Firm Dollar Debt and Central Bank Dollar Reserves: A Case of Moral Hazard?

Rajeswari Sengupta[1]

University of California, Santa Cruz

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ABSTRACT

In this paper, we explore the hypothesis that foreign exchange reserves accumulated by central banks of emerging market economies may cause moral hazard among non financial sector firms, encouraging them to increase the share of dollar debt in their balance sheets. Using a novel firm-level balance sheet database on assets and liabilities, we test the moral hazard hypothesis for close to 1000 firms in four major Latin American (LATAM) economies, Argentina, Brazil, Chile and Mexico. Results suggest that over the sample period 1995-2007, accumulation of reserves may have led to an increase in the dollar borrowing of publicly traded non financial sector firms of these economies. The results are robust to the inclusion of firm-level and country-level control variables, as well as country, sector, and time dummies. To the best of our knowledge, this is the first attempt to emphasize and empirically analyze the role played by reserves in causing moral hazard among firms in emerging economies.

JEL Classification: F3; F4

Keywords: *Foreign exchange reserves, foreign currency denominated debt, moral hazard, exchange rate regimes, currency crisis.*

[1]Corresponding address: Department of Economics,University of California, Santa Cruz, 95064, CA, USA. Email: rsengupt@ucsc.edu.

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1 Introduction

One of the most significant economic developments of the last two decades has been the widespread liberalization of international financial markets. The resultant explosion of cross-border capital flows has also been associated with capital flow reversals, as witnessed during the disruptive currency crises in Mexico, Thailand, Indonesia, Russia, Brazil, Turkey and Argentina, in the 1990s and early 2000s. Several analysts have suggested that the spate of financial crises in the emerging market economies (henceforth EMEs) were of a new kind, reflecting fragilities in the balance sheets of firms and banks, rather than current account imbalances.[2] One source of balance-sheet fragility often emphasized is that of foreign currency denominated debt held in the corporate sector in EMEs.[3] On one hand, interest rates on dollar debt are lower than on domestic currency debt.[4] On the other hand, dollar debt exposes firms to a currency mismatch between foreign currency liabilities and domestic currency revenues, thereby increasing the vulnerabilities of firms to exchange rate depreciations.[5]

Many observers argue that the large buildup of unhedged foreign currency liabilities in the corporate sector of East Asian and Latin American (LATAM) economies is caused mainly by fixed or pegged exchange rate regimes. Other authors, however, have claimed that the problem of private sector dollar indebtedness extends across EMEs, regardless of exchange rate regimes.[6] Although the debate among academicians and policy makers has been intense, hardly any consensus has been reached on

[2]See, for example, Dornbusch (2001) and Krugman (1999).

[3]As noted in Caballero and Krishnamurthy (2003), while observers continue to debate the causes underlying the crises, one factor they converge on is that contracting external debt in foreign currency as opposed to domestic currency, by domestic firms, creates balance sheet mismatches that lead to bankruptcies.

[4]Henceforth, dollar debt and foreign currency debt to be used interchangeably.

[5]The role played by currency mismatch in corporate balance sheets in particular, has been theoretically explored, among others by, Chang and Velasco (1999), Krugman (1999b), Aghion, Bacchetta and Banerjee (2001a, b), Schneider and Tornell (2001) and Caballero and Krishnamurthy (2003). Hausman, Panizza and Stein (2001) also provide evidence that most contracts between lenders and borrowers in emerging markets take the form of dollar debt.

[6]See, for example, the evidence in Hausman et al (2001) of the prevalence of dollar denominated debt in economies with fixed as well as flexible exchange rate systems. They argue that this problem arises due to the fundamental inability of EMEs to borrow abroad in their own currencies, a problem they refer to as the 'original sin'.

the issue of firm-level dollar borrowing in EMEs and the determinants thereof.

The objective of the current study is to shed light on the much-debated issue of corporate dollar debt in EMEs. While during a fixed exchange rate regime, firms have a higher incentive to borrow in dollars, as the economy shifts to a flexible regime, ideally dollar debt should decrease. However, the Central Bank (CB) of the economy may exhibit a lower credibility of maintaining a regime of float. In other words, the CB may use its stock of foreign exchange reserves and actively intervene in the foreign exchange market to stabilize the exchange rate. Exchange rate stabilization helps avoid damaging effects of a major currency depreciation on the balance sheets of financial and non-financial sectors of the economy. This can lead to a potential moral hazard issue wherein firms implicitly assume that in the event of any major currency depreciation, exchange rates will be stabilized by the CB using its reserves.[7] Over the past couple of decades, foreign exchange reserves of EMEs have exhibited a staggering increase, despite the shift away from fixed exchange rates (see, for example, Aizenman and Lee, 2007 and Aizenman, 2007). Such ex-ante reserve accumulation may provide an implicit guarantee to the firms who in turn may consider themselves insulated against the currency risk associated with incurring dollar debts and continue to borrow in dollars. In light of this hypothesis, we explore the following questions: What could be the potential impact of international reserves accumulated by the Central Banks of EMEs on the foreign currency debt used by the non-financial sector firms of these economies? Does hoarding of reserves lead to moral hazard at the firm-level?

Reserves are accumulated by the CBs of EMEs to provide insurance against future speculative attack and financial instability associated with potential sudden-stop risks. As noted in Kamin (2002), moral hazard refers to the possibility that the provision of such insurance, by diminishing the incentives to prevent a particular outcome may actually result in a rise in the incidence of that outcome.[8]

[7]See, for example, Chamon and Hausmann (2005) who argue that if every atomistic firm expects all other firms to borrow in dollars, then it will also expect the CB to stabilize the exchange rate at the expense of higher volatility of the interest rate (and hence hold higher reserves, as a precaution against a mass bankruptcy). Consequently, the firm itself will end up borrowing in dollars as well.

Our paper makes two important contributions to our understanding of the external financing choices of EME firms. Firstly, the association between CB's foreign exchange reserves and EME firms' foreign currency denominated debt has not been empirically explored before in the relevant literature. Several studies, mostly theoretical, endogenize the currency composition of private sector debt. According to one approach, foreign currency debt arises in the banking sector because of the moral hazard created by systemic bailout guarantees doled out by the CB as a lender of last resort.[9] Dooley (2000) points out that fixing the exchange rate offers free insurance to firms that borrow in dollars, thereby encouraging dollar borrowing and creating moral hazard. Distortion of private sector incentives owing to implicit free insurance is also behind the government-bailout-type models, such as in Burnside, Eichenbaum and Rebelo (2001). In their view, stabilizing the exchange rate creates moral hazard. It conveys the impression that the government is socializing the exchange risk, thereby encouraging the private sector to accumulate unhedged exposures.

While a significant part of the literature on the causes of dollar debt has focussed on moral hazard interpretations, most of the focus has either been on systemic government bailout guarantees or on insurance offered for bank deposits in foreign currencies or on the bailout packages offered by International Monetary Fund(IMF).[10] What has largely been neglected is the possibility that recourse to self-insurance or precautionary policies by CBs may have diminished the incentives for firms in EMEs to reduce the extent of their dollar borrowing. The line of thinking expressed in our paper can also be linked to the famous 'fear of floating' hypothesis as proposed by Calvo and Reinhart (2002). Hausmann et al. (2001) also argue that given the persistence of

[8]Moral hazard is related to asymmetric information, a situation in which one party in a transaction has more information than another. The party that is insulated from risk (in our case, EME firms) generally has more information about its actions and intentions than the party providing the insurance (in our case, the CB of an EME). More broadly, moral hazard occurs when the party with more information about its actions or intentions has a tendency or incentive to behave inappropriately from the perspective of the party with less information.

[9]See, for example, McKinnon and Pill (1998); Burnside, Eichenbaum and Rebelo (2001) and Schneider and Tornell (2001).

[10]Also see for example, Dooley (2000), Lane and Phillips (2000), Burnside et al (2001), Schneider and Tornell (2004) and Kamin (2002).

dollar liabilities in the private sector, CBs will float, but with a life jacket, i.e. they let the exchange rate float over some range but aggressively intervene if a certain threshold is reached.

The second contribution of our paper is the use of a novel firm-level balance-sheet database to explore the possible association between CB's reserves and EME firms' dollar debt.[11] Most of the existing work in the relevant literature remains theoretical, primarily owing to dearth of appropriate data on firm-level dollar denominated assets and liabilities. Yet, this issue in essence remains one that merits careful examination of suitable data. According to Krugman (1999), there exists a sort of external diseconomy to borrowing in foreign currencies. The decision by an individual firm to borrow in dollars imposes costs on the rest of the economy. This is because such borrowing magnifies the real-exchange-rate impact of adverse shocks, and also because real depreciation interacts with capital-market imperfections to cause economic distress. Hence the issues to be considered have crucial implications for academic researchers and policy makers, alike.

At the macro level there is a substantial literature documenting the high levels of foreign currency debt in EMEs.[12] However, EME firm-level studies on dollar debt have mostly documented the impact of currency depreciations on firms' investments or net worth in the presence of dollar-debt, to understand whether depreciations have a contractionary impact on these firms.[13] There is much less empirical work on the determinants of dollar debt at the micro level. Schmukler and Vesperoni (2001) analyze the effect of financial liberalization on firms' financing choices during the 1980s and 1990s, for a sample of seven emerging economies (LATAM and East Asian). However

[11] I am sincerely thankful to Herman Kamil at the IMF for allowing me to access this data base. In 2002, the Research Department of the Inter-American Development Bank (IDB) spearheaded a LATAM research project called 'Debt Composition and Balance Sheet effects of Exchange Rate Fluctuations in Latin America: A firm-level Analysis'. One of the main goals of this project was to collect firm-level data on liability composition for a large sample of LATAM companies. As a result of this project, new firm-level information was collected by the IDB for major LATAM economies such as Argentina, Brazil, Chile, and Mexico (Kamil, 2004). The database is henceforth referred to as the IDB database.

[12] See, for example, Arteta (2002), Ize and Yeyati (2003), Cespedes et al (2004).

[13] See, for example, Bleakley and Cowan (2008).

in absence of data on the currency composition of firms' assets and liabilities, they are unable to examine the factors influencing the use of foreign currency denominated debt, by the firms of these economies.

Building on the important research that precedes it, our paper sheds light on the effects of reserve accumulation and other firm-level and country-level determinants, on firm-level dollar borrowing. Our focus on corporate balance sheet data is useful in understanding the moral hazard hypothesis from the point of view of the firms and also allows us to exploit the heterogeneity across firms in our sample.

Regression analyses conducted on the pooled data-set containing all firms of all four economies yield several key findings. Firstly, results are suggestive of the presence of a possible moral hazard effect. Increase in foreign exchange reserves is found to have a positive impact on the share of dollar debt held in the non-financial sector firms of these economies. This effect is significant even after controlling for firm-level characteristics as well as macroeconomic factors such as exchange rate volatility and differential borrowing cost between domestic and foreign economies. Secondly, firm specific features such as share of exports in sales, firm size and access to international equity markets, are found to have significant impact on firm dollar borrowing, across all economies in our sample. Our results also survive a series of robustness checks.

2 Data and Methodology

2.1 Empirical Model

We use annual data for the non-financial sector firms of four LATAM economies namely, Argentina, Brazil, Chile, and Mexico, to assess the possible moral hazard effect caused by reserve accumulation in EMEs. Our analysis covers the time period from 1995 to 2007, chosen primarily on the basis of firm-level data availability. Our baseline specification is given by the following regression models:

$$D_{ijt} = \beta_0 + \beta_1 R_{jt-1} + \alpha_i + \epsilon_{ijt}, \tag{1}$$

$$D_{ijt} = \beta_0 + \beta_1 R_{jt-1} + \alpha_i + X'_{ijt-1}\beta_2 + \epsilon_{ijt}, \tag{2}$$

$$D_{ijt} = \beta_0 + \beta_1 R_{jt-1} + \alpha_i + X'_{ijt-1}\beta_2 + Z'_{jt-1}\beta_3 + \epsilon_{ijt}, i = 1..N; j = 1..K; t = 1..T \tag{3}$$

where i denotes firms (N = 1025), j represents economies (K = 4), and t denotes time (T = 13). D_{ijt} is the ratio of dollar liabilities to total liabilities of firm i in country j at time t, R_{jt-1} is the ratio of reserves to GDP of country j at time t-1, X'_{ijt-1} is a vector of firm-level control variables lagged by 1 period, Z'_{jt-1} denotes a vector of country-level control variables also lagged by 1 period and α_i are the firm fixed effects. The latter controls for unobserved heterogeneity factors that may affect firm dollar debt but cannot be controlled for owing to lack of data, such as risk appetite of firms, stock market value of firms, share of imported inputs etc.[14] According to our moral hazard hypothesis, the implicit guarantee provided by ex-ante reserves accumulation in period (t-1) may induce firms to increase ratio of dollar debt to total debt in period t. Thus, we would expect β_1 to have a positive sign in our estimations.

The dependent variable is firm-level dollar debt normalized by total debt to facilitate comparison across heterogenous firms with varying degrees of leverage. The explanatory variables can be grouped into two main categories: (i) firm-level microeconomic variables, and (ii) country-level macroeconomic indicators. The variables in the first category focus on key characteristics of firms. These variables have mostly been identified by the corporate finance literature as important factors influencing firm financing choices.[15] The group of firm-level variables consists of the ratio of exports to sales for each firm, firm size (proxied by the natural logarithm of total assets of each firm) and access to international equity markets, captured by a dummy variable that takes the value 1 from the year that a given firm starts trading (or raising capital) in a foreign equity market, and 0 otherwise.

[14]Most of the explanatory variables may themselves be affected by the share of dollar debt in firm balance sheets (such as reserves, exchange rate volatility, exports to sales ratio etc). To control for potential endogeneity biases, we lag all variables by 1 period.

[15]See, for example, Booth, Demirguc-Kunt, and Maksimovic (2001), Myers (1977) and Graham and Harvey (2001).

The second category comprises country-level macroeconomic variables that may affect firms' dollar borrowing. This includes international reserves to GDP ratio of each country, which is the focal point of our analysis, volatility of exchange rate (measured using the annual standard deviation of monthly nominal exchange rates) and the difference between interest rates in domestic and foreign markets (proxied using the difference between domestic lending rate and LIBOR of the same maturity). We incorporate these categories of explanatory variables sequentially in our estimations to highlight the importance of each group of determinants. Later on we also consider a different normalization of international reserves as a robustness check.

2.2 Data Sources

Data on firm-level dollar denominated debt, total debt and total assets, as well as other firm-level explanatory variables such as exports and sales of firms, and dummies indicating access to international equity markets, have been collected from the IDB database.[16] All publicly traded firms that are listed or have been listed in these economies stock exchanges are included, rather than only the most liquid firms or firms with the highest market capitalization, as has been common in other related cross-country studies.[17] Most of the information has been collected by the IDB research team from annual reports and audited corporate filings obtained from local stock markets and regulatory agencies in each country.

Prior to using the data we make several data adjustments. In particular, we remove all outliers, i.e. firms in our sample with less than three years of data. Also some firms leave the data set after one or two years only to re-enter after a few years. This might artificially affect the dollar-debt composition of the sample. Hence

[16]For further details on the IDB database, see Kamil (2004). The database does not include commercial banks, brokerage firms, financial groups, insurance companies and mutual funds. Capital structure of financial-sector firms is not comparable with behavior of non financial firms, due to banking regulations impacting currency mismatches on balance sheets. For other studies that have used this database, see, Galindo, Panizza and Schiantarelli (2003), Cowan, Hansen and Herrera (2004), Pratap, Lobato and Somuano (2003), Benavente, Johnson and Morande (2003) and Bonomo, Martins and Pinto (2003).

[17]See, for example, Allayanis, Brown and Klapper (2003).

we remove firms that have gaps or breaks in their spell and include firms that have a continuous duration in the sample. We convert all financial and income related data to U.S. dollars using contemporaneous exchange rates to facilitate analysis of the pooled data-set of all firms of all economies. While there is no clear distinction regarding the specific currencies in which the debt is denominated, following Kamil (2004) we assume that majority of the debt is issued in US dollars. An important caveat worth mentioning here is that Argentina underwent large scale *pesification*, i.e. conversion of dollar contracts into peso contracts, in the aftermath of the 2000-01 currency crisis. This phenomenon of sudden drop in the dollar debt of Argentine firms may distort our estimations. Hence we exclude the post 2001 years for Argentina in our sample.

Among the macroeconomic variables, data on international reserves of economies has been collected from International Financial Statistics (IMF). International reserves are measured by total reserves minus gold, as reported by the IMF, for each country. Data on M2 (broad money base) are from the World Development Indicators (WDI). Data on exchange rates, lending rates and LIBOR have been put together from the Global Financial Database (GFD). Table 1 reports descriptive statistics (mean and standard deviation) of the important variables (both firm-level and country-level) used in our analysis. The table reveals the extent of diversity in the average firm-level dollar debt among the economies in our sample. Average share of dollar debt in total debt of firms is reasonably different between Argentina and Mexico on one hand (more than 35 percent) and Brazil and Chile on the other (20 percent). The overall average across all economies is 27 percent. The share of exports in firms' sales is higher in Brazil and Mexico relative to the other two economies. Also in terms of firm size (total assets), Brazil and Mexico seem to have the largest firms. Finally, with regard to reserves, Chile has the highest reserves to GDP ratio while the other three economies have identical average reserve ratios. When scaled by M2 as well, Chile has the highest reserves ratio (this is consistent with Chile's rapid rate of accumulation of reserves and build up of sovereign wealth fund).

3 Estimation Results

The results of the fixed effects panel regressions based on equations (1) to (3) are presented in Table 2. These are our baseline results on the effect of reserves on firms' dollar debt and their robustness is examined in subsequent analyses. The effects of reserves to GDP ratio and firm-level control variables are reported under the Columns labeled (1) to (4). Columns (5) and (6) show the contributions of the other country-level variables.

In absence of any control variable, the coefficient estimate of the reserves to GDP ratio (*res_gdp*) is highly significant with a p-value less than 0.001. It has a positive impact on firm-level dollar debt to total ratio. Without controlling for the effects of other determinants, a unit increase in an economy's international reserves of the previous period, induces an estimated increase of 0.26 unit in the share of dollar debt in total debt of an average firm in the current period. Hence in addition to statistical significance, the effect of the reserves to GDP ratio is of practical relevance as well. This effect attests to our hypothesis that an increase in CB's reserves stock may induce the EME firms to borrow more in dollars, due to the underlying implicit guarantee of exchange rate stabilization and hence insulation from currency risk.

Among the firm-level explanatory variables, exports to sales ratio (*export_sales*)is statistically significant and the sign of its estimated coefficient is in accordance with theoretical predictions. For instance, as discussed in Caballero and Krishnamurthy (2003), producers of tradable goods may be in a better position to access external financing opportunities, by virtue of their foreign currency denominated revenues. They are likely to be able to better hedge their currency exposure using their dollar denominated export earnings. Also, they may have better access to international credit markets, as they can pledge their export receivables as collateral to foreign lenders (Jeanne 2003). Hence, firms producing tradable goods may be expected to issue higher dollar debt as compared to firms in the non-tradable sectors. Hence in our case, the significant and positive coefficient of the exports to sales ratio across all specifications implies that an exporting firm is more likely to borrow in dollars as

opposed to a non-exporting firm.

Firm size (*firm_size*) measured by the natural log of total assets, though positive, does not come out significant in any of the specifications in Table 2. On the other hand access to international equity markets (*adr_gdr*) captured by a dummy variable, is significant with a negative sign. It may be argued that firms that can access external equity markets prefer to borrow less in dollars given the currency risk associated with dollar debt, since they can raise the required capital from international stock markets. The inclusion of the firm-level control variables marginally improves the adjusted R-squares estimate (which is very low to start off with, potentially because of the large number of observations). In presence of these firm-level variables, the effect of the reserves to GDP ratio continues to remain significant and positive and in fact increases in magnitude when controlled for exports to sales ratio and firm size.

In Columns (5) and (6), we report the effects of sequentially adding exchange rate volatility (*ex_vol*) and differential borrowing cost (r-r^*), to the baseline regression specification. Higher exchange rate volatility implies higher currency fluctuations and hence higher risk associated with issuing dollar debt, and should lead to a lower dollar debt to total debt ratio.[18] This is consistent with our result that exchange rate volatility is significant with a negative sign in both Columns (5) and (6). Furthermore, the choice between local and foreign currency debt should be an increasing function of the benefits of each type of debt and a decreasing function of the costs of debt, as predicted by the static trade-off theory.[19] The most obvious cost, is the difference between interest rates in the domestic and the foreign borrowing markets.[20] Thus, we hypothesize that the difference between domestic and foreign interest rates should be positively associated with the use of foreign currency denominated debt. In the absence of precise data on corporate bond spreads, the differential borrowing cost in domestic and foreign capital markets (r-r^*) is proxied using the difference between

[18]See, for example, Burnside et al (2001a).

[19]See, for example, Allayanis et al (2003).

[20]Graham and Harvey (2001) find that 44 percent of firms responding to their survey report that lower foreign interest rates are 'important or very important' in the decision to use foreign debt.

the lending rates of respective economies and LIBOR of same maturity.[21] Our results validate our hypothesis-the differential borrowing cost variable is significant with a positive sign.

The inclusion of the macroeconomic controls weakens the impact of the reserves to GDP ratio on firm-level dollar debt (both in terms of magnitude and statistical significance)-however it is still significant and positive. After controlling for the effects of the micro and macro determinants of dollar debt, a unit increase in an economy's international reserves of the previous period, induces an estimated increase of 0.19 unit in the share of dollar debt in total debt of an average firm in the current period The addition of the country-level variables also leads to a large increase in adjusted R-squares estimate.

In addition to the ones mentioned here, several other explanatory variables were also included in the regressions, such as the ratio of M2 to GDP to control for the depth of financial markets, a proxy for the terms of trade index given the high degree of dependence of LATAM economies on exports, a proxy for financial openness, and domestic financial market development measured using the ratio of of stock market capitalization and domestic private credit extended by deposit money banks to GDP. However, by and large, the results were insignificant and hence have not been reported here.[22]

4 Robustness Checks

In this section we report the results of a few robustness checks performed to validate the effect of CB reserves on firm's dollar borrowing across different scenarios.

[21] We also used the difference between yields on domestic sovereign bonds and US Treasury Bonds of the same maturity, with data from Datastream the Macroeconomic Databases For Emerging And Developed Markets (CEIC). Results were the same and have not been reported here for brevity but are available upon request.

[22] Full estimation results with all control variables are available upon request.

4.1 Alternative Measure of International Reserves

We have so far normalized international reserves by an economy's GDP to facilitate comparison across economies of different sizes. While this normalization scheme is quite standard in the empirical literature on international reserves, it may understate the role of other economic variables in assessing the adequacy of international reserve holding. For instance, Obstfeld, Shambaugh and Taylor (2008) argue that M2 (the size of domestic financial liabilities that could potentially be converted into foreign currency divided) acts as a proxy for depth of financial markets and is a significant predictor of reserve demand. Thus normalizing international reserves by M2 of an economy would facilitate comparison across our sample of LATAM economies that have varying degrees of financial market depth.[23] To assess the robustness of the effect of reserves on firm's dollar debt, we re-estimate equations (1) to (3) using the ratio of reserves to M2 (lagged by 1 period). The estimation results are presented in Table 3.

Columns (1) to (4) correspond to regression equations (1) and (2) as before whereas Columns (5) and (6) correspond to equation (3). The effect of the reserves to M2 ratio is consistently robust across all specifications. However its estimated coefficient is now smaller than before (0.08 as opposed to 0.19 in Table 2). The estimated impact of the other explanatory variables is fairly similar to Table 2 (both in terms of magnitude and statistical significance). The adjusted R-squares estimates however are now relatively higher than before. Once again inclusion of the macro variables significantly increases the adjusted R-squares estimates.

4.2 Panel Tobit Analysis

One problem with the baseline specification is that a large fraction of firms have zero dollar debt every year (roughly 23 percent in total). In other words, observations for dollar debt are *left-censored at 0*. In order to account for this kind of a corner solution in the choice problem of firms, we re-estimate equation (3) using a panel

[23]The M2 to GDP ratios of Brazil, Mexico, Chile and Argentina over the sample period are 0.263, 0.433, 0.489 and 0.262 respectively.

Tobit (censored) model for limited dependent variable. The structural equation of a pooled Tobit model is as follows:

$$D^*_{ijt} = \beta_0 + \beta_1 R_{jt-1} + X'_{ijt-1}\beta_2 + Z'_{jt-1}\beta_3 + \epsilon_{ijt} \tag{4}$$

where D^*_{ijt} is a latent variable observed for values greater than 0. Then observed D_{ijt} is defined by the following equations:

$$D_{ijt} = D^*_{ijt} \; if \; D^*_{ijt} > 0 \tag{5}$$

$$D_{ijt} = 0 \; if \; D^*_{ijt} \leq 0 \tag{6}$$

Accordingly, the structure of the Panel Tobit model with random effects would be:

$$D_{ijt} = \quad D^*_{ijt} = \beta_0 + \beta_1 R_{jt-1} + \alpha_i + X'_{ijt-1}\beta_2 + Z'_{jt-1}\beta_3 + \epsilon_{ijt} \; if \; RHS > 0 \tag{7}$$

$$D_{ijt} = \qquad 0 \; otherwise, \tag{8}$$

where the residuals are *iid* and normally distributed with mean 0 and variance σ^2.[24] Results of the Panel Tobit model estimations are presented in Table (4) and Table (5). Column (1) of each table includes the same explanatory variables as discussed in the previous section. In Table 4, reserves are normalized using GDP whereas in Table 5, the independent variable of interest is reserves to M2 ratio of an economy. In Column (2) of each table, in addition to the control variables discussed above, we also incorporate country, sector and year specific dummy variables.

Table (4) shows that when the censored nature of the dependent variable is taken into account, the reserves to GDP ratio is positive for both specifications but significant only when the country, sector and year dummies are also added. Also notable is the significant and positive estimated coefficients of firm size. This is consistent with the predictions in the relevant literature. Larger firms are likely to have more assets to pledge as collateral and to have a higher credibility. Also, firm size can be

[24]Unobserved firm-specific effects can be assumed to be either random or fixed. Random Effects assumption implies that unobserved individual effects are uncorrelated with any of the observed variables included in the model. Since the dependent variable is censored and Tobit is a non-linear model, it is not technically feasible to use the fixed effects estimator (Hsiao, 2003).

an inverse proxy for the probability of financial distress, and hence positively related to leverage (Allayanis et al, 2003). Thus, larger firms are more likely to use dollar debt to obtain the desired level of debt financing.

The dummy variable capturing firms' access to international equity markets now has a positive sign ((adr_gdr) significant in Column (2)). This is perhaps more plausible because as pointed out in Allayanis et al (2003), firms may be able to reduce agency costs of debt by credibly signaling their superior quality and creditworthiness via foreign stock market listing. Thus, consistent with this hypothesis we find here that firms which have developed a reputation in foreign capital markets via a foreign equity listing, are more likely to contract dollar denominated debt. All other explanatory variables have the expected sign as discussed before and are mostly significant. The magnitude of the reserves to GDP ratio (0.16 in Column (2)) is also close to that of Column (6) in Table 2 (0.19).

4.2.1 Tobit Model with alternative measure of reserves

As a final robustness check, we estimate the Panel Tobit equation (7) using the reserves to M2 ratios of the respective economies. Results are reported in Table (5) wherein the Columns (1) and (2) refer to the same specifications as in Table (4). Now, reserves to M2 ratio is significant (and positive) even when we do not control for the country, sector and year specific effects. However, the impact is much smaller than in Table (4) in terms of magnitude (0.06 as opposed to 0.16). Firm size is once again positive and significant as are the export to sales ratio and external equity access dummy variable. Exchange rate volatility and differential borrowing cost also have the expected signs and are highly significant. Thus, accounting for possible corner solutions in the financial choice of firms sustains the possible positive impact of CBs' reserves accumulation on the dollar borrowing of these firms.

5 Conclusion

In this study, we explore the possibility of moral hazard on the part of EME firms, resulting from the implicit guarantee provided by the ex-ante accumulation of foreign

exchange reserves by EME Central Banks. Using novel firm-level balance sheet data for close to 1000 firms across four major LATAM economies, we estimate a simple model with fixed effects panel regression technique and present evidence consistent with our moral hazard hypothesis.

An increase in international reserves leads to an increase in the dollar borrowing of non-financial sector firms in our sample under specified circumstances. Results hold when controlled for firm-level determinants of dollar debt, such as exports to sales ratio, variable firm size, and access to international equity markets. The results are also robust to the inclusion of differences between domestic and external borrowing costs and nominal exchange rate volatility. Furthermore, the positive impact of reserves on firm dollar debt is sustained when we account for the fact that a significant fraction of the firms in our sample issue zero dollar debt i.e. possibility of corner solutions in the firms' financing choices. The result also holds when we incorporate country, sector and year specific effects.

The results presented here are new findings which contribute substantially to our understanding of the impact of EME international reserve accumulation on firms' financing decisions as well as on the factors determining firms' foreign currency borrowing. Future work will shed light on the mechanism underlying the possible moral hazard effect (perhaps through a theoretical model). It may also be worthwhile to conduct economy-specific analysis of the impact of reserves on the firm-level dollar borrowing of each economy. Such an exercise will provide insights into the differential responses of firms of different economies to their respective central bank's reserve accumulation policies. The global financial crisis of 2008-09 is in many ways a watershed event, not only for the developed nations but also for major EMEs such as those in the LATAM region. In this context, an exercise such as the current one or the future work proposed maybe highly informative regarding the impact of the crisis on the non-financial sector firms of EMEs.

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TABLE 1: Descriptive Statistics for Full Sample (1995-2007)

Variables	Brazil	Mexico	Chile	Argentina*	All
dollar debt/total debt	0.20	0.36	0.20	0.57	0.27
(std. dev.)	(0.20)	(0.30)	(0.29)	(0.29)	(0.30)
exports/sales	0.12	0.17	0.07	0.07	0.10
(std. dev.)	(0.22)	(0.23)	(0.19)	(0.16)	(0.21)
total assets(billions USD)	2.09	1.58	0.32	0.51	1.21
(std. dev.)	(7.51)	(3.83)	(0.82)	(1.16)	(4.99)
total no. of firms	370	196	263	196	1025
reserves_gdp	0.07	0.07	0.19	0.07	0.11
(std. dev.)	(0.02)	(0.02)	(0.04)	(0.02)	(0.06)
reserves_m2	0.27	0.16	0.40	0.28	0.29
(std. dev.)	(0.06)	(0.03)	(0.12)	(0.03)	(0.10)

Source: Author's own calculations. First four columns report average values across all firms in each country. Last column reports average values across all firms in the pooled sample.*Argentina sample truncated in 2001 due to large scale pesification post crisis.

Table 2: Firm Dollar-Debt and CB Dollar-Reserves

	Dependent Variable: dollar debt/total debt					
Indep. Vars.	(1)	(2)	(3)	(4)	(5)	(6)
res_gdp	0.259***	0.300***	0.304***	0.213**	0.166*	0.187**
	(0.075)	(0.081)	(0.082)	(0.091)	(0.090)	(0.090)
export_sales		0.060***	0.059***	0.047**	0.045**	0.049**
		(0.019)	(0.019)	(0.021)	(0.020)	(0.021)
firm_size			0.001	0.004	0.003	0.005
			(0.004)	(0.004)	(0.004)	(0.004)
adr_gdr				-0.048***	-0.042***	-0.028**
				(0.013)	(0.013)	(0.014)
ex_vol					-0.002***	-0.002***
					(0.000)	(0.000)
r-r*						0.002***
						(0.000)
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	0.247***	0.258***	0.232***	0.208**	0.245***	0.158*
	(0.008)	(0.009)	(0.079)	(0.082)	(0.082)	(0.084)
Observations	8588	7114	7112	6917	6917	6556
Adj. R^2	0.002	0.004	0.004	0.004	0.024	0.043

Note: Column (1) corresponds to equation (1), Columns (2) to (4) correspond to equation (2) while Columns (5) and (6) correspond to equation (3) in the text. *res_gdp* is international reserves scaled by GDP of each country, *export_sales* is the ratio of firm-level exports and sales, *firm_size* is firm size measures by log of total assets, *adr_gdr* is a dummy variable denoting whether the firm is listed in a foreign stock exchange, *ex_vol* is volatility of exchange rate of each country, and *r-r** is the differential borrowing cost between domestic and foreign economies. All explanatory variables are lagged by 1 period. Argentina sample has been truncated in 2001 due to large scale pesification post crisis. Robust standard errors are in parentheses. ***, **, and * denote signicance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 3: With Alternative Measure of Reserves

	Dependent Variable: dollar debt/total debt					
Indep. Vars.	(1)	(2)	(3)	(4)	(5)	(6)
res_m2	0.177***	0.213***	0.219***	0.200***	0.084**	0.077**
	(0.027)	(0.029)	(0.030)	(0.032)	(0.034)	(0.035)
export_sales		0.055***	0.054***	0.044**	0.044**	0.048**
		(0.019)	(0.019)	(0.021)	(0.020)	(0.021)
firm_size			0.005	0.007	0.004	0.006
			(0.004)	(0.004)	(0.004)	(0.004)
adr_gdr				-0.048***	-0.041***	-0.028**
				(0.013)	(0.012)	(0.014)
ex_vol					-0.002***	-0.002***
					(0.000)	(0.000)
r-r*						0.002***
						(0.000)
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	0.223***	0.230***	0.137*	0.115	0.218***	0.138
	(0.008)	(0.009)	(0.080)	(0.083)	(0.083)	(0.086)
Observations	8588	7114	7112	6917	6917	6556
Adj. R^2	0.006	0.010	0.010	0.009	0.024	0.043

Note: Column (1) corresponds to equation (1), Columns (2) to (4) correspond to equation (2) while Columns (5) and (6) correspond to equation (3) in the text. *res_m2* is international reserves scaled by M2 of each country. All other explanatory variables are as in Table 1. Argentina sample has been truncated in 2001 due to large scale pesification post crisis. Robust standard errors are in parentheses. ***, **, and * denote signicance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 4: Panel Tobit Model Estimates

	Dep. Var: dollar debt/total debt	
Indep. Vars.	(1)	(2)
res_gdp	0.077	0.156*
	(0.055)	(0.091)
export_sales	0.060***	0.076***
	(0.012)	(0.012)
firm_size	0.018***	0.030***
	(0.002)	(0.002)
adr_gdr	-0.011	0.018**
	(0.008)	(0.008)
ex_vol	-0.002***	-0.001***
	(0.000)	(0.000)
r-r*	0.001***	0.000**
	(0.000)	(0.000)
Firm Specific Effects	Y	Y
Country Dummies		Y
Sector Dummies		Y
Year Dummies		Y
Constant	-0.445***	-1.010***
	(0.085)	(0.090)
Observations	6556	6556
Uncensored Obs. (%)	77.03	77.03

Note: Column (1) corresponds to equation (4), and Column (2) corresponds to equation (5) in the text. Coefficient estimates denote marginal effects on dependent variable, evaluated at mean values of independent variables. For dummies, it is the effect of discrete changes from 0 to 1. All explanatory variables are as in Table 1. Argentina sample has been truncated in 2001 due to large scale pesification post crisis. Standard errors are in parentheses. ***, **, and * denote signicance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 5: With Alternative Measure of Reserves

	Dep. Var: dollar debt/total debt	
Indep. Vars.	(1)	(2)
res_m2	0.060***	0.058*
	(0.022)	(0.035)
export_sales	0.059***	0.076***
	(0.012)	(0.012)
firm_size	0.019***	0.030***
	(0.002)	(0.002)
adr_gdr	-0.012	0.018**
	(0.008)	(0.008)
ex_vol	-0.002***	-0.001***
	(0.000)	(0.000)
r-r*	0.001***	0.000**
	(0.000)	(0.000)
Firm Specific Effects	Y	Y
Country Dummies		Y
Sector Dummies		Y
Year Dummies		Y
Constant	-0.491***	-1.008***
	(0.087)	(0.090)
Observations	6556	6556
Uncensored Obs. (%)	77.03	77.03

Note: Column (1) corresponds to equation (4), and Column (2) corresponds to equation (5) in the text. Coefficient estimates denote marginal effects on dependent variable, evaluated at mean values of independent variables. *res_m2* is international reserves scaled by M2 of each country. All other explanatory variables are as in Table 1. Argentina sample has been truncated in 2001 due to large scale pesification post crisis. Standard errors are in parentheses. ***, **, and * denote signicance at the 1 percent, 5 percent, and 10 percent levels, respectively.