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

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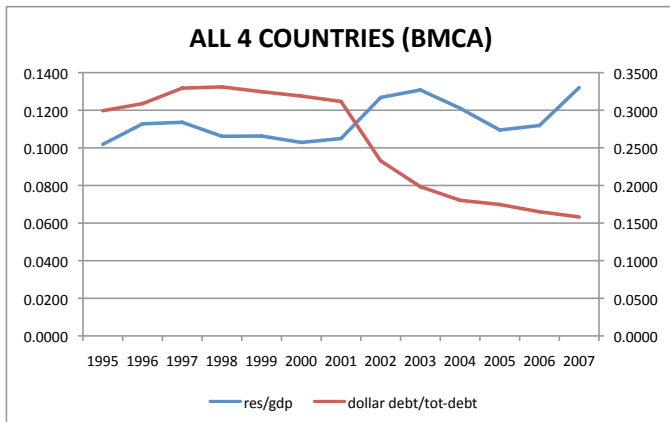
└─ Main Topic

   └─ Background

- Corporate firms in emerging market economies (EMEs) borrow largely in foreign currency (or dollars).
- Interest rates on dollar debt are lower than on local currency (peso) debt.
- While liabilities are denominated in dollars, assets are mostly in pesos - especially for firms in non-tradable sectors.
- Resultant currency mismatch on firms' balance sheets is a source of financial vulnerability.
- An exchange rate depreciation increases peso value of dollar debt.
- This in turn increases likelihood of debt default and bankruptcy.
- Cause of concern for EMEs in Latin America, East Asia and Eastern Europe.

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└─ Main Topic

   └─ Identification and Hypothesis

- During fixed exchange rate regime, firms have higher incentive to borrow in dollars.
- As an economy shifts to flexible regime, ideally share of dollar debt should decrease.
- However, an EME central bank (CB) may exhibit a lower credibility of maintaining a regime of float ('float with a lifejacket').
- CB may intervene in forex market to stabilize exchange rate using its stock of international reserves (IR).
- IR are accumulated as means of self-insurance against future financial instability (*precautionary motive*; see Aizenman and Lee, 2007)
    - Moral Hazard: Firms may consider themselves insulated against currency risk.

Objective

Understand whether act of holding reserves may act as potential signal of currency stabilization, inducing firms to continue borrowing in dollar.

- Firm-level database: close to 1000 firms in 4 LATAM countries.

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└─Main Topic

 └─Identification and Hypothesis

ALL 4 COUNTRIES (BMCA)

LHS axis: Avg. International Reserves to GDP ratio of Brazil, Mexico, Chile and Argentina (1995-2007).

RHS axis: Avg. Firm-Level Dollar Liabilities to Total Liabilities ratio of non-financial sector firms of 4 countries.

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

└─ Agenda

- Main Topic
  - Context in Literature
- Objective & Contribution
- Data
- Empirical Model
- Results (work in progress)
- Summary & Next Steps

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└─ Agenda

  └─ Context in Literature

- Financial liberalization has led to widespread cross-border capital flows as well as capital flow reversals.

    - Currency crises in Mexico(1994-95), Thailand(1997), Indonesia(1997), Russia(1998), Brazil(1999), Turkey(2000-01) and Argentina(2001).

- Crises of 1990s reflected fragilities in balance sheets of firms, banks and governments (Dornbusch, 2001; Krugman, 1999).

- One source of balance-sheet fragility often emphasized is, *foreign currency debt*.

    - Krugman(1999); Aghion, Bacchetta and Banerjee(2001); Schneider and Tornell (2001); Cespedes, Chang and Velasco(2004).

        - Theoretically explored role played by currency mismatch in corporate balance sheets.
        - This reflects a shift of emphasis from government/macro variables to firm level financial variables.

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└─ Agenda

  └─ Context in Literature

- McKinnon and Pill(1998); Schneider and Tornell (2001) :
  Endogenize currency composition of private debt.

  - Pvt. sector dollar debt arises due to *moral hazard* created by
    bailout guarantees of CB (mostly bank bailouts).

- Dooley (1997); Burnside, Eichenbaum and Rebelo(2001):
  Stabilizing exchange rate may lead to more foreign currency debt.

- 'Fear of Floating': (Calvo and Reinhart, 2002; Hausmann, Panizza
  and Stein, 2001).

  - EMEs formally float their currency, but tend to limit exchange
    rate movement.
  - Aggressively intervene in forex markets, using large stock of
    reserves.

- Over past twenty years, CBs in EMEs (including LATAM) have accumulated large amounts of dollar reserves.

Question

Does accumulation of reserves result in moral hazard by encouraging firms to borrow in dollars?[1]

Contributions:

- Association between CB's reserves and firms' dollar debt has not been empirically explored before.
  - Dearth of data on firm level dollar assets and liabilities.
- Use of a novel firm-level balance-sheet database covering close to 1000 firms in 4 major LATAM countries, to explore this association.
- Looking into this question will also throw light on possible determinants of LATAM firm level dollar debt.

[1]Moral hazard occurs when the party with more information about its intentions has an incentive to behave inappropriately from the perspective of the party with less information.

- New database from Inter-American Development Bank (IDB): Annual balance sheet information of non-financial sector firms.

- 4 major LATAM countries (Argentina, Brazil, Chile & Mexico), over the period, 1995-2007.

- Annual reports, audited corporate filings from country specific sources, regulatory agencies.

  1. Sector a firm belongs to (1, 2,3 digit ISIC classification),
  2. Total assets and liabilities,
  3. Total dollar assets and liabilities,
  4. Maturities of assets and liabilities,
  5. Exports and sales,
  6. Dummies indicating :
     - Whether firm owned by a foreign company,
     - Whether it has issued ADR-GDR in foreign stock exchanges,
     - Whether the firm belongs to a tradable sector.

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└─ Data: Firm Level

- Other studies that have used this IDB database: Cowan, Hansen and Herrera (2004); Cowan and Bleakley (2008); Galindo, Panizza and Schiantarelli (2003) etc.

- Mostly explored the impact of dollar debt in balance sheets on firms' investment.

- Country level data from:
  1. Global Financial Database (Exchange rates, Lending rates & LIBOR)
  2. World Development Indicators (WDI) (Reserves, GDP)
  3. Datastream (Sovereign bond yields)
  4. World Bank Financial Structure Database (Beck, Demirguc-Kunt and Levine, 2007) (Stock market cap. and private credit by banks to GDP ratio)

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└─Data: Firm Level

  └─Data Slicing

- To ensure that estimation is done with sufficient and consistent observations:
  - Drop firms with less than three years of data.
  - Drop firms with embedded gaps in duration/spell.
  - Checking for inconsistent accounting data (e.g. dollar liabilities > total liabilities.)

- All data converted to US dollars using contemporaneous exchange rates, to facilitate pooling of data.

- For Argentina: most debt contracts were rewritten through *pesification* in 2002 (crisis).
  - Exclude post-2001 years as contractual changes may distort estimations.

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└─ Empirical Model

   └─ Regression Equation

- Fixed Effects Panel regressions over data-set including firms of all 4 countries during 1995-2007.

$$D_{ijt} = \beta_0 + \beta_1 R_{jt-1} + \alpha_i + X'_{ijt-1}\beta_2 + Z'_{jt-1}\beta_3 + \epsilon_{ijt}, \qquad (1)$$

$i = 1..N$ (firm) ; $j = 1..K$ (country); $t = 1..T$ (time)

- D_{ijt} = ratio of dollar liabilities and total liabilities of firm i in country j at time t.
- R_{jt-1} = ratio of international reserves and gdp of country j at time t-1.

- X'_{ijt-1} = Firm level control variables.
- Z'_{jt-1} = Country level control variables.

- 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.

- Expected $\beta_1 > 0$.

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└─Empirical Model

  └─Explanatory Variables: Firm Level

- Ratio of exports to sales:
    - Firms with higher exports to sales ratio are likely to be able to hedge their currency exposure using dollar denominated export earnings (Caballero and Krishnamurthy, 2003).
    - Likely to have better access to international credit markets as can pledge export receivables as collateral (Jeanne, 2003).

- Firm size measured by log of total assets.
    - Larger firms likely to have more assets to pledge as collateral and hence will be able to issue more dollar debt (Allayanis, 2003)

- Dummy $adr\_gdr = 1$ from year when a firm starts trading in a foreign equity market.
    - Foreign stock market listing enables a firm to signal its superior quality to creditors (Allayanis, 2003) .

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└─Empirical Model

  └─Explanatory Variables: Country Level

- Volatility in exchange rate:
    - A highly volatile exchange rate should lower the ratio of dollar debt to total debt.

- Differential Borrowing cost (r-r*): difference in domestic lending rate and LIBOR of same duration.
    - Positively associated with use of dollar debt (Graham and Harvey, 2001).

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└─ Empirical Model

    └─ Summary Statistics

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.

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└─ Results

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

Indep. Vars.	(1)	(2)	(3)	(4)	(5)	(6)
			Dependent Variable: dollar debt/total debt			
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
Observations	8588	7114	7112	6917	6917	6556
$Adj. R^2$	0.002	0.004	0.004	0.004	0.024	0.043

Robust Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Res_gdp is ratio of international reserves to GDP.

A constant is included but not reported.

All explanatory variables are lagged by 1 period.

- Lagged reserves to gdp ratio: Positive in line with hypothesis and statistically significant.

  - A unit increase in reserves-gdp ratio induces an estimated increase of 0.19 unit in the dollar debt ratio of a firm, on average.

- Exports to sales ratio of firms: Significant predictor of firms' dollar debt.

  - Result consistent with studies of firms' financing choices (Caballero and Krishnamurthy, 2003; Jeanne, 2003; and Allayanis at al, 2003)

- Exchange rate volatility: Expected negative sign.

- Differential borrowing cost: Expected positive sign.

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

└─ Results

   └─ Robustness Checks: 1

Table 3: With Alternative Measure of Reserves

Indep. Vars.	Dependent Variable: dollar debt/total debt					
	(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
Observations	8588	7114	7112	6917	6917	6556
Adj. R^2	0.006	0.010	0.010	0.009	0.024	0.043

Robust Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Res_m2 is ratio of international reserves to M2.
A constant is included but not reported.
All explanatory variables are lagged by 1 period.

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└─ Results

    └─ Robustness Checks: II

- One concern with baseline specification: large fraction of firms have zero dollar debt every year (roughly 23% in total).
- Observations for dollar debt are left censored at 0.
    - Estimate equation (1) using a Panel Tobit (censored) model for limited dependent variable (LDV).
- Structural equation of Panel Tobit model with random effects:

$$D_{ijt}^* = \beta_0 + \beta_1 R_{jt-1} + \alpha_i + X_{ijt-1}'\beta_2 + Z_{jt-1}'\beta_3 + \epsilon_{ijt} \tag{2}$$

where D_{ijt}^* is a latent variable observed for values greater than 0.

- Observed D_{ijt} is defined by the following equations:

$$D_{ijt} = D_{ijt}^* \ if \ D_{ijt}^* > 0 \tag{3}$$
$$D_{ijt} = 0 \ if \ D_{ijt}^* \leq 0 \tag{4}$$

i = firm; j = country; t = time.

- α_i = Unobserved firm-specific effects

- Assume ϵ_{ijt} is normally distributed with mean 0 and variance σ^2.
- Also incorporate country, sector and year specific dummy variables.

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└─ Results

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
Observations	6556	6556
Uncensored Obs. (%)	77.03	77.03

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All explanatory variables are as in Table 2.
Coeff. estimates denote marginal effects on dep.var.
For dummies, it is the effect of discrete changes from 0 to 1.

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

└─Summary

- *Objective:* Use firm level balance sheet data for LATAM (4) to explore possibility of moral hazard from implicit guarantee provided by ex-ante reserve-accumulation.

- *Evidence:* Increase in reserves may lead to an increase in dollar borrowing of non-financial sector firms.

- *Robustness:* Results hold when controlled for:

  1. firm-level and country-level determinants of dollar debt;
  2. firm-specific effects & sector, time and country dummies;
  3. accounted for corner solutions in firms' financing choices

- Next Steps

  1. Country specific analysis of potential moral hazard.
  2. Policy implications with regard to responses of leveraged firms in LATAM to the current global financial crisis of 2008-09.

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Questions/Comments

Thank You

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

└─Appendix

Table 5: Panel Tobit: With Reserves/M2

	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
Observations	6556	6556
Uncensored Obs. (%)	77.03	77.03

Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$
All explanatory variables are as in Table 2.
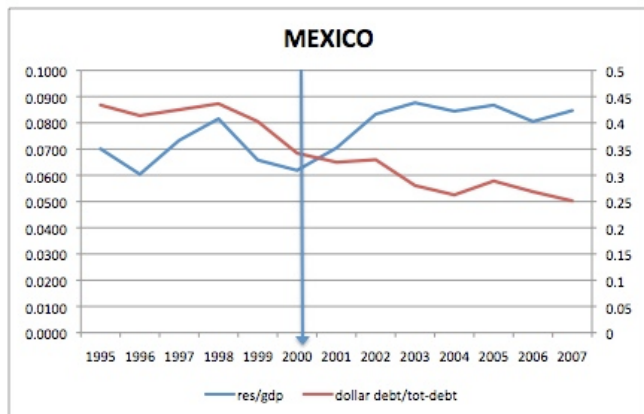Coeff. estimates denote marginal effects on dep.var.
For dummies, it is the effect of discrete changes from 0 to 1.

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

└ Appendix

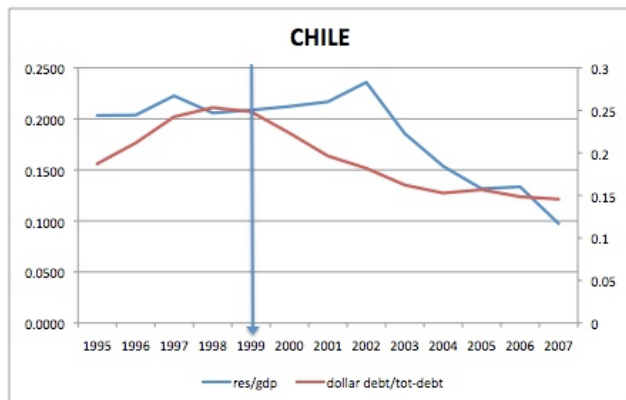LHS axis: International Reserves to GDP ratio of Brazil (1995-2007).

RHS axis: Avg. Firm-Level Dollar Liabilities to Total Liabilities ratio of non-financial sector firms.
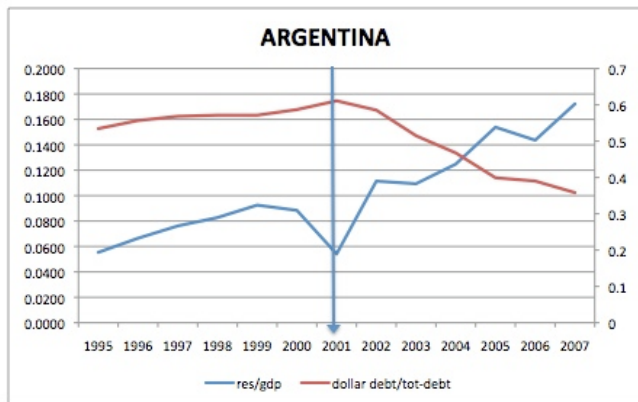
MEXICO

LHS axis: International Reserves to GDP ratio of Mexico (1995-2007).

RHS axis: Avg. Firm-Level Dollar Liabilities to Total Liabilities ratio of non-financial sector firms.

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

└─Appendix

LHS axis: International Reserves to GDP ratio of Chile (1995-2007).

RHS axis: Avg. Firm-Level Dollar Liabilities to Total Liabilities ratio of non-financial sector firms.

LHS axis: International Reserves to GDP ratio of Argentina (1995-2007).

RHS axis: Avg. Firm-Level Dollar Liabilities to Total Liabilities ratio of non-financial sector firms.