

How Do Exchange Rate Regimes Affect the Corporate Sector's Incentives to Hedge Exchange Rate Risk?

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Systemic Importance of Balance Sheet Currency Mismatches

- Currency mismatches in firms' balance sheets have been a source of financial vulnerability in emerging markets.
- Firms highly leveraged in foreign currency debt but with little foreign currency earnings are exposed to sudden swings in the exchange rate.
- Currency risk exposure in the corporate sector can lead to financial stress in the banking system.

Substantial Controversy on the Role of Exchange Rate Regimes in Explaining Currency Mismatches...

- Majority view: pegged regimes provide an implicit guarantee that leads to excessive currency risk-taking (Burnside, Eichenbaum and Rebelo, 2002; Goldstein and Turner, 2004; Schneider and Tornell, 2004).
- Opposite view: the problem of unhedged foreign currency liabilities has deeper roots than the choice of exchange rate regimes (Calvo and Reinhart, 2000a and 2000b; Eichengreen, Hausmann and Panizza, 2003).

... Leading to Different Empirical Predictions

- Majority view: switching to flexible regimes will reduce balance sheet currency mismatches, as high-frequency volatility discourages foreign-exchange-denominated borrowing and provides incentives for firms to hedge currency risk.
- Opposite view: higher exchange rate volatility associated with floating rates leads to higher costs of hedging foreign currency risk. This, in turn, discourages hedging and thus exacerbates currency mismatches.

Mixed Evidence on the Effect of Exchange Rate Regimes on Private Sector Currency Mismatches

- Arteta (2005) finds that floating regimes *exacerbate* balance sheet currency mismatches at the *bank level*.
- At the *firm-level*, Martinez and Werner (2002) and Cowan, Hansen and Herrera (2005) look at the individual experiences of Mexico and Chile, respectively.
- There is no cross-country, microeconomic study specifically looking at the financial vulnerability induced by different exchange rate regimes.

Aim of the Study

To answer the following question:

- Do Flexible Exchange Rate Regimes Encourage More Hedging of Currency Risk at the Firm Level?
- Analysis based on new micro-level dataset with information on the currency composition of balance sheet variables for seven Latin American countries, between 1992 and 2005.

Outline of the Presentation

Organization of the rest of the presentation:

- Description of Data Set and Key Stylized Facts.
- Empirical Results.
- Conclusions and Policy Implications.

Firm-Level Data Used

- Microeconomic data-set with accounting information for 2,200 firms in Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay.
- Detailed information on:
 - Fraction of liabilities and assets that are denominated or indexed to foreign currency.

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 - Fraction of liabilities and assets that are denominated or indexed to foreign currency.
 - Breakdown of sales into domestic and foreign markets.
 - Firms' access to international capital markets.

Exchange Rate Regime Classification

- Classify regimes into Fixed/Pegged or Floating based on the IMF de facto classification.
- Construct Calvo and Reinhart (2002)'s measure of Freedom to Float (FtoF) Index: quantifies how much the central bank chooses not to stabilize the exchange rate for a given level of pressure on its currency.

Flexibility of Exchange Rates Across Regimes

	Year of Regime	Nominal Exchange Rate 2/		Freedom to Float Index 3/	
	Change 1/	Fixed/ Pegged	Floating	Fixed/ Pegged	Floating
Argentina	2002	0.00	2.10	0.00	0.35
Brazil	1999	0.78	6.92	0.00	1.08
Chile	1999	1.61	2.96	0.13	1.03
Colombia	1999	2.53	2.29	0.32	1.31
Mexico	1994	1.07	2.74	0.01	0.23
Peru	1999	0.98	0.92	0.02	0.20
Uruguay	2002	1.48	2.11	0.02	0.09

Sources: International Financial Statistics; and author's calculations.

1/ Based on IMF's de Facto Classification of Exchange Rate Regimes

2/ Standard deviation of monthly percentage changes of U.S. dollar-domestic currency bilateral exchange rates.

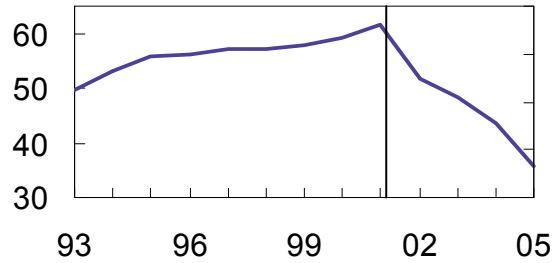
3/ The index is defined as the ratio of the variance of percentage changes in the nominal exchange rate to the sum of variances of the percentage change in foreign exchange reserves and the change in interest rate.

Significant Decline in the Value of Foreign Currency Debt Contracting

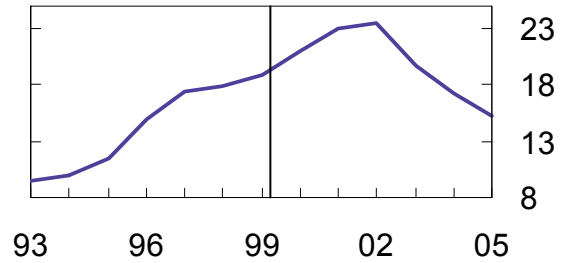
Share of Foreign Currency Liabilities in Total Liabilities

(annual averages across firms, in percent)

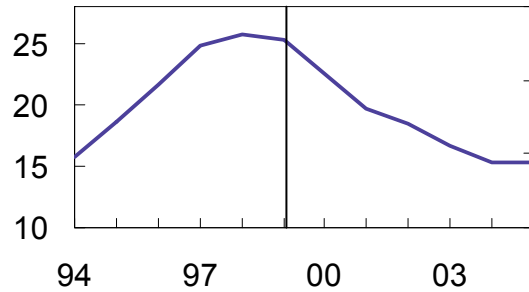
Argentina



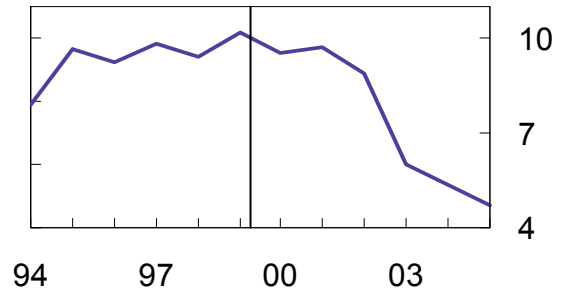
Brazil



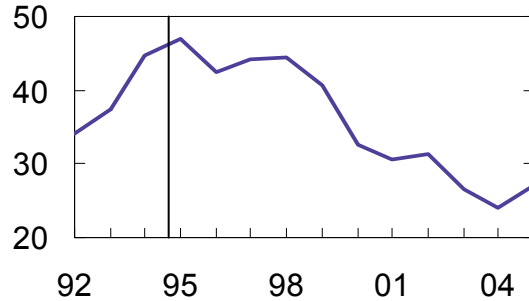
Chile



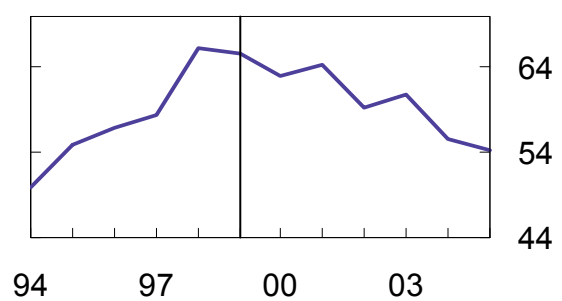
Colombia



Mexico



Peru



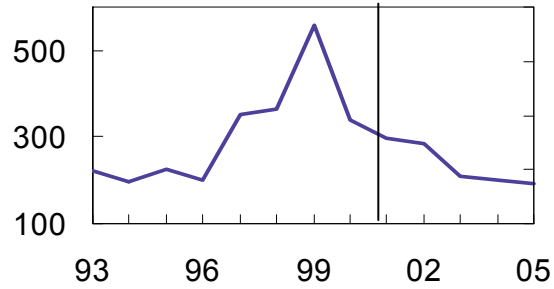
Source: Author's calculations.

Use of Natural Currency Hedges

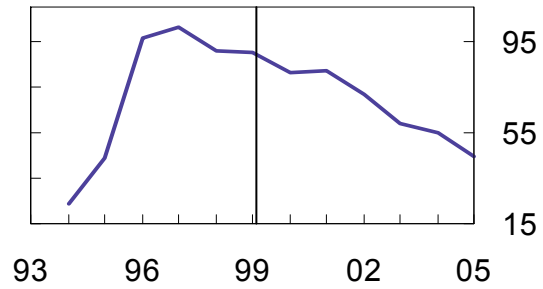
Foreign Currency Liabilities as a share of (Exports plus Dollar Assets)

(annual medians across firms, in percent)

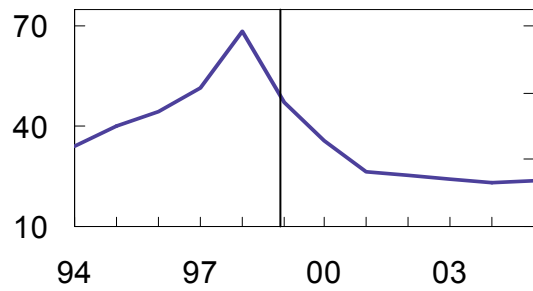
Argentina



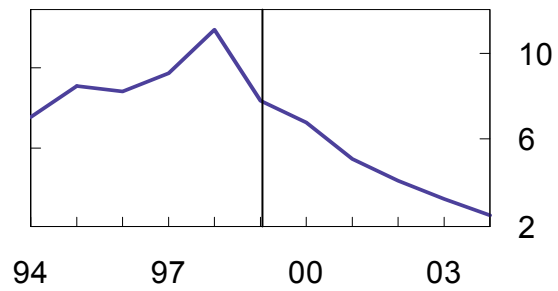
Brazil



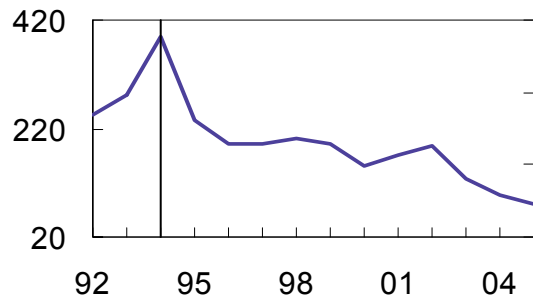
Chile



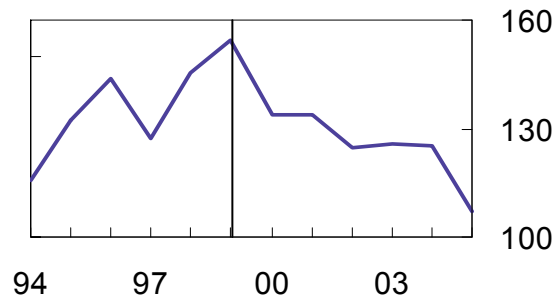
Colombia



Mexico



Peru



Source: Author's calculations.

Establishing the Causal Impact of Exchange Rate Regimes

Potential confounding factors need to be accounted for before drawing causal inferences:

- Endogeneity between firms' foreign currency mismatches and the decision to move to flexible regimes.
- Simultaneous occurrence of other macro events, either country-specific or at the regional level (sudden reversal of capital flows).
- Firm-level unobserved characteristics correlated with the decision to hold dollar debt and generate foreign currency earnings.

Econometric Specification (I): Panel Data

Empirical Model: Censored Tobit

$$\begin{aligned} \frac{D^*}{D} ijct &= \alpha_0 + \alpha_1 FLEX_{ct} + \alpha_2 \frac{EXP}{S} ijct + \alpha_3 \frac{A^*}{A} ijct-1 \\ &+ \alpha_4 \left[\frac{EXP}{S} ijct * FLEX_{ct} \right] + \alpha_5 \left[\frac{A^*}{A} ijct-1 * FLEX_{ct} \right] \\ &+ \mathbf{X}_{ijct-1} \boldsymbol{\beta} + \gamma_c + \phi_j + \lambda_t + e_{ijct} \end{aligned}$$

- Where indices denote:

i firm

j economic sector

c country

t year

Econometric Specification (I): Panel Data

Tobit Model

$$\begin{aligned} \frac{D^*}{D}_{ijct} = & \alpha_0 + \alpha_1 FLEX_{ct} + \alpha_2 \frac{EXP}{S}_{ijct} + \alpha_3 \frac{A^*}{A}_{ijct-1} \\ & + \alpha_4 \left[\frac{EXP}{S}_{ijct} * FLEX_{ct} \right] + \alpha_5 \left[\frac{A^*}{A}_{ijct-1} * FLEX_{ct} \right] \\ & + \mathbf{X}_{ijct-1} \boldsymbol{\beta} + \gamma_c + \phi_j + \lambda_t + e_{ijct} \end{aligned}$$

- **Key Estimated Parameters on Currency Matching Effect:**

α_4 , α_5 measure the average *change* in the degree of currency matching under floating regimes.

Baseline Results I: Panel Data Estimation
(Tobit Model; Specification with Flexible Regime Dummy)

<u>Dependent Variable: Fraction of Dollar Liabilities</u>	(1)	(2)
Flex Regime Dummy	-0.05 *** (0.02)	0.00 (0.09)
Exports to Sales ratio	0.29 *** (0.04)	0.30 *** (0.04)
Dollar Assets ratio	0.41 *** (0.05)	0.40 *** (0.05)
<u>Differential FX Regime Effects</u>		
Export ratio x Flex Regime Dummy	0.02 (0.04)	0.01 (0.04)
Dollar Assets ratio x Flex Regime Dummy	0.17 *** (0.06)	0.20 *** (0.07)
<u>Controls</u>		
Size Medium	0.12 *** (0.02)	0.12 *** (0.02)
Size Big	0.16 *** (0.02)	0.16 *** (0.02)
International Access	0.16 *** (0.02)	0.17 *** (0.02)
Crisis Year	0.05 *** (0.01)	0.02 (0.02)
<u>Fixed Effects</u>		
Country	Yes	Yes
Year	Yes	Yes
Economic Sector	Yes	Yes
Country x Year		Yes
Number of Observations	9039	9039
Non-Corner Observations (in %)	78.2	78.2
McFadden's R2	0.63	0.64

Baseline Results II: Panel Data Estimation
(Tobit Model; Specification with Freedom to Float Index)

<u>Dependent Variable: Fraction of Dollar Liabilities</u>	(1)	(2)
Freedom to Float Index	-0.03 *** (0.01)	-0.03 * (0.02)
Exports to Sales ratio	0.29 *** (0.03)	0.29 *** (0.03)
Dollar Assets ratio	0.46 *** (0.05)	0.46 *** (0.05)
<u>Differential FX Regime Effects</u>		
Export ratio x Freedom to Float	0.03 (0.04)	0.02 (0.04)
Dollar Assets ratio x Freedom to Float	0.12 ** (0.05)	0.15 *** (0.05)
<u>Controls</u>		
Size Medium	0.12 *** (0.02)	0.12 *** (0.02)
Size Big	0.16 *** (0.02)	0.16 *** (0.02)
International Access	0.16 *** (0.02)	0.17 *** (0.02)
Crisis Year	0.04 *** (0.01)	0.02 (0.02)
<u>Fixed Effects</u>		
Country	Yes	Yes
Year	Yes	Yes
Economic Sector	Yes	Yes
Country x Year		Yes
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Economic Significance of Estimated Coefficient: Sample Calculations

Quantify the effect of exchange rate flexibility in redistributing dollar debt across firms with differing abilities to bear exchange rate risk (different dollarization of assets).

$$\hat{\alpha}_5 \left[\left(\frac{A^*}{A} \text{99th percentile} - \frac{A^*}{A} \text{1st percentile} \right) (F_{t0}F_{99th} - F_{t0}F_{1st}) \right]$$

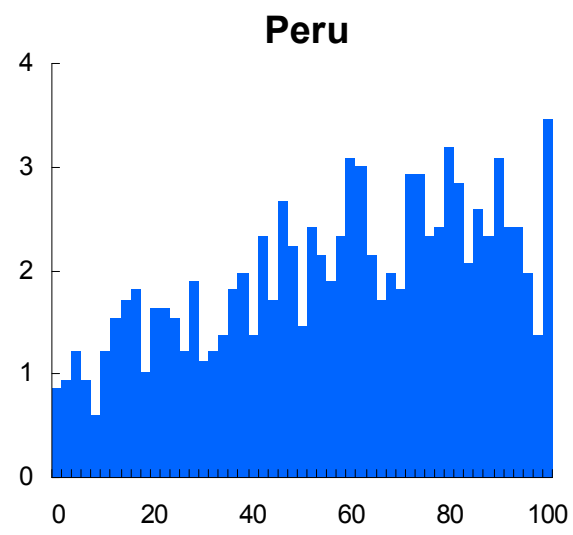
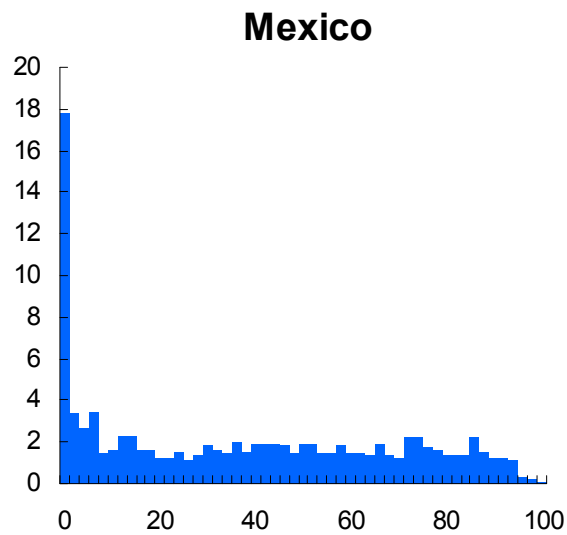
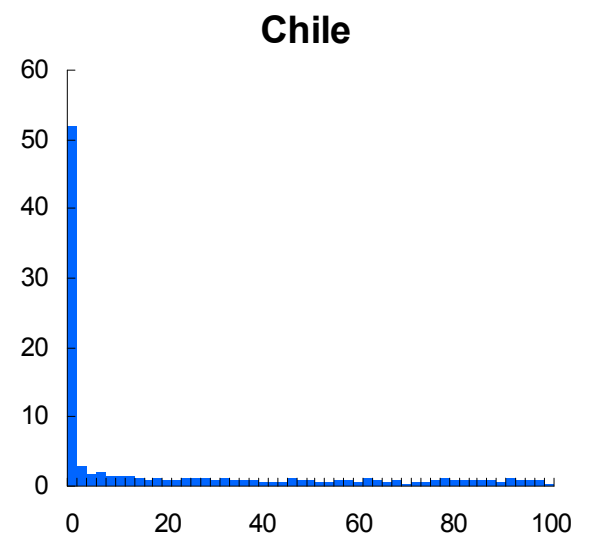
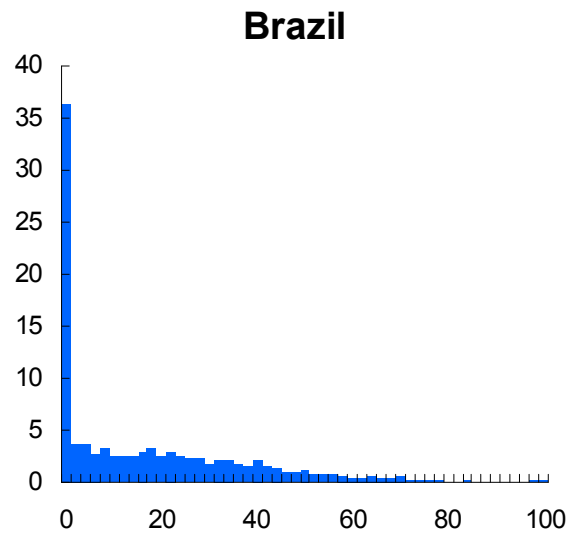
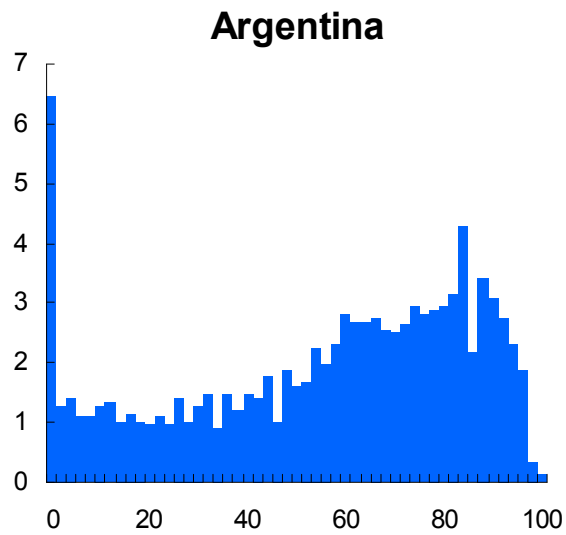
Economic Significance of Estimated Coefficient: Sample Calculations

- Difference in debt dollarization levels between firms in both extremes of the distribution of dollarized assets in countries with the highest exchange rate flexibility (Chile) is **28.6% higher** than the difference in average dollar debt shares between the same two groups of firms in countries that attained the lowest exchange rate flexibility in the sample (Argentina).

$$(0.15 * [(0.91 - 0) (2.06 - 0)]) * 100 = \mathbf{28.6}$$

- As a comparison, the difference across these two countries in relative dollarization among firms in these two extremes of the distribution is approximately **55.5%**.

Cross-Sectional Distribution of Dollar Debt Ratios Within Countries (Percentage of firms for each level of dollarization of liabilities)



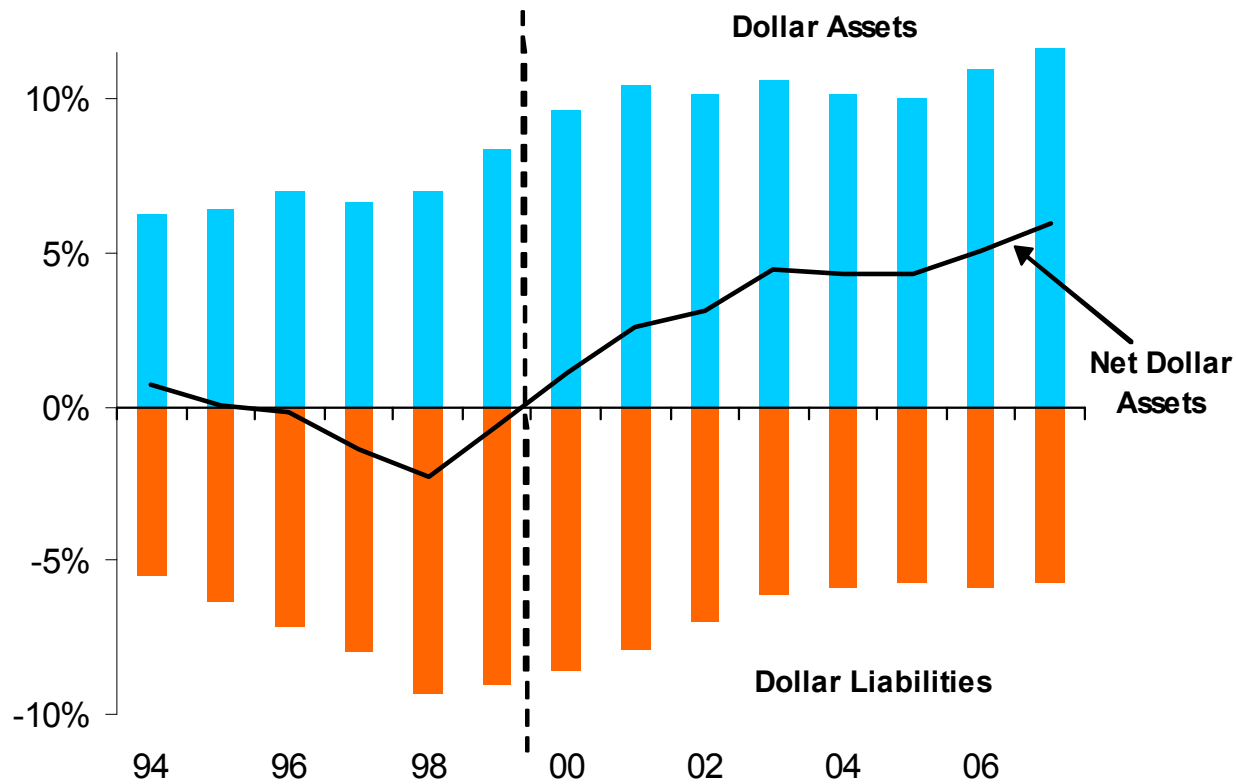
Robustness Tests I: Panel Data Estimation

(Tobit Model; Full Specification with Flex Regime Dummy)

Dependent Variable: Fraction of Dollar Liabilities	Firms with Dollar Debt (1)	Balanced Sample (2)
Flex Regime Dummy	-0.03 (0.11)	-0.09 ** (0.05)
Exports to Sales ratio	0.26 *** (0.03)	0.39 *** (0.05)
Dollar Assets ratio	0.31 *** (0.06)	0.34 *** (0.06)
<u>Differential FX Regime Effects</u>		
Export ratio x Flex Regime Dummy	0.00 (0.03)	0.00 (0.06)
Dollar Assets ratio x Flex Regime Dummy	0.24 *** (0.07)	0.22 *** (0.08)
Number of Observations	7801	3573
Non-Corner Observations (in %)	89.2	75.2
McFadden's R2	0.69	0.65

Chile: Strong Accumulation of Net Dollar Assets since Onset of Flexible Regime in 1999

(annual averages across firms, in percent of Total Assets)



Source: Author's calculations.

Robustness Tests II: Panel Data Estimation
(Tobit Model; Full Specification with Flex Regime Dummy)

<u>Dependent Variable: Fraction of Dollar Liabilities</u>	Other Interactions (1)
Flex Regime Dummy	-0.01 (0.09)
Exports to Sales ratio	0.30 *** (0.04)
Dollar Assets ratio	0.39 *** (0.05)
<u>Differential FX Regime Effects</u>	
Export ratio x Flex Regime Dummy	0.00 (0.04)
Dollar Assets ratio x Flex Regime Dummy	0.22 *** (0.07)
<u>Other Interactions</u>	
Size Medium x Flex Dummy	0.00 (0.02)
Size Big x Flex Dummy	0.03 (0.03)
International Access x Flex Dummy	0.03 (0.03)
<hr/>	
Number of Observations	9035
Non-Corner Observations (in %)	77.1
McFadden's R2	0.64

Robustness Tests III: Panel Data Estimation
(Tobit Model; Full Specification with Flex Regime Dummy)

<u>Dependent Variable: Fraction of Dollar Liabilities</u>	Pre-Existing Trends (1)
Flex Regime Dummy	0.04 (0.11)
Exports to Sales ratio	0.28 *** (0.04)
Dollar Assets ratio	0.36 *** (0.06)
<u>Differential FX Regime Effects</u>	
Export ratio x Flex Regime Dummy	0.03 (0.05)
Dollar Assets ratio x Flex Regime Dummy	0.26 *** (0.08)
<u>Other Interactions</u>	
"Early Float" Dummy	0.16 ** (0.08)
"Early Float" Dummy x Export ratio	0.04 (0.04)
"Early Float" Dummy x Dollar Asset ratio	0.04 (0.04)
<hr/>	
Number of Observations	9035
Non-Corner Observations (in %)	77.1
McFadden's R2	0.64

Econometric Specification (II): Event Study

Empirical Model: First Differences Across Periods

$$\Delta \left(\frac{D^*}{D} \right) = \frac{D^*}{D}_{t=1} - \frac{D^*}{D}_{t=0} = \alpha_1 \Delta FLEX + \alpha_2 \Delta \frac{EXP}{S} + \alpha_3 \Delta \left(\frac{A^*}{A} \right) \\
+ \alpha_4 \Delta \left[\frac{EXP}{S} * FLEX \right] + \alpha_5 \Delta \left[\frac{A^*}{A} * FLEX \right] \\
+ \Delta \mathbf{X} \boldsymbol{\beta} + \Delta e_{ijct}$$

- Where indices denote:

$t = 1$: period immediately after regime change

$t = 0$: period immediately before regime change

Econometric Specification (II): Event Study

Noting that:

$$\Delta FLEX = FLEX_{t=1} - FLEX_{t=0} = 1 - 0 = 1$$

Empirical Model: First Differences

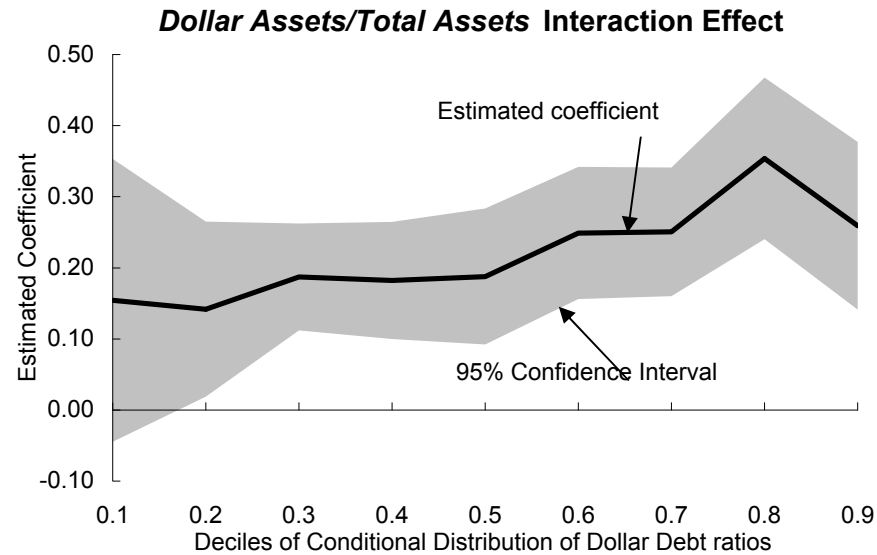
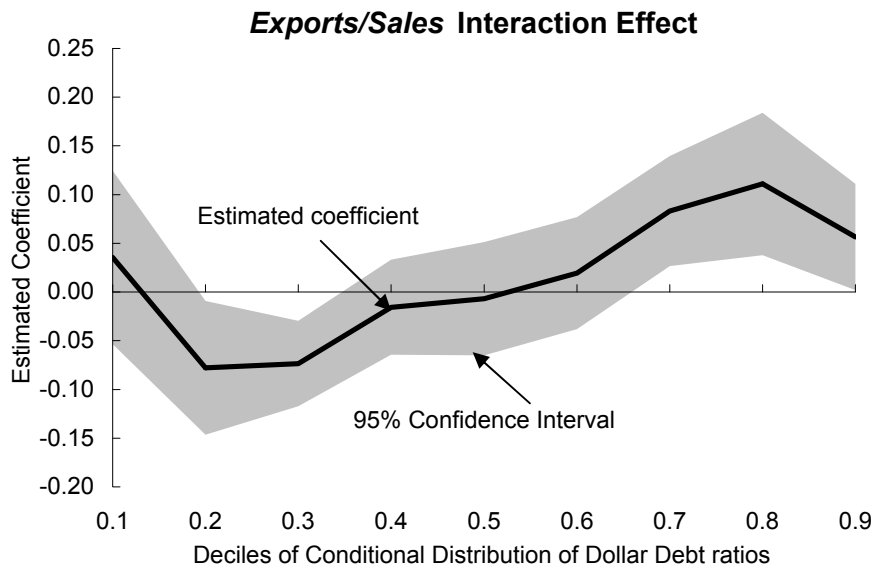
$$\Delta \left(\frac{D^*}{D} \right) = \alpha_1 + \alpha_2 \Delta \left(\frac{EXP}{S} \right) + \alpha_3 \Delta \left(\frac{A^*}{A} \right) + \alpha_4 \left(\frac{EXP}{S} \right)_{t=1} \\ + \alpha_5 \left(\frac{A^*}{A} \right)_{t=1} + \Delta \mathbf{X} \boldsymbol{\beta} + u$$

Event Study Estimation

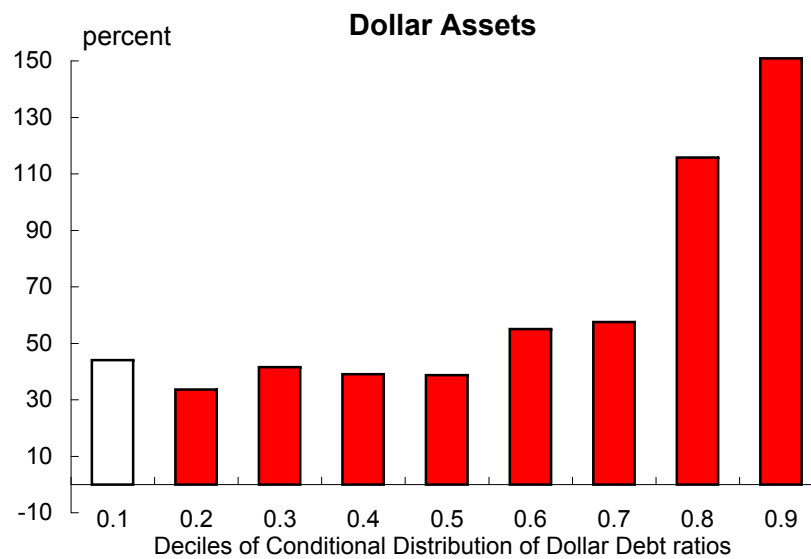
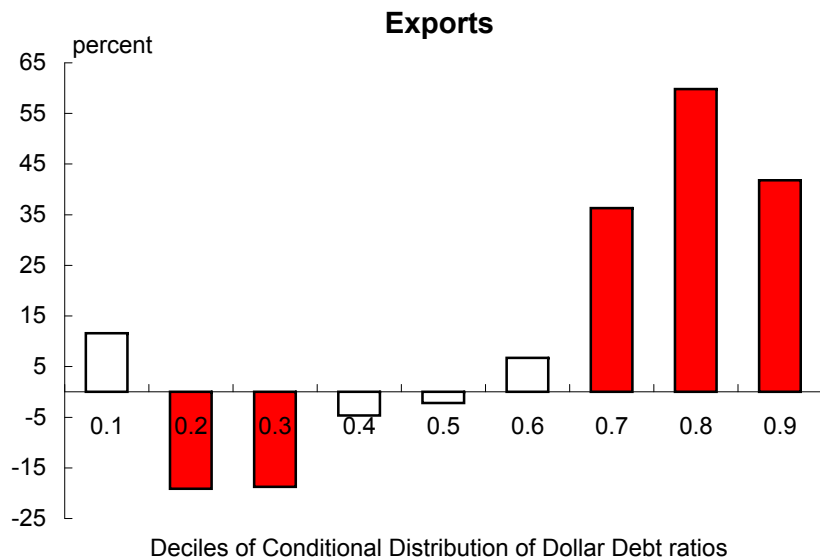
OLS Model for Within-Firm Changes in average Dollar Debt Ratios between T-3 and T+3

	(1)
Change in Exports to Sales ratio	0.10 * (0.06)
Change in Dollar Assets ratio	0.15 ** (0.06)
<u>Differential FX Regime Effects</u>	
Export ratio in Post-Period	-0.02 (0.03)
Dollar Assets ratio in Post-Period	0.12 ** (0.05)
<u>Controls</u>	
Change in Medium Size Firms	0.00 (0.03)
Change in Bigger Size Firms	-0.01 (0.04)
Change in International Access	0.10 *** (0.02)
<hr/>	
Number of Observations	765
R-Square	0.06

Effect of Switch to Flexible Regimes at Different Points of the Cross-Sectional Distribution of Dollar Debt Ratios



Percentage Increase under Flex Regimes in Currency Matching of Dollar Debt with respect to:



Main Findings

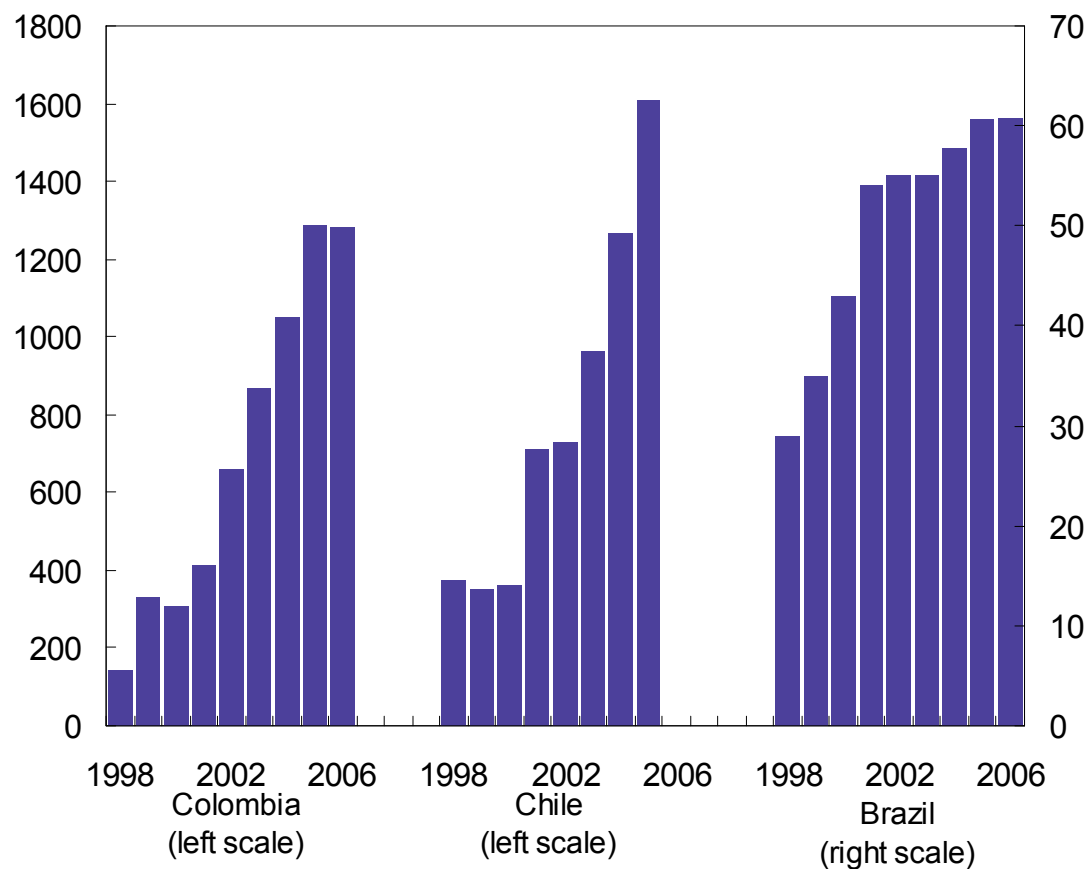
- Over the past 10 years, Latin American firms have sharply cut their balance sheet exposure to a sudden devaluation.
- Firms have reduced the share of debt contracted in foreign currency, and have built-in better exchange rate shock absorbers through natural currency hedges.
- Using panel data and event study techniques, I find that the adoption of a floating regime causes a significant increase in the degree of currency matching in firms balance sheets, especially in those more exposed to devaluation risk.

Policy Implications

- A plausible interpretation of the results is that the shift to flexible exchange rate regimes seems to have made the risks of foreign currency borrowing more apparent.
- As a result, firms have taken steps to adapt their balance sheet structure and risk-management practices to meet the potential challenges posed by greater exchange rate flexibility.

Participation of Firms in Currency Derivatives Markets has Surged in Recent Years

(Number of firms) 1/



Sources: National authorities; and IMF staff calculations.

1/ For Colombia and Chile, corresponds to the total number of publicly traded and private firms. For Brazil, the share of publicly traded firms.

Common Regional Trend in Firm-Level Dollarization (Estimated Time Dummies from the Model)

