1 includes only the interaction between dollar debt and the change in the real exchange rate $(D^* \times \Delta e)$. As in previous studies for Chile, the estimated coefficient is not negative: firms with more dollar debt do not invest relatively less in periods following a depreciation. At the same time, the estimated coefficient on lagged leverage is as expected – negative– suggesting a negative balance sheet effect.

As discussed above, the estimated coefficient on $(D^* \times \Delta e)$ will be biased upwards if firms

holding dollar debt also see their current and future profits expand following a depreciation. To control for this bias, columns (2) through (4) include interactions between changes in the real exchange rate and two proxies for $\alpha$: the ratio of exports over assets and a dummy for firms in the tradeable sector. In both cases the estimated coefficient on the interaction term is positive, and in case of the tradeable dummy interaction, significantly so. The estimated coefficient on $(D^* \times \Delta e)$ remains insignificant, although marginally more negative that in column (1).

The discussion so far in this section, and indeed most of the empirical literature on firm level currency-balance sheet effects, focuses on dollar debt as the only mechanism through which an change in $e$ can have balance sheet effects. By doing so, it is ignoring the fact that firms may also hold dollar denominated assets – be it current assets in a foreign bank or offshore investments – an that the inflated value of these sources of income following a depreciation will offset the negative balance sheet effect of dollar liabilities. Although a necessary simplification in many cases, due to the absence of data on the currency composition of assets, it is a simplification that can introduce substantial biases into the estimation of the balance sheet effects of a depreciation in a country such as Chile where foreign assets in the hands of domestic firms are signiifcant. In our sample, the average ratio of dollar assets to total assets is 5.8%, very close to the 9.3% average of dollar liabilities.

With this in mind, columns (5) and (6) include an additional interaction between dollar assets and the change in the real exchange rate $(A^* \times \Delta e)$. As expected, the coefficient on the interaction is positive – firms holding dollar assets see their fixed capital investment go up by relatively more than firms holding only peso assets. This in itself suggestive of a balance sheet effect: firms seeing their liabilities go down relative to total assets are perceived as less risky, face a lower cost of external finance, and consequently a higher optimal capital level.

Once the effect of $(A^* \times \Delta e)$ is considered, the estimated coefficient on $D^* \times \Delta e$ falls, becoming negative and significant. This confirms our prior: the insignificant coefficient on $(D^* \times \Delta e)$ in column (1), and in many of the empirical papers so far, is due to omitted variables, positively correlated with dollar debt. The reason is matching: firms that hold dollar debt are also those firms that have dollar assets (which offsets the BS effect) and export a larger share of their output (which also offsets the negative BS effect).

Finally, to control for differential effects of changes in the exchange rate on firm cash flow, not captured by the interactions between tradeable sectors and the exchange rate and exporting firms and the exchange rate, Column (7) includes a measure of cash flow from operations in the specification. As expected the cash flow variable is positive and highly significant, measuring relaxed credit constraints due to improved net worth and/or changes in the marginal product of capital. Also as expected. the estimated coefficient on $(D^* \times \Delta e)$ drops further after including the cash flow measure.

What are the implications of the results we have presented so far? In the first place, our results suggest that firms match the currency composition of their income and assets with that of their liabilities. As a result, those firms holding dollar debt during a depreciation, see the value of their profits and assets expand in line with the value of their liabilities. Hence, the negative balance sheet effect of the exchange rate on debt is offset by the positive balance sheet effect of the exchange rate on assets and profits. Second - our results suggest substantial balance sheet effects: exogenous changes in leverage brought about by inflated peso values of debt and assets have significant effects on investment. In our sample, the investment to asset ratio of firms holding 50% of their debt in foreign currency, is ~0.025 lower that their peso indebted counterparts following a 20% real

depreciation (similar to the 1999 depreciation in Chile). This difference is sizeable considering a sample mean of 3.8% Third – from a measurement perspective, these result highlight the importance of having a measure of total balance sheet exposure to determine the effect of a depreciation in investment and output.

Recent years have seen a substantial expansion of the Chilean derivatives market (some figures..), in particular the market for currency derivatives. Although average net positions are still small in relation to total assets, they are no longer negligible, and in the case of some firms, substantially alter the level net (or uncovered) dollar debt. What are the effect of these derivative positions on firm level investment? To answer this question, Column (8) includes an interaction between the real depreciation and net forex derivative position over assets in the previous period ($F^* \times \Delta e$). The estimated coefficient in positive and significant – in periods following a depreciation, those firms holding long forex derivative positions invest relatively more than those that do not.

Arguably, what matters for the effect of derivatives on output is not the total change in the real exchange rate, but the deviation from the change from the price preestablished in the contract. We address this concern by using interest rate differentials, and assuming covered interest parity, to construct a measure of deviations of realized depreciation from the depreciation implicit in the forward contract, $\Delta e^u$.

$$\Delta e_t^u = \Delta e_t - (r_{t-1} - r_{t-1}^*)$$

where $r_{t-1}$ is the rate on UF indexed debt for 90-365 days and $r_{t-1}^*$ is the dollar lending rate in the domestic financial system for the same period. Figure 1 plots $\Delta e_t^u$ and $\Delta e_t$ over our sample period. Built in this way, most of the large depreciations where "unexpected", even the 1999 depreciation. Bearing this in mind, we should not expect our results to vary substantially when we include an interaction of derivative positions with $\Delta e_t^u$. Indeed, the estimated coefficient (reported in column 9) is very similar to our previous result using total exchange rate movements.

Note that the absolute value of the estimated coefficients on dollar debt, dollar assets and currency derivatives are similar: an F-test for coefficient equality fails to reject the hypothesis that all three coefficients are equal. With this in mind, we build an "accounting" measure of currency mismatch ($E^*$), equal to dollar debt net of assets and the net long position in forex derivatives $E^* = D^* - A^* - F^*$.

In column (10) we repeat our baseline estimation of investment and include an interaction between exposure and changes in the real exchange rate ($E^* \times \Delta e$) . As expected the estimated coefficient on the interaction ($E^* \times \Delta e$) is negative and significant at conventional confidence level. The estimated coefficient implies that 10% higher exposure will lead (cet par) to a close to 0.6% lower investment if the currency depreciates by 10%.

In the last two columns of table (3), we present two of the alternative specifications we estimated to test the robustness of our main results. Recall if adjustment costs are quadratic $I_t = \lambda (k_t^* - k_{t-1})$. It is relatively straightforward to show that tobin's q, is a monotone function of $(k_t^* - k_{t-1})$ , so that $I_t = \phi q$. There is a substantial empirical literature that has estimated this equation. In particular, the literature on firm level credit constraints (see Fazzari et al 1988) augments this equation with cash flow and leverage – arguing that significant coefficients on these variables suggest credit constraints. Along these lines, column (11) adds a measure of average-q to our baseline specification. First of all, although the absolite size of the estimated coefficient on

($E^* \times \Delta e$) falls, it is still negative and significant. Second – in line with previous literature for Chile, we fail to find a meaningful coefficient on the q-variable (indeed we are pressed to find a plausible explanation for the negative coefficient estimate we obtain).

In column (12) we estimate an empirical specification that follows directly from equation (4). To do so we include the lagged capital stock. The main result remains unchanged: the estimated coefficient on ($E^* \times \Delta e$) is negative and significant. As expected, the estimated coefficient on lagged capital stock is negative and significant. In the tables that follow, we use the specification from column (12) as our baseline result.

Summing up: we find evidence of sizeable balance sheet effects and of firm level matching. These results are robust to a series of alternative specifications and firm level controls[9].

## 4.3 Sensitivity Analysis

### 4.3.1 Exposure to Exchange Rate Shocks or Aggregate Credit Conditions?

By focusing exclusively on exchange rate fluctuations, we have ignored the fact that many of the exchange rate changes in our sample occur simultaneously with changes in the supply (and cost) of foreign and domestic credit. One could think, for example, that firms holding dollar debt are less sensitive to changes in the domestic interest rates than firms holding peso liabilities. If domestic rates rise in periods of a depreciation because the Central Bank is defending the currency, then our coefficient on the ($E^* \times \Delta e$) interaction would be biased upwards. Alternatively, the large negative coefficient on the ($E^* \times \Delta e$) could be the result of rising external capital costs that coincide with periods of depreciation.

Furthermore, although this paper concentrates on exposure to exchange rate fluctuations, this is by no means the only aggregate shock that impacts firm output and investment decisions. It is therefore informative to see how aggregate credit shocks (domestic and foreign) have differential effects on firms with different financial structures.

To control for changing credit conditions, we estimate the investment regressions including an indicator of domestic credit conditions – the domestic interest rate – and an indicator of external credit conditions – the return on the EMBI bond basket. In each case, we interact the macroeconomic variable with our measure of currency exposure and the ratio of dollar debt to total assets. In addition we also interact the macro variables with a measure of the firm's maturity mismatch[10]. The risk of "maturity mismatch" for emerging-market firms has received almost as much attention as the risk of currency mismatch in recent years. Although business assets are (stereotypically) installed for the long term and therefore illiquid, capital-market frictions and distortions may induce firms to issue debt with relatively short maturity. Should aggregate credit conditions shift suddenly, these same firms, unable to renew their debt, might have to curtail investment and perhaps liquidate.

[9] In addition to the specification reported here we carry out the following additional robustness tests: i) estimate using lagged investment and interaction of $\Delta \ln(rer)$ with exports and tradeable, ii) estimate using lagged investment and firm fixed effect using Arellano-Bond. In all cases our main results remain unchanged.

[10] Although we do not report them in the table, we tested the robustness of our results to a series of additional interactions. At the firm level we used short term debt, log(assets) and total leverage. At the macro level, we used net capital inflows, changes in the stock of bank loans to the private sector and a dummy for sudden stops (as defined by Calvo et al 2004). These results are available from the authors.

Table (4) shows the results obtained for investment after including aggregate credit variables. First and foremost, we find that the $(E^* \times \Delta e)$ interaction is significant and negative even after including this additional set of controls. Additionally, the point estimates change only slightly. Most of the additional coefficients estimated have the expected signs, but are not significant at conventional confidence levels. We do, however, obtain interesting results for the interactions with the maturity mismatch variable. *Cet-par,* firms with more short term debt relative to short term assets, react more to hikes in the domestic interest rates.

### 4.3.2 Differential Balance Sheet Effects Across Firms

The sample-average effect presented above was strongly negative, but this might mask larger (or smaller) balance sheet effects across different groups of firms. Indeed, we would expect the estimated coefficient on the $(E^* \times \Delta e)$ interaction to be relatively smaller (in absolute terms) for firms that we would consider a-priori less credit constrained or financially stronger.

With this in mind we partition the sample by predetermined firm characteristics in Table (5). Column (1) replicates our baseline results, while columns (2) through (5) introduce an additional interaction between the $(E^* \times \Delta e)$ variable and one of four indicator variables. The first of these is a dummy that takes on a value of 1 for firms that are eligible to be included in the AFP portfolio. Two previous studies for Chilean firms have found that investment of firms in this category is less correlated with cash flow and less sensitive to leverage (Medina and Valdes 1998 and Gallego and Loayza 2000). The additional three dummy variables where described above: i) a dummy for foreign ownership, ii) a dummy for firms with ADRs, iii) and a dummy for firms belonging to a grupo financiero[11]. We also include the indicator variable in all the specifications, its interaction with total leverage and its interaction with $\Delta e$, – although only the coefficients on $(E^* \times \Delta e)$ and the triple interaction are reported. Structuring the specification in this manner allows us to estimate how the effect of $(E^* \times \Delta e)$ among the indicated set of firms differs from the rest of the sample.

In all cases except the grupo dummy, the estimated coefficient on the additional interaction is positive, suggesting that less credit constrained firms are less vulnerable to the balance sheet effects of currency exposure. Nevertheless, with the exception of the AFP interaction, the coefficients are all estimated very imprecisely, so these findings must be taken with caution. We have no explanation for the results of the grupo dummy as of yet.

## 5 Foreign Currency Hedging by Chilean Non-Financial Firms

The previous section provides empirical support of a strong balance sheet effect arising from the interaction of foreign debt and exchange rate depreciations after controlling for differences in the composition of the balance sheet and net operational income. The evidence also suggests that Chilean non-financial corporates actively use foreign debt as a hedge for other sources of foreign currency exposure. This section studies the hedging behavior of Chilean firms during the sample period. We estimate a set of regressions to examine the extent of currency matching in our sample and the relationship between hedging and those variables identified in the corporate finance

[11] We exclude those periods from the sample in which a firm changes categories. This explains the smaller sample than in previous specifications.

literature to explain "risk aversion" in non-financial corporations.

## 5.1 Determinants of Currency Exposure in Chilean Firms

### 5.1.1 Dollar Debt and Productive Structure

In this section we evaluate the first prediction of the mean variance framework we presented in the previous section – that firms match the currency composition of their liabilities with that of their assets and income. To do so we estimate the following equation on pooled firm level data for the period 1996-02

$$\beta_{it} = \delta\alpha_{it} + \upsilon_{it} \tag{5}$$

in which for firm $i$ in period $t$, $\beta_{it}$ is a measure of dollar debt to total assets and $\alpha_{it}$ is the set of variables introduced in the previous section that proxy for the elasticity of firm income to the real exchange rate: direct exports as a share of total sales, a dummy variable that takes on a value of one if the firm is in a tradable sector (agriculture, mining, or manufacturing), and the ratio of dollar denominated assets to total assets.

Columns (1) and (2) of table (6) report the OLS estimation for the ratio of dollar debt to assets. In column (1) we include the tradeable dummy while column (2) includes a set of dummies for 1 digit ISIC sectors (not reported). Because $\beta_{it}$ is left-hand censored at 0, in columns (3) and (4) we also estimate (5) using a Tobit method. In all four specifications, the estimated coefficients on exports and dollar assets are positive and highly significant. The coefficients are also sizeable. Using the estimated coefficients from column (1): the fraction of dollar-denominated liabilities over assets is 6.5% higher in firms that export 50% of their output than in those firms that sell their output domestically. Similarly, firms with a 50% share of dollar denominated assets on average have dollar debt over asset ratios that are 13% higher. The dummy for the tradeable dummy is positive and significant in column (3) even after controlling for dollar assets and exports dollar liabilities are 3% higher (as a % of total assets) than in non-tradeable sectors.

We obtain cualitatively identical results when we measure $\beta$ as the ratio of dollar debt to total debt (in columns 5 through 8), when we replace $\beta$ by an indicator variable for firms that hold non zero dollar debt (column 9 and 10) and when we measure $\beta$ as dollar debt over assets net of derivative positions, in columns (11) and (12).

Summing up: we find strong evidence that firms match the currency composition of their debt with that of their accounting assets and income streams. Effective foreign currency exposure is therefore substantially smaller than what foreign currency debt suggests, so that in periods of depreciation we expect the negative balance sheet effects of dollar debt to be offset (or reversed) by the positive balance sheet effects of dollar assets and income.

### 5.1.2 Structural Determinants of Derivative Use

What ultimately matters for firm performance is the net exposure to exchange rate shocks. Nevertheless, because in our sample derivative positions are relatively small vis-a-vis total dollar debt, results for net dollar debt (dollar debt net of long forex derivative positions) are driven to a large

extent by the debt component. Therefore, we believe it is informative to present some results for the determinants of derivative use.

We report the results of these estimates in table (7). In columns (1) and (2) the LHS variable is the nominal value of net derivative positions over total assets. In columns (3) and (4) the LHS is an indicator variable for firms holding any form of forex derivative.

In all specification the estimated coefficient on dollar debt is positive and significant at conventional confidence levels. Firms holding dollar debt hold larger long positions in forex derivatives and are in turn more likely to hold any form of forex derivative. On the other hand, the estimated coefficients on the ratio of exports to sales and the ratio of dollar assets to total assets are negative and significant only in columns (1) and (2). Controlling for dollar debt, firms exporting a larger share of their sales and firms with a larger share of dollar denominated assets hold significantly lower long derivative positions. It is not surprising that the estimated coefficients on exports and dollar assets are not significant in columns (3) and (4) as long positions are treated identically to short positions in the dummy variable.

Hence, firms in our sample use derivatives as a complement to real hedges – i.e. firms use derivatives to offset the balance sheet risk of dollar debt when their income is not correlated with the real exchange rate.

### 5.1.3 Currency Exposure and Risk Aversion

Controlling for $\alpha$ and the relative cost of domestic and foreign credit $\tau + \varepsilon$ the level of exposure to currency shocks will be lower for more "risk averse" firms (higher $\mu$). To test this predition empirically we estimate a measure of "excess" currency exposure for firms over the period 2000-02. We do this in two stages. In the first, we estimate a regression of dollar debt against our proxies for $\alpha$ (exports, sector and dollar assets) and against the measure of $\mu$. The first terms capture matching, the second term captures possible correlations between $\mu$ and $\varepsilon$ the idiosincratic componet of the expected interest. In the second stage we calculate the absolute deviations between the fitted values from the 1st stage and observed net dollar debt (net of derivatives), and regress them on $\mu$. Table (8) reports the estimated coefficients for the second stages of this estimation for data pooled over the period 2000-02. Each cell reports the estimated coefficient and standard error of univariate regresions of excess net dollar debt against the respective measure of risk aversion or in the case of the liquidity and investment opportunities variables, the coefficients from a regression that also includes log(total assets).

The first section of table (8) reports the estimated coefficients for variables we believe a-priori to be correlated with credit constraints. The first is firm size. A series of empirical studies have argued that large firms are less credit constrained because of fixed costs in information disclosure. The estimated coefficient is consistent with this hypothesis – large firms hold net foreign debt positions that are on average further from the "matching" composition than small firms, and are therefore more exposed (in terms of their balance sheet at least) than small firms. This result is also consistent with the effect of size limitations in the domestic market.

The next two variables measure foreign ownership – either via the US stock market in the case of firms issuing ADRs or directly, as part of a foreign conglomerate, in the case of firms owned by foreign corporations. In both cases we estimate a positive and significant coefficient – suggesting that these firms are less credit constrained that their counterparts.

A series of empirical papers for Chile have grouped Chilean firms according to their eligibility for pension fund investment, the idea being that firms eligible for AFP portfolios will be less credit constrained than their pairs. For a start, firms eligible for AFP investment can access a larger pool of accumulated wealth. In addition, if there are fixed costs to monitoring, then AFP-able firms will be more closely monitored by the investment managers in the AFPs, reducing the degree of information asymmetry (include more references). With this in mind, we include a dummy variable for firms classified by the SAFP as eligible for AFP investment as a proxy for $\mu$.

Finally, we include the grup dummy, for firms belonging to financial conglomerates. As was the case for the ADR, foreign ownership and AFP dummies we find a positive and significant coefficients.

The next section of table(8) include variables that measure liquidity risk. As discussed above, we expect firms with higher liquidity risk to minimize exposure to currency fluctuations. Nevertheless the estimated coefficients for the coverage ratio is not significant at conventional confidence levels and the estimated coefficient of the current ratio is the opposite of what we expect. These results are robust to using alternative liquidity measures, not reported in the table: the quick ratio, total leverage, short term debt and the maturity mismatch. Although the approach we follow here is relatively standard in the corporate finance literature, these "puzzling" results suggest that our specification suffers from endogeneity issues. Lagging the RHS variable, as we do in this table, only addresses part of the problem. For example, an omitted firm level variable, negatively correlated with credit constraints, would drive up leverage and at the same time lead to higher dollar exposure - as indeed we find in table.

Finally, the last panel of table (8) shows the results for two variables that proxy for investment opportunities: a lagged moving average of investment over assets and the (log) market to book ratio. Note that the sample drops significantly once the market to book variable is included because a substantial share of our firms are not listed. We fail to find a statistically significant effect of lagged investment. On the other hand, the estimated coefficient on market to book ratio is negative and significant, as expected.

# 6 Exchange Rate Regime, Net Exposures and the Balance Sheet Effect

The empirical evidence in the previous section indicated that Chilean firms in the sample actively hedged their balance sheet exposure matching foreign currency liabilities, assets and derivatives. Also, across firms in the sample, net exposures are smaller among those that are more likely to face financial constraints and suffer a negative balance sheet effect from exchange rate fluctuations. In this section, we focus on the time dimension of our panel of firms in order to examine the impact of the adoption of a floating exchange rate regime in the late 90's on currency mismatches and the size of the balance sheet effect in Chilean firms.

Through most of the 1990's, Chilean authorities followed a monetary/exchange rate regime based on three main pillars: an active monetary policy aimed at achieving a gradual stabilization of prices based on year-end targets for the inflation rate, a crawling band for the nominal exchange rate, and regulatory restrictions on capital inflows, mainly through unremunerated reserve requirements. These restrictions where put in place in order to reduce interest rate differentials and smooth

frictions between monetary and exchange rate policies in an scenario of abundant international liquidity for emerging markets and the Chilean economy.

The aftermath of the Asian crisis hit the Chilean economy severely through 1998 and 1999 and highlighted flaws of the prevailing policy regime. Based on this experience, fiscal and monetary authorities completely revamped macroeconomic policies between 1998 and 2001. The Central Bank of Chile (CBCh) eliminated the encaje in September 1998, adopted a floating exchange rate regime in september 1999 and a fully-fledge inflation targeting framework for monetary policy. In march 2000, the new Lagos´administration committed to a fiscal policy rule aimed to target a surplus of 1% of GDP for the full-employment budget. In April 2001, all capital account restrictions were eliminated.

The shift in the policy regime affected the two macroeconomic variables that explain currency mismatches in the mean-variance framework: interest rate differentials and exchange rate volatility. Indeed, the economy-wide differentials between domestic and foreign borrowing costs declined while exchange rate volatility increased. Accordingly, we expect that the new policy regime created greater incentives for firms to hedge and reduce their currency risk exposures. Further, we expect the reduction to be more intense in those firms that have relatively weaker balance sheets and are more likely to face capital market imperfections and financial constraints. Both predictions imply that the empirical relevance of the adverse effect of exchange rate depreciations on balance sheets should have declined in Chile after 1999.

We examine these predictions in this section, and look for changes in both the level exposure and the size of the balance sheet effect in our sample of Chilean firms after the shift in the macroeconomic policy regime.

### 6.1 Reforms in the macroeconomic policy regime in the late 90´s

From 1991 to 1998, chilean monetary and fiscal policies were managed through a common framework. The Central Bank conducted monetary policy to achieve a gradual stabilization of prices anchored in declining yearly inflation targets. Money market interest rates were actively managed to keep inflationary pressures under control and internal demand growth in line with potential output and fluctuations of the terms of trade. For most of the decade, domestic interest rates, adjusted for inflation differentials, were kept well above international levels, more in line with the high rates of output growth of the economy. From 1994 until 1997, the average 3-month interest rate for time deposits was 13,1%, in pesos, while the ex-post average 3 month Libo Dollar rate was 7,7%, in pesos.

The interest rate differential put pressure for the appreciation of the peso. However, the Central Bank intervened in the market to reduce the speed of appreciation and avoid an unsustainable deterioration in external competitiveness that could de-rail the trade balance and the current account deficit. Exchange rate policy was anchored on the commitment of the Central Bank to buy or sell dollars within a crawling band on the real exchange rate. Although the band was nominally wide, +/-10% in 1995, the peso was always very close to the floor of the band and very stable in nominal terms. The real exchange rate appreciated on a consistent basis at an average 4,7% a year between 1994 and 1997.

The CBCh intervened in the foreign exchange market on a regular basis, buying dollars on a sterilized basis and accumulating international reserves. The width and the level of the band was

adjusted on several ocassions from 1990 to 1997, always at times of pressures for further appreciation of the peso. After 1996 the CBCh introduced a gradual (real) appreciation trend within the crawling factor of the band to reduce the probability of big adjustment. However, the trending factor further increased the expected interest rate differential. Only at the end of 1997, did the peso begin to depreciate but again the Central Bank stepped, in selling dollars and narrowing the bad in mid 1998.

Through the 1990s, the CBCh used restrictions on capital inflows and an opportunistic liberalization of outflows in order to reduce discrepancies between interest rate differentials, restrictive monetary policy, exchange rate rigidity and abundant foreign capital. Since the early 1990´s, authorities began gradually liberalizing capital outflows and attempted to reduce capital inflows through administrative measures. Indirect taxes and a 30% unremunerated reserve requirement (the *encaje*) were imposed on some capital inflows.

The encaje was not initially applied uniformly to all capital inflows but coverage was gradually extended to various types of debt, portfolio and direct investment inflows. The encaje restriction was very costly for arbitrage inflows, distorting the uncovered interest parity condition for short term interest rates, but less so for long term debt inflows allowing firms to borrow abroad at long maturities (Herrera and Valdes, 2001; De Gregorio, Edwards and Valdes, 2000). Adjusting international borrowing rates for the encaje reduced the interest rate differential from 5,4% to 2,1% for a one year debt inflow but only to 4,5% for a four years debt inflow. Other regulations required Chilean firms issuing bonds abroad to comply with some minimum requirments in terms of size and risk classification.

The combination of interest differentials and nominal exchange rate stability provided incentives for domestic firms to borrow abroad and for domestic investors to stay at home. After 1992, the Central Bank lowered or eliminated most restrictions to investment abroad, but residents did not use the opportunity to diversify their portfolios. For example, in 1997 pension funds were allowed to invest up to 16% of their portfolio abroad, but chose only to hold 1% of foreign assets.

On the liabilities side, Chilean blue-chip corporations had strong incentives to substitute domestic UF debt for international debt and small incentives to hedge the currency risk, as in the forward market the peso traded constantly at a discount to compensate for interest rate differentials, while on the spot market the peso exchange rate remained stable with ocassional discrete adjustments towards appreciation. From 1993 to 2000, the stock of foreign debt of Chilean non-financial private firms went up from US$5.8 billion to US$29.5 billion. The forward market did not develop significantly until 1998. By the end of 1997, Chilean firms had bought less than $500 million in the forward market. The development of the local market for private bonds was minimal until 2000 and the only important issuer in the local market was the Central Bank in order to sterilize its intervention in the forex market.

By the last quarter of 1997, the Chilean economy began to suffer the aftermath of the Asian crisis. Terms of trade deteriorated, the current account deficit widened toward 9% of GDP and foreign financing became more expensive. The peso depreciated within the exchange rate band, and inflationary pressures increased in an economy already working at or above full capacity.

The CBCh stepped in early 1998 to contain the depreciation of the peso, reduce cost pressures on inflation, and speed up the adjustment of the current account. The policy response along 1998 was a mix of restrictive monetary policy interest, non-sterilized intervention in the foreign exchange market, narrowing of the exchange rate band, issuance of dollar-linked debt and fiscal adjustment.

During this period, the ex post interest rate differential became negative, mainly because of the depreciation of the peso but also due to the increase in risk premiums. The combination of negative external shocks and the contractionary policy mix moved the chilean economy into a recession in 1999.

In September of 1999, after a gradual re-widening of the exhange rate band, the CBCh abandoned the crawling band and the peso was allowed to float freely. Also the Central Bank adopted a formal inflation targeting scheme as the framework to conduct monetary policy. Earlier, in 1998, administrative restrictions on capital inflows have been lowered and encaje was set at a zero rate. During 1999, prudential regulations were issued to cap market risk exposure of banks, while limits on investment of pension funds abroad were increased. In March 2000, the new Lagos'administration commited to a fiscal policy rule based on a target for the full-employment budget surplus at 1% of GDP and adopted a restrictive stance to bring fiscal expenditures in line with permanent revenue. Finally, in April 2001, the capital account was completely liberalized and all restrictions to capital flows—in or out—were eliminated.

As inflation rapidly came down through 1999, the CBCh began to ease monetary policy. After a short lived recovery in early 2000, domestic monetary policy rate continue easing until reaching a record low level of 1,75% by early 2004. From September 1999 until May 2004, the average 3-mo. interest rate for time deposits was 5,8%, in pesos, while the ex post average 3-mo. Libo Dollar rate was 7,2%, in pesos, a negative differential compared to the significantly positive differential in the period prior to 1998.

Also exchange rate volatility in Chile increased to levels which are equivalent to other economies with floating exchange rate regimes. In the period prior to 1998, the anualized standard deviation of weekly changes was 4,5%. It increased to 6% during the through 1998 to august 1999, and after the floating of the peso in september 1999 increased further to 7,6%. Exchange rate flexibility has been particularly noticeable in periods of regional financial stress as the Argentine crisis in 2001 and Brazilian elections in 2002.

In the new scenario, Chilean firms increased their long position in US dollars against the forward market and began to issue long term bonds in the local market. Currency hedging started in 1998 and continued developing afterwards. Also, pension funds started diversifying their portfolios into international assets. By June 2004, 28% of their portfolio was invested abroad, quite different from the situation back in 1997, when their investments abroad were only 1%. Almost 70% of the holdings of foreign currency assets in pension funds have been swapped for local currency through the forward market, and pension funds are the single largest supplier of foreign currency in the forward market.

### 6.2 Floating and currency risk exposure in Chilean firms

In this subsection, we review evidence on the evolution of currency risk exposure across firms in our sample. First, we review different average measures of exposure to foreign exchange risk, and then we reestimate the matching regressions of the previous section to examine changes in the behavior of firms after the shift to the floating exchange regime.

All aggregate measures of foreign exchange exposure show a similar patter (see figure 1) An initial phase of rising currency mismatches from 1995 to 1998, a significant drop through 1999 and 2000, and relative stability during the following two years. In the case of dollar debt, between

1995 an 1998 it increased from 20% of total liabilities to 27%, but in the following two years fell back to 20% of total liabilities (18% when adjusted for the depreciation of the real exchange rate), and stayed at that level. Similarly, hedging activity increased sharply during 1998 and 1999 and then stabilized. Until 1997 firms net (and gross) position on forward markets where negligible, afterwards the net but position increased sharply reaching around 4% of total liabilities or 10% of foreign currency debt.

Similarly, an alternative measure of net accounting exposure in the balance sheet of firms, foreign currency debt adjusted for foreign currency assets and derivatives, increased gradually from 1995 to 1997, and then started to decline, quite sharply in the years 1999 and 2000, until becoming slightly negative in the final years of our sample. Overall, the evolution of aggregate measures of foreign exchange exposition in our sample of firms is consistent with a reduction of exposure after the shift in the macro policy regime.

The empirical evidence on the differential behavior of firms pre and post-changes in the macro-policy regime is shown in Table (9). We re-estimate regressions on the hedging behavior of firms including a time dummy for the period prior to the adoption of the floating exchange rate regime and other reforms. Although changes in macro policies were implemented during 1998 and 1999, we consider there could be some adjustment costs to the composition of the balance sheet that may lead to a lagged response of firms, therefore the dummy variable covers from 1995 to 1999.

The results for all regressions indicate a significant drop of foreign currency exposure or a significant increase in foreign currency hedging after 1999. The ratio of dollar debt to total assets declines significantly for all firms, around 20% of the pre-float exposure. The dollar debt ratio adjusted for derivatives declines further, around 35% of the pre-float exposure, and the net accounting exposure disappears after 1999. Similarly, after 1999 the net derivative position increases significantly. As we saw in the graphs for the aggregate numbers, most of the action comes from the reduction of foreign currency debt and a smaller effect of the increase in derivatives.

As we have detected an increase in the volatility of the exchange rate in the period after 1999, we expect the drop in the exposure will be larger for those firms which have a more vulnerable financial condition. Firms are sampled according to those variables identified in the previous section as measures of "risk aversion" of the firm, and then we test for differences in the change of the forex exposure after 1999. To measure forex exposure we replicate the methodology discussed in the previous section, i.e., we estimate the "matching" portfolio using dollar assets, exports and tradeable dummies, and estimate deviations from this portfolio. To allow for changes across periods in this matching relationship we estimate the first stage allowing for different coefficients across regimes. These coefficients will capture the differences in levels of exposure we discussed above. In the second stage, we interact the firm level dummies we found to be positively correlated with higher "mismatches" in the float period with the pre-float dummy. We report these second stage results in table (10). In all cases the estimated coefficient on the interactions are negative, although only the interaction with the AFP dummy is significantly so. This is contrary to what we expect.

Until now we have attributed the fall in dollar debt or average exposure to the shift in the macro policy regime and its impact on compressing interest rate differentials and increased exchange rate volatility. Note that we have not attempted to disentangle the effects of each of these components. In table (11) we take a first pass at decomposing these two macro effects. To do so, we reestimate our regressions of firm hedging, incorporating the return on the EMBI bond index as a measure of the cost of external finance and the average rate on 1-3 year loans in UF in the Chilean banking system as a measure of the domestic interest rate. We report the results of these estimates in

table (11). The estimated signs on the interest rate coefficients are as expected - with dollar debt rising when domestic rates are higher and falling with the cost of external financing. As reported in column (2), we also obtain a positive coefficient on the pre-float dummy, even after controlling for the interest rates individually or (as in column (3)) by the spread between both rates.

The interest rate differentials provide an alternative way to validate the a-priori measures of credit constraints used in previous sections. One of the predictions of the framework presented above, is that interest rate differentials have a large effect on currency exposure of less risk averse firms. To test this hypotheses we estimate interactions between the interest rate differential and the measures of a-priori credit constraints that we found to be significant in explaining excess net dollar debt (or exposure). In all cases we obtain positive coefficients (as expected), although these are only significant for the AFP and size variables. Hence, we find some evidence that firms that are less risk averse, respond most to changes in interest rate differentials, as the cost (in terms of financial distress or missed investment opportunities) are lower.

A higher exchange rate volatility in the post-float period is a plausible explanation for the positive coefficient on the pre-float dummy. However, other economy-wide events occurring during the same period could also be driving our results. An alternative hypothesis to explain why firms closed their currency mismatches after 1998 would be to argue that during this period they faced an external liquidity crunch that pushed them to the local market, independently of the shift in the policy regime and the measured interest rate spread. They had no option but to close the currency mismatches because they could not continue borrowing abroad.

The evidence on credit spreads is consistent with the observation that in the aftermath of the Asian crisis foreign borrowing by Chilean firms became more expensive and restrictive. Credits spreads increase to record level in mid 1998, but local interest rates also increased to record levels in the same period, partly to compensate for increases in external rates and expectations of further depreciation of the exchange rate through the ceiling of the band.

Furthermore, we find no compelling evidence to argue that after 1998, either the Chilean economy was liquidity constrained in international markets or that firms have been cut-off from international credit. Indeed, in January 1999 the Government was able to fund its fiscal deficit taping into international markets with spreads of 200 bp, while risk premiums on private debt had returned to 300 bp in early 1999. Also, total private foreign debt of non financial firms continued increasing in 1998, 1999 and 2000, increasing from US$21 to US$29.4 billion. After 2000, credit spreads have continued to decline, although private foreign debt of non-financial firms has stabilized at US$ 29 billion. However, despite the reduction in the cost of international borrowing, we have not witnessed a surge on capital inflows, particularly after 2002 when international liquidity conditions became more abundant.

Another candidate for the positive pre-float dummy could be changes in micro prudential regulations on credit risk. In 1999, regulatory caps on market risk, including currency risk, were introduced for banks. However, foreign currency exposition at the time was limited, and foreign currency lending by local banks to domestic firms was very limited at the time with the exception of trade related credits.

# 7 Conclusions

This paper contributes to the existing empirical literature on the balance sheet effects of currency mismatches in three ways.

First of all, we assemble a new firm level database which allows us to build more comprehensive measures of currency exposure. In addition to data on foreign currency debt our dataset incorporates data on firm level exports, foreign currency assets and foreign currency derivative positions. This data should allow us to correct for the omitted variables present in many of the previous studies of balance sheet effects.

Second, we explicitly look at differences in exposure across firm level variables that the corporate finance literature has argued (or shown) to be correlated with firm level risk aversion.

Finally, by looking at firm level data for Chile over the period 1995 to 2003 we are able to identify changes in the level and distribution of dollar debt across two distinct policy regimes. Pre 1999 Chile had an exchange rate band and therefore an explicit commitment to exchange rate stability. Post 1999, the Central Bank has allowed the exchange rate to float freely.

As in previous studies for Chile by Benavente et al (2003) and Fuentes (2003), we find that in periods following a depreciation firms with higher dollar debt do not underperform their peso counterparts. However, once we adequately control for differences in the currency composition of assets and income, and net derivative positions, we find a significant balance sheet effect. In other words, we find that when correctly measured currency mismatches matter. In addition, we find that derivatives play a role in insulating firm level investment from exchange rate shocks and that the balance sheet effects are (weakly) smaller for firms we categorize a-piori as less credit constrained.

In line with previous firm level studies, we also find evidence of currency matching in Chilean corporates. Firms in Chile appear to be aware of the risks associated with open currency positions and choose the currency composition of their debt and their derivative positions accordingly. They do this by matching the currency composition of their debt with that of their income and assets, and by taking on derivatives if no "real" hedge is available. We also find that "exposure" – as measured by deviations of dollar-debt net of derivatives from the levels predicted by a simple regression between debt, assets and exports– is positively correlated with measures of credit constraints (or firm risk aversion) and investment opportunities. Our results on exposure, suggest that those firms most exposed to currency risk, are either those better "prepared" to take this risk..

Finally, we find significant changes in the level of exposure after the exchange rate was floated in 1999. This drop is significant even after controlling for a (crude) measure of interest rate differentials. We argue that one possible interpretation of these results is due to the effect of higher exchange rate variance on the relative risk of domestic and foreign debt. This being the case, floating exchange rate regimes would reduce exposure, by eliminating an implicit exchange rate insurance and forcing firms to correctly internalize exchange rate risk. In this last point the paper is suggestive rather than conclusive.

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**Table 1: Balance Sheet Literature**

| Author | Countries Covered | Firms Covered | Measure of fx exposure | Performance variables | Measures of Income Elast. | Derivatives ? | Dollar Assets? | Evidence of Matching? | Balance Sheet Effect? |
|---|---|---|---|---|---|---|---|---|---|
| Aguiar (2002) | Mexico | Large listed | Short and long term dollar debt | Fixed capital investment, profits, net worth and working capital | Exports and ADR | No | No | Yes | Negative and significant |
| Allayanis et al (2001) | S. Korea, Hong-Kong, Indonesia, Phillipines, Malasya, Taiwan, Thailand | Large listed | Dollar Debt and derivatives | Excess return, Beta and Exchange rate sensitivity | Foreign EBIT, foreign cash | Yes | No | Yes | Negative and significant |
| Benavente el at (2003) | Chile | Large listed | Dollar Debt | Fixed capital investment | Tradeable sectors dummy | No | No | Yes | Positive or not significant |
| Bleakley and Cowan (2002) | Argentina, Brazil, Chile, Colombia, Mexico | Large listed | Dollar Debt | Fixed capital investment, inventory accumulation | Tradeable sectors dummy | No | No | Yes | Positive or not significant |
| Bonomo et al (2003) | Brazil | Large listed | Dollar Debt | Fixed capital investment | Tradeable sectors dummy | No | No | Yes (not signicant) | Negative not significant |
| Carranza et al (2003) | Peru | Large listed | Dollar Debt | Fixed capital investment | Tradeable sectors dummy and export ratio by sector | No | No | Yes | Negative and significant |
| Echeverry et al (2003) | Colombia | Listed and unlisted firms | Dollar Debt | Fixed capital investment and profits | Exports, Imports, Sectorial GDP growth | No | No | Yes | Not significant for investment and negative and |
| Fuentes (2003) | Chile | Large listed | Short and long term dollar debt | Fixed capital investment | | No | No | N/A | Positive for long term debt, negative for short term debt |
| Galiani et al (2003) | Argentina | Large listed, large unlisted and privatized | Dollar Debt | Fixed capital investment, Sales and Earnings | Exports | No | No | Yes (not signicant) | Negative and significant |
| Luengnaruemitchai (2003) | S. Korea, Indonesia, Phillipines, Malasya, Taiwan, Thailand | Large listed | Dollar Debt | Fixed capital investment | Share of earnings before income tax from foreign currency (FEBIT) | No | No | Yes | Positive or not significant |
| Martinez and Werner (2002) | Mexico | Large listed | Dollar Debt | -- | Exports | No | No | Yes, post 1995 | -- |
| Pratab et al (2003) | Mexico | Large listed | Dollar Debt | Fixed capital investment and earnings | Exports and tradeable sectors dummy | No | No | Yes, post 1994 | Negative and significant |

**Table 2 : Descriptive Statistics**

| *Variable* | *Observations* | *Mean* | *Standard Deviation* | *Minimun* | *Maximun* |
|---|---|---|---|---|---|
| Investment in Fixed Capital over Lagged Assets | 1326 | 0.038 | 0.149 | -2.200 | 1.071 |
| Dollar Debt over Lagged Assets | 1183 | 0.093 | 0.139 | 0.000 | 1.013 |
| I (Firm has Dollar Debt) | 1179 | 0.651 | 0.476 | 0.000 | 1.000 |
| Dollar Assets over Lagged Assets | 1186 | 0.058 | 0.164 | -0.029 | 1.008 |
| Net Forex Derivatives Position over Lagged Assets | 1325 | 0.007 | 0.043 | -0.153 | 0.562 |
| I (Firm has derivatives) | 1326 | 0.141 | 0.348 | 0.000 | 1.000 |
| Exposure (Dollar Debt - Forwards - Dollar Assets) over Lagged Assets | 1181 | 0.027 | 0.169 | -1.008 | 0.648 |
| Cash Flow over Lagged Assets | 1326 | 0.072 | 0.185 | -1.584 | 3.209 |
| Exports over Lagged Assets | 1309 | 0.053 | 0.156 | 0.000 | 1.379 |
| Exports over Sales | 1309 | 0.098 | 0.229 | 0.000 | 1.027 |
| Lagged Capital Expenditure over Assets | 1326 | 0.772 | 0.451 | 0.000 | 4.833 |

**Table 3: Effect of Exchange Rate Exposure on Investment 1995-2003**

| RHS variables: | Dependent Variable: Investment in Fixed Capital | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **Interactions** | | | | | | | | | | | | |
| Dollar Debt x (Δ log Real Exchange Rate) | 0.009 | -0.02 | -0.049 | -0.043 | -0.428 | -0.448 | -0.462 | -0.509 | -0.507 | | | |
| | [0.155] | [0.126] | [0.109] | [0.112] | [0.205]** | [0.186]** | [0.192]** | [0.194]*** | [0.196]*** | | | |
| Exposure x (Δ log Real Exchange Rate) | | | | | | | | | | -0.673 | -0.37 | -0.646 |
| | | | | | | | | | | [0.188]*** | [0.180]** | [0.181]*** |
| **Main Effects** | | | | | | | | | | | | |
| Dollar Debt | 0.014 | 0.015 | 0.026 | 0.025 | 0.021 | 0.023 | 0.006 | 0.004 | 0.004 | | | |
| | [0.063] | [0.059] | [0.060] | [0.057] | [0.060] | [0.054] | [0.042] | [0.044] | [0.044] | | | |
| Exposure | | | | | | | | | | -0.002 | 0.022 | -0.009 |
| | | | | | | | | | | [0.022] | [0.023] | [0.026] |
| Total Debt | -0.097 | -0.095 | -0.1 | -0.099 | -0.098 | -0.097 | -0.096 | -0.097 | -0.097 | -0.095 | -0.046 | -0.087 |
| | [0.057]* | [0.057]* | [0.057]* | [0.057]* | [0.058]* | [0.057]* | [0.057]* | [0.057]* | [0.057]* | [0.057]* | [0.038] | [0.050]* |
| **Controls** | | | | | | | | | | | | |
| Exports | | -1.239 | | 0.001 | | -1.006 | -0.919 | -0.978 | -0.975 | -1.117 | 1.655 | -1.235 |
| | | [1.191] | | [1.229] | | [1.095] | [1.035] | [1.057] | [1.058] | [1.089] | [1.037] | [0.955] |
| Exports x ( log Real Exchange Rate) | | 0.205 | | 0.004 | | 0.165 | 0.147 | 0.156 | 0.155 | 0.178 | -0.27 | 0.21 |
| | | [0.179] | | [0.187] | | [0.164] | [0.157] | [0.161] | [0.161] | [0.166] | [0.164] | [0.146] |
| Tradeable x ( log Real Exchange Rate) | | | 0.169 | 0.17 | | | | | | | | |
| | | | [0.059]*** | [0.061]*** | | | | | | | | |
| Dollar Assets | | | | | 0.013 | 0.009 | 0.01 | 0.01 | 0.01 | | | |
| | | | | | [0.029] | [0.031] | [0.028] | [0.029] | [0.029] | | | |
| Dollar Assets x (Δ log Real Exchange Rate) | | | | | 0.847 | 0.834 | 0.729 | 0.748 | 0.747 | | | |
| | | | | | [0.210]*** | [0.210]*** | [0.196]*** | [0.198]*** | [0.199]*** | | | |
| Cash flow from operations | | | | | | | 0.326 | 0.326 | 0.326 | 0.327 | 1.044 | 0.312 |
| | | | | | | | [0.144]** | [0.144]** | [0.144]** | [0.145]** | [0.180]*** | [0.128]** |
| Net long derivative pos. | | | | | | | | 0.023 | 0.026 | | | |
| | | | | | | | | [0.063] | [0.062] | | | |
| Net long derivative pos. x (Δ log Real Exchange Rate) | | | | | | | | 0.416 | | | | |
| | | | | | | | | [0.196]** | | | | |
| Net long derivative x (Δ log Real Exchange Rate Unexpected) | | | | | | | | | 0.369 | | | |
| | | | | | | | | | [0.187]** | | | |
| Lagged Capital Stock | | | | | | | | | | | | -0.17 |
| | | | | | | | | | | | | [0.072]** |
| ln (tobin q) | | | | | | | | | | | -0.039 | |
| | | | | | | | | | | | [0.011]*** | |
| **Regresion Information** | | | | | | | | | | | | |
| N | 1326 | 1326 | 1326 | 1326 | 1326 | 1326 | 1326 | 1326 | 1326 | 1326 | 861 | 1326 |
| $R^2$ | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.36 | 0.36 | 0.36 | 0.36 | 0.67 | 0.41 |
| Estimator | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Year SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports the OLS estimates of variants of equation (xx) in the text. All independent accouting variables with the exception of cash flow from operations and ln(tobin-q) are once lagged. Standard errors adjusted for clustering by year are reported 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. The dependent variable is as indicated above. All accounting variables are scaled by the lag of total firm assets. The baseline real exchange rate is defined as the nominal exchange rate divided by the domestic CPI. Unexpected changes in the real exchange rates are as described in text. Net derivative positions are the notional values with domestic banks. The accounting data are from the SVS sample, as described in the text. Macro data are drawn from various sources. For detailed sources and descriptions, see Section 3 and Appendix.

**Table 4: Changes in Aggregate Credit Conditions**

| | Dependent Variable: Investment in Fixed Capital | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Interactions** | | | | | | |
| Exposure x (Δ log Real Exchange Rate) | -0.59 | -0.679 | -0.627 | -0.631 | -0.659 | -0.663 |
| | [0.145]*** | [0.185]*** | [0.170]*** | [0.172]*** | [0.177]*** | [0.179]*** |
| **Baseline Controls** | | | | | | |
| Exposure | 0.049 | -0.051 | 0.008 | 0.007 | -0.009 | -0.01 |
| | [0.064] | [0.047] | [0.026] | [0.025] | [0.025] | [0.026] |
| Exports | -1.251 | -1.249 | -1.272 | -1.324 | -1.25 | -1.43 |
| | [0.951] | [0.951] | [0.938] | [0.832] | [0.961] | [0.935] |
| Exports x (Δ log Real Exchange Rate) | 0.212 | 0.212 | 0.216 | 0.224 | 0.213 | 0.243 |
| | [0.145] | [0.146] | [0.143] | [0.125]* | [0.147] | [0.142]* |
| Cash flow from operations | 0.312 | 0.311 | 0.312 | 0.312 | 0.312 | 0.309 |
| | [0.128]** | [0.128]** | [0.128]** | [0.128]** | [0.129]** | [0.129]** |
| Lagged Capital Stock | -0.169 | -0.17 | -0.171 | -0.172 | -0.173 | -0.173 |
| | [0.072]** | [0.072]** | [0.072]** | [0.072]** | [0.073]** | [0.073]** |
| Total Debt | -0.086 | -0.087 | -0.082 | -0.082 | -0.104 | -0.106 |
| | [0.050]* | [0.050]* | [0.051] | [0.051] | [0.058]* | [0.059]* |
| **Additional Controls** | | | | | | |
| Exposure x EMBI yield | -0.435 | | | | | |
| | [0.472] | | | | | |
| Exposure x Domestic Interest Rate | | 0.597 | | | | |
| | | [0.701] | | | | |
| Dollar Debt | | | -0.044 | -0.066 | | |
| | | | [0.057] | [0.088] | | |
| Dollar Debt x EMBI yield | | | -0.016 | | | |
| | | | [0.289] | | | |
| Dollar Debt x Domestic Interest Rate | | | | 0.273 | | |
| | | | | [0.907] | | |
| Maturity Mismatch | | | | | -0.006 | 0.131 |
| | | | | | [0.067] | [0.059]** |
| Maturity Mismatch x EMBI yield | | | | | 0.312 | |
| | | | | | [0.455] | |
| Maturity Mismatch x Domestic Interest Rate | | | | | | -1.288 |
| | | | | | | [0.624]** |
| **Regresion Statistics** | | | | | | |
| N | 1326 | 1326 | 1326 | 1326 | 1326 | 1326 |
| $R^2$ | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| Estimator | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Year SE | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports the OLS estimates of variants of equation (xx) in the text. All independent accouting variables are once lagged. Standard errors adjusted for clustering by year are reported 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. The dependent variable is as indicated above. Maturity mismatch is defined as the difference between current liabilities and current assets, scaled by total assets. All additional accounting variables are scaled by the lag of total firm assets. Macroeconomic variables (real exchange rates, domestic and international interest ratesI) are from the current period (i.e., concurrent with the LHS investment variable). The baseline real exchange rate is defined as the nominal exchange rate divided by the domestic CPI. Domestic interest rate is the annualiazed average rate on 1-3 years loans in the domestic financial system in UF. Unexpected change in the real exchange rates is as described in text. The accounting data are from the SVS sample, as described in the text. Macro data are drawn from various sources. For detailed sources and

**Table 5: Effect of Exposure Across Firm Categories**

| | Dependent Variable: Investment in Fixed Capital | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Exposure | -0.662 | -1.135 | -0.719 | -0.696 | 0.132 |
| x (Δ log Real Exchange Rate) | [0.186]*** | [0.376]*** | [0.256]*** | [0.194]*** | [0.365] |
| Exposure | -0.007 | -0.030 | -0.017 | -0.013 | -0.012 |
| | [0.024] | [0.033] | [0.024] | [0.024] | [0.024] |
| Total Debt | -0.096 | -0.126 | -0.112 | -0.104 | -0.086 |
| | [0.056]* | [0.079] | [0.065]* | [0.059]* | [0.059] |
| Cash flow from operations | 0.327 | 0.300 | 0.328 | 0.326 | 0.324 |
| | [0.145]** | [0.153]** | [0.145]** | [0.145]** | [0.145]** |
| I(AFP) x Exposure | | 1.009 | | | |
| | | [0.452]** | | | |
| I(foreign) x Exposure | | | 0.305 | | |
| | | | [0.687] | | |
| I(ADR) x Exposure | | | | 0.521 | |
| | | | | [0.488] | |
| I(grupo) x Exposure | | | | | -1.050 |
| | | | | | [0.483]** |
| **Regresion Information** | | | | | |
| N | 1326 | 1102 | 1323 | 1308 | 1326 |
| $R^2$ | 0.36 | 0.35 | 0.36 | 0.36 | 0.36 |
| Estimator | OLS | OLS | OLS | OLS | OLS |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Cluster Year SE | Yes | Yes | Yes | Yes | Yes |

This table reports the OLS estimates of variants of equation (xx) in the text. All independent accouting variables are once lagged. Standard errors adjusted for clustering by year are reported 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. The dependent variable is as indicated above. All accounting variables are scaled by the lag of total firm assets. The baseline real exchange rate is defined as the nominal exchange rate divided by the domestic CPI. The accounting data are from the SVS sample, as described in the text. Firm ownership data are from various sources. As detailed in text, periods in which firms change across categories are excluded from the sample. Macro data are drawn from various sources. For detailed sources and descriptions, see Section 3 and Appendix.

**Table 6: Dollar Debt and Production Structure**

| | Dollar Debt / Total Assets | | | | Dollar Debt / Total Debt | | | | I(dollar debt) | | Net Dollar Debt / Total Assets | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Dollar Assets / Total Assets | 0.269 | 0.271 | 0.330 | 0.343 | 0.586 | 0.604 | 0.702 | 0.735 | 7.466 | 5.061 | 0.274 | 0.276 |
| | [0.052]*** | [0.049]*** | [0.034]*** | [0.034]*** | [0.082]*** | [0.087]*** | [0.070]*** | [0.071]*** | [2.332]*** | [1.830]*** | [0.051]*** | [0.050]*** |
| Exports / Sales | 0.128 | 0.140 | 0.174 | 0.185 | 0.356 | 0.365 | 0.441 | 0.444 | 1.894 | 1.871 | 0.149 | 0.159 |
| | [0.033]*** | [0.033]*** | [0.026]*** | [0.025]*** | [0.069]*** | [0.068]*** | [0.052]*** | [0.051]*** | [0.466]*** | [0.594]*** | [0.033]*** | [0.032]*** |
| Tradeable | -0.008 | | 0.027 | | 0.077 | | 0.157 | | 0.547 | | -0.008 | |
| | [0.018] | | [0.013]** | | [0.040]* | | [0.027]*** | | [0.184]*** | | [0.017] | |
| Dollar Debt / Total Assets | | | | | | | | | | | | |
| **Regresion Information** | | | | | | | | | | | | |
| N | 1078 | 1078 | 1078 | 1078 | 1078 | 1078 | 1078 | 1078 | 1085 | 1085 | 1075 | 1075 |
| $R^2$ | 0.17 | 0.24 | -- | -- | 0.29 | 0.33 | -- | -- | -- | -- | 0.21 | 0.26 |
| Sector Dummies | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Cluster RUT | Yes | Yes | No | No | Yes | Yes | No | No | Yes | Yes | Yes | Yes |
| Estimator | OLS | OLS | Tobit | Tobit | OLS | OLS | Tobit | Tobit | Probit | Probit | OLS | OLS |

This table reports the estimates of equation (xx) in the text. The estimation method is reported under each column. Standard errors are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The dependent variable is as detailed in the table.Tradeable firms are those from sectors ISIC=1 to 3. Net derivatIve position is the notional value of the net long position of forex derivatives with domestic banks. For detailed sources and descriptions, see Section 3.

**Table 7: Determinants of Derivative Use**

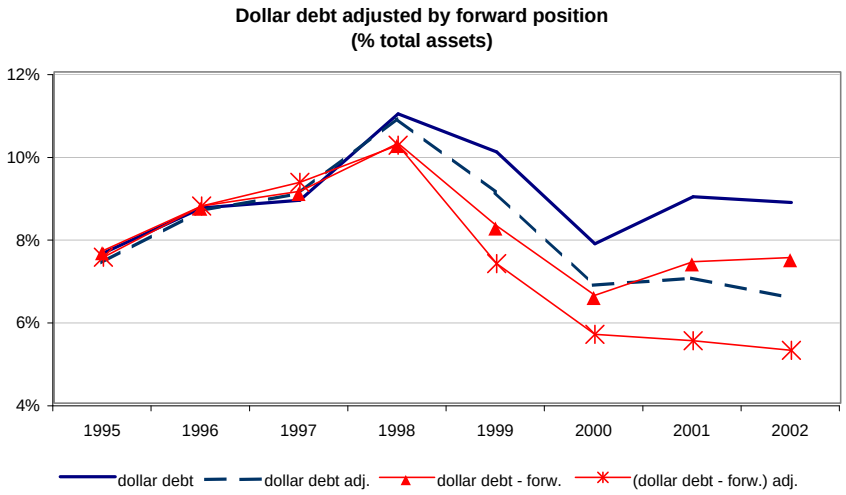
| | Net Derivatives/ Total Assets | | I(dollar derivatives) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Dollar Assets / Total Assets | -0.040 | -0.039 | -0.179 | -0.077 |
| | [0.013]*** | [0.014]*** | [0.578] | [0.492] |
| Exports / Sales | -0.037 | -0.036 | -0.426 | -0.244 |
| | [0.009]*** | [0.009]*** | [0.358] | [0.379] |
| Tradeable | 0.000 | | 0.543 | |
| | [0.005] | | [0.209]*** | |
| Dollar Debt / Total Assets | 0.112 | 0.110 | 1.313 | 1.311 |
| | [0.038]*** | [0.039]*** | [0.519]** | [0.527]** |
| **Regresion Information** | | | | |
| N | 1075 | 1075 | 1078 | 1078 |
| $R^2$ | 0.13 | 0.13 | -- | -- |
| Sector Dummies | No | Yes | No | Yes |
| Cluster RUT | Yes | Yes | Yes | Yes |
| Estimator | OLS | OLS | Probit | Probit |

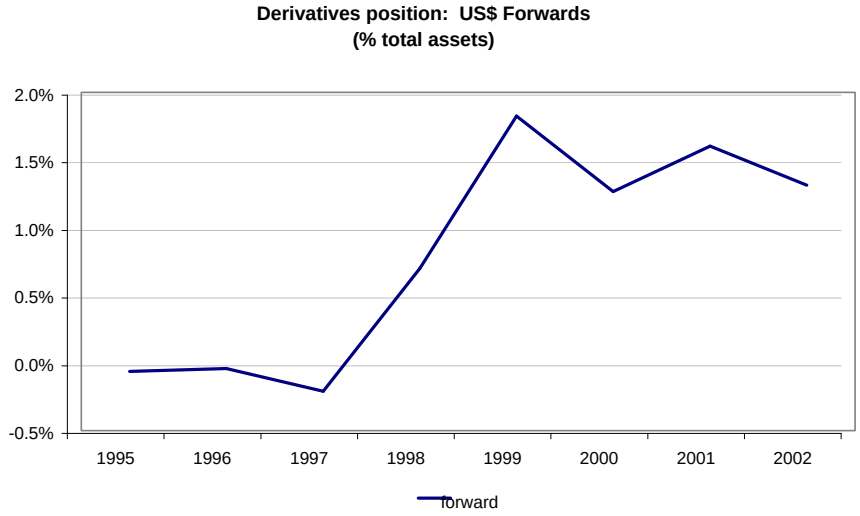
**Table 8: Corporate Determinants of Currency Exposure**

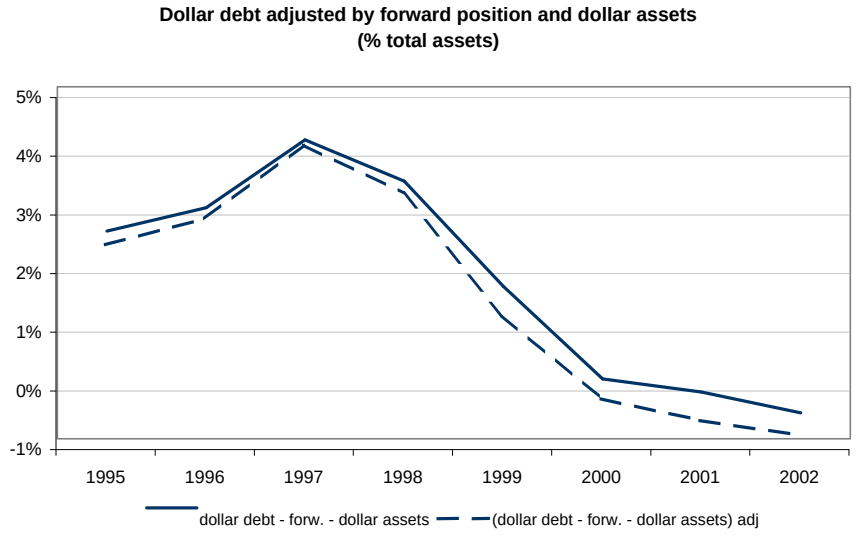
| LHS: Absolute Excess Dollar Debt (Net of derivatives) | |
|---|---|
| **Ownership** | |
| Log ( total assets) | 0.018 |
| | [0.003]*** |
| I(ADR) | 0.081 |
| | [0.024]*** |
| I(Foreign) | 0.043 |
| | [0.013]*** |
| I(grupo) | 0.026 |
| | [0.012]** |
| I (AFP) | 0.02 |
| | [0.009]** |
| **Liquidity risk (lagged)** | |
| Current Assets / Current Liabilities | -0.001 |
| | [0.000]* |
| Accrued Interest / Earnings from Operations | 0.002 |
| | [0.002] |
| **Investment opportunities** | |
| lagged investment to asset ratio | 0.023 |
| | [0.031] |
| ln (market to book) | -0.004 |
| | [0.002]** |

The table reports estimated coefficients and robust standard errors for univariate regressions between "excess" dollar debt and each ownership variable reported in the table. In the case of liquidity risk variables and investment opportunities variables, the regression also includes total assets as a control. Excess dollar debt is defined as the absolute value of the error term in a regression of dollar debt on firm productive structure, as detailed in Column 2 of Table 6. Firm owership, liquidity and investment opportunity variables are as defined in text. Firm ownership data are from various sources. All liquidity variables are once lagged. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%.

**Figure 1:Exchange Rate Exposure and Derivatives Position in Chilean Firms**



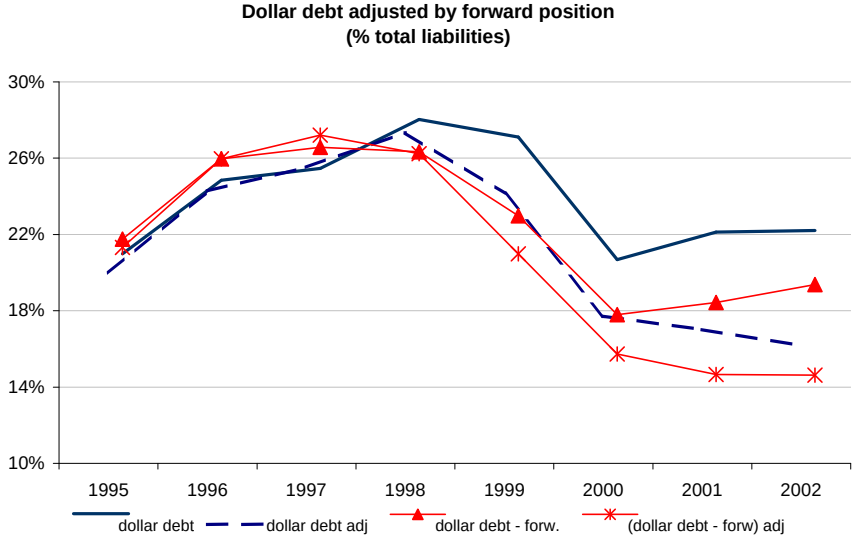



**Table 9: Exposure Pre and Post Float**

| **RHS variables:** | **LHS: Ratio of exposure to total assets:** | | | | | | **LHS: Ratio of exposure to total liabilities** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dollar Debt | | Dollar Debt Net of Derivative Position | | Dollar Debt Net of Derivative Position and Dollar Assets | | Dollar Debt | | Dollar Debt Net of Derivative Position | | **Net Derivative Position** | | **Dollar Assets / Total Assets** | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| log (total assets) | 0.025 [0.004]*** | 0.048 [0.012]*** | 0.019 [0.004]*** | 0.044 [0.012]*** | 0.008 [0.006] | 0.004 [0.018] | 0.061 [0.008]*** | 0.056 [0.024]** | 0.05 [0.008]*** | 0.044 [0.026]* | 0.003 [0.001]** | 0 [0.006] | | |
| Dollar Assets / Total Assets | 0.229 [0.057]*** | 0.133 [0.028]*** | 0.25 [0.056]*** | 0.133 [0.029]*** | | | 0.522 [0.071]*** | 0.31 [0.056]*** | 0.561 [0.069]*** | 0.304 [0.059]*** | -0.045 [0.014]*** | -0.012 [0.013] | | |
| Exports / Sales | 0.117 [0.036]*** | -0.017 [0.037] | 0.136 [0.033]*** | -0.033 [0.038] | 0.031 [0.043] | 0.138 [0.056]** | 0.409 [0.062]*** | 0.113 [0.075] | 0.474 [0.060]*** | 0.068 [0.079] | -0.031 [0.008]*** | 0.017 [0.017] | | |
| Dollar Debt / Total Assets | | | | | | | | | | | 0.105 [0.036]*** | 0.086 [0.016]*** | | |
| **dummy(1996-1999)** | 0.016 [0.007]** | 0.019 [0.006]*** | 0.028 [0.007]*** | 0.031 [0.006]*** | 0.038 [0.013]*** | 0.039 [0.008]*** | 0.067 [0.014]*** | 0.064 [0.011]*** | 0.102 [0.016]*** | 0.095 [0.012]*** | -0.014 [0.004]*** | -0.014 [0.003]*** | -0.015 [0.014] | -0.018 [0.007]*** |
| **Regresion Information** | | | | | | | | | | | | | | |
| N | 923 | 923 | 921 | 921 | 921 | 921 | 923 | 923 | 921 | 921 | 921 | 921 | 921 | 921 |
| $R^2$ | 0.28 | 0.75 | 0.29 | 0.72 | 0.02 | 0.6 | 0.41 | 0.79 | 0.43 | 0.77 | 0.16 | 0.51 | 0 | 0.7 |
| Estimator | OLS | OLS/FE | OLS | OLS/FE | OLS | OLS/FE | OLS | OLS/FE | OLS | OLS/FE | OLS | OLS/FE | OLS | OLS/FE |
| Cluster RUT | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No |
| **dummy(1996-1999) as a % of pre float exposure** | 18% | 22% | 33% | 37% | 122% | 125% | 28% | 27% | 44% | 41% | | | | |

This table reports the estimates of equation (xx) in the text. The estimation method is reported under each column. Standard errors are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The dependent variable is as detailed in the table. Net derivative position is the notional value of the net long position of forex derivatives with domestic banks. For detailed sources and descriptions, see Section 3.

**Table 10: Excess Dollar Debt**

| | LHS: Absolute Value of Excess Dollar Debt (Net) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| pre | 0.004 | 0.063 | 0.005 | 0.009 | 0.003 | 0.007 | 0.003 | 0.000 | 0.003 | 0.007 |
| | [0.005] | [0.049] | [0.004] | [0.004]** | [0.005] | [0.005] | [0.005] | [0.006] | [0.005] | [0.006] |
| log(assets) | 0.016 | 0.018 | | | | | | | | |
| | [0.002]*** | [0.003]*** | | | | | | | | |
| pre x log(assets) | | -0.003 | | | | | | | | |
| | | [0.003] | | | | | | | | |
| I(ADR) | | | 0.049 | 0.081 | | | | | | |
| | | | [0.014]*** | [0.024]*** | | | | | | |
| pre x I(ADR) | | | | -0.052 | | | | | | |
| | | | | [0.022]** | | | | | | |
| I(Foreign) | | | | | 0.033 | 0.043 | | | | |
| | | | | | [0.011]*** | [0.013]*** | | | | |
| pre x I(Foreign) | | | | | | -0.015 | | | | |
| | | | | | | [0.012] | | | | |
| I (AFP) | | | | | | | 0.025 | 0.02 | | |
| | | | | | | | [0.008]*** | [0.009]** | | |
| pre x I(AFP) | | | | | | | | 0.007 | | |
| | | | | | | | | [0.009] | | |
| I(Grupo) | | | | | | | | | 0.022 | 0.026 |
| | | | | | | | | | [0.010]** | [0.012]** |
| pre x I(Grupo) | | | | | | | | | | -0.006 |
| | | | | | | | | | | [0.009] |
| **Regresion Information** | | | | | | | | | | |
| N | 1221 | 1221 | 1221 | 1221 | 1211 | 1211 | 1221 | 1221 | 1221 | 1221 |
| $R^2$ | 0.14 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |
| Estimator | OLS | OLS | OLS | OLS | OLS | OLS | OLS | OLS | OLS | OLS |
| Cluster RUT | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports the estimates of equation (xx) in the text. Standard errors are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. For detailed sources and descriptions, see Section 3.

**Table 11: Macroeconomic Determinants of Net Dollar Debt**

| RHS variables: | Dependent variable: Dollar debt net of derivative positions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Macro determinants of net dollar debt | | | Macro determinants of net dollar debt interacted with firm characteristics | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\alpha$ | | | | | | | | |
| Exports / Sales | 0.043 | 0.043 | 0.043 | 0.017 | 0.049 | 0.046 | 0.048 | 0.043 |
| | [0.077] | [0.077] | [0.077] | [0.070] | [0.079] | [0.078] | [0.078] | [0.077] |
| Dollar Assets / Total Assets | 0.136 | 0.139 | 0.14 | 0.121 | 0.139 | 0.14 | 0.135 | 0.139 |
| | [0.034]*** | [0.036]*** | [0.036]*** | [0.032]*** | [0.036]*** | [0.036]*** | [0.033]*** | [0.036]*** |
| ***(r-r*)*** | | | | | | | | |
| Domestic Interest Rate | 0.59 | 0.268 | | | | | | |
| | [0.151]*** | [0.244] | | | | | | |
| Foreign Interest Rate | -0.171 | -0.212 | | | | | | |
| | [0.060]*** | [0.049]*** | | | | | | |
| Spread = ( r-r* ) | | | 0.224 | 0.197 | 0.178 | 0.065 | 0.134 | 0.208 |
| | | | [0.065]*** | [0.069]*** | [0.080]** | [0.136] | [0.091] | [0.146] |
| $s^2$ | | | | | | | | |
| dummy(1996-1999) = pre | | 0.014 | 0.015 | 0.022 | 0.015 | 0.014 | 0.017 | 0.015 |
| | | [0.006]** | [0.004]*** | [0.004]*** | [0.004]*** | [0.004]*** | [0.004]*** | [0.004]*** |
| $s^2$ **( r-r*)** | | | | | | | | |
| pre x spread | | | | | | | | |
| **interactions with** $\mu$ | | | | | | | | |
| I(grupo) | | | | | | | | 0 |
| | | | | | | | | [0.000] |
| I(grupo) x spread | | | | | | | | 0.026 |
| | | | | | | | | [0.138] |
| pre x I(grupo) x spread | | | | | | | | |
| I(Foreign) | | | | | | | 0.168 | |
| | | | | | | | [0.068]** | |
| I(Foreign) x spread | | | | | | | 0.34 | |
| | | | | | | | [0.290] | |
| pre x I(Foreign) x spread | | | | | | | | |
| I(AFP) | | | | | | 0.012 | | |
| | | | | | | [0.014] | | |
| I(AFP) x spread | | | | | | 0.322 | | |
| | | | | | | [0.172]* | | |
| pre x I(AFP) x spread | | | | | | | | |
| I(ADR) | | | | | 0.025 | | | |
| | | | | | [0.063] | | | |
| I(ADR) x spread | | | | | 0.623 | | | |
| | | | | | [0.768] | | | |
| pre x I(ADR) x spread | | | | | | | | |
| log(assets) | | | | 0.053 | | | | |
| | | | | [0.011]*** | | | | |
| log(assets) x spread | | | | 0.077 | | | | |
| | | | | [0.038]** | | | | |
| pre x log(assets) x spread | | | | | | | | |
| **Regresion Information** | | | | | | | | |
| N | 1221 | 1221 | 1221 | 1198 | 1221 | 1221 | 1211 | 1221 |
| $R^2$ | 0.68 | 0.68 | 0.68 | 0.69 | 0.68 | 0.68 | 0.69 | 0.68 |
| Estimator | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE | OLS/FE |
| Cluster Year | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports the estimates of equation (xx) in the text. Firm fixed effects included but not reported. Standard errors adjusted by year cluster are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The dependent variable is dollar debt net of the notional derivative value with domestic banks. Ownership dummies are described in text and are from various sources. The domestic interest rates is the annualized rate on 1 to 3 year loans in UF. The foreign interest rate is the annualized return on the EMBI bond index.

**APPENDIX A : Variables Definitions and Sources**

| *Name* | *Definition* | *Source* | *Code* |
|---|---|---|---|
| *Main variables* | | | |
| investment in fixed capital | k(t) - k(t-1) / total assets (t-1) | FECU | i2a |
| dollar debt over lagged assets | book value of dollar debt (t) / total assets | complementary note to FECU | dd2a |
| dollar assets over lagged assets | book value of dollar assets (t) / total assets | complementary note to FECU | da2a |
| net long derivatives position over lagged assets | nominal valule of forex forward position / total assets | Central Bank of Chile and FECU | f2a |
| exposure | dd2a - f2a - da2a | | ddfa2a |
| tradeable | 1 if ciiu code (rev 2) is 1, 2 or 3. **(1)** | FECU | trad |
| exports over total assets | exports / total assets | PROCHILE and FECU | x2a |
| exports over sales | exports / sales | PROCHILE and FECU | x2s |
| *Secondary variables* | | | |
| total assets | 5.10.00.00 | FECU | a |
| sales | 5.31.11.11 | FECU | |
| capital stock | 5.12.10.00 + 5.12.20.00 + 5.12.30.00 + 5.12.40.00 | FECU | k |
| leverage (total debt) over total assets | (5.10.00.00 - 5.24.00.00) / total assets | FECU | l2a |
| cash flow from operations (EBIT) | 5.31.11.00 + depreciation | FECU | |
| cash flow from operations over assets | EBIT / total assets | | cf2a |
| depreciation | 5.12.60.00 (t) - 5.12.60.00 (t-1) | FECU | |
| current ratio = current assets / current liabilities | 5.11.00.00 / 5.21.00.00 | FECU | current |
| coverage ratio = accrued interest / cash flow from operations | 5.31.12.60 / EBIT | FECU | coverage |
| market capitalization = pqe | Market cap (December) | Bolsa de Comercio | pqe |
| accounting equity | 5.24.00.00 | FECU | |
| log(market-to-book) | log(pqe / accounting equity) | FECU + Bolsa de Comercio | lnmkt2book |
| log(tobin q) | log (( pqe + total debt ) / total assets) | FECU + Bolsa de Comercio | lntobinq |
| maturity mismatch = ( current liab - current assets ) / total assets | (5.21.00.00- 5.11.00.00) / total assets | FECU | mmis2a |
| *Ownership* | | | |
| **foreign ownership** | **completar** | | |
| ADR | 1 if firm has ADR | Bank of New York | |
| grupo | 1 if firm is in a economic conglomerate | Superintendency of Securities and Insurance (SVS) | |
| AFP | 1 if firms is AFP-able | Superindentency of Pension Funds Administrators (SAFP) | |
| *Macro* | | | |
| log (real exchange rate) | log(tc_dic / cpi_dic) | International Financial Statistics, IFS. | lrer |
| embi yield | annual embi return | Bloomberg | embir |
| domestic interest rate | average annualized loan rate in financial system in UF (1 - 3 years) | Central Bank of Chile | iuf |
| cpi_dic | consumer price index (december) | International Financial Statistics, IFS. | cpi_dic |
| tc_dic | nominal exchange rate (december) | International Financial Statistics, IFS. | tc_dic |

Note: the numbers

Note:

(1) There are two companies that we classified as tradeable that do not follow this definition: LAN CHILE (the national airline) and CIA SUD AMERICANA DE VAPORES (the shipping company)