Financial Dollarization in Emerging Markets: Efficient Risk Sharing or Prescription for Disaster?

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Financial Dollarization in Emerging Markets

- Credit Dollarization $\rightarrow$ Firms borrow in foreign currency ('dollars')
- Deposit Dollarization $\rightarrow$ Households save in dollars.

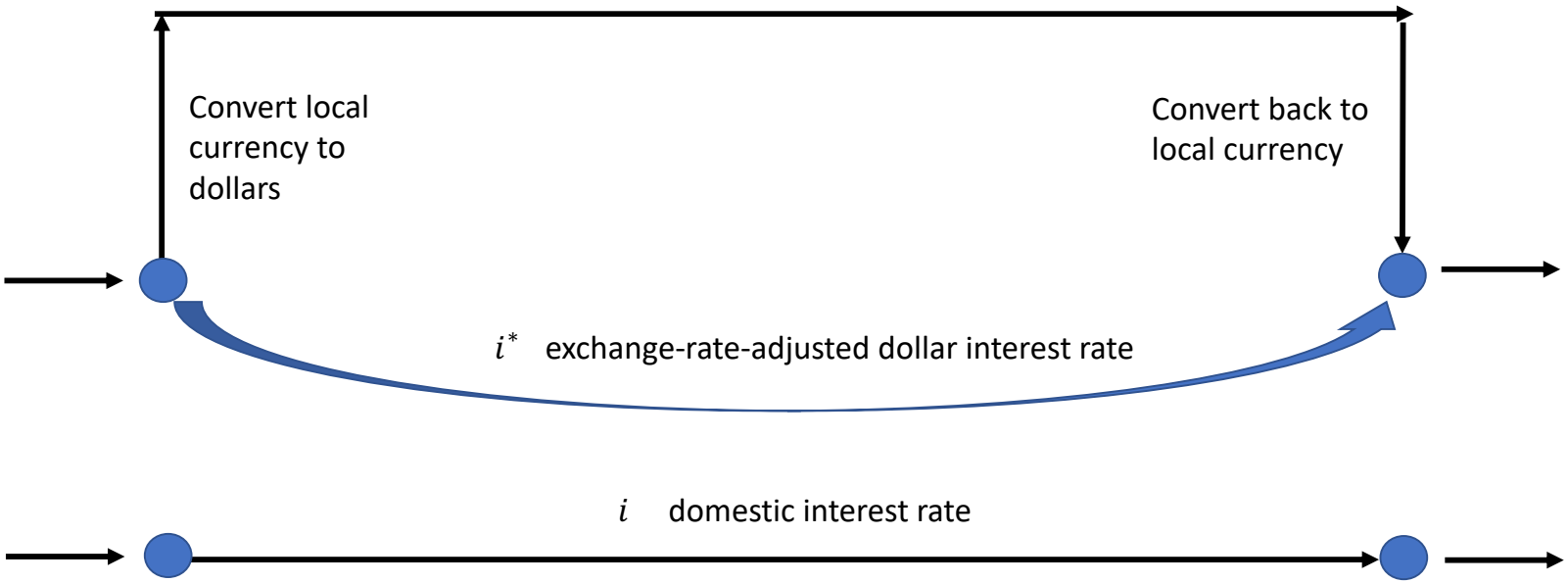
Two Themes in Financial Dollarization Literature

- Dollarization a source of international risk sharing
  - Gourinchas, et. al., "Exorbitant Privilege and Exorbitant Duty"
- Dollarization a source of financial fragility
  - Bocola and Lorenzoni, AER, 2020.
  - Most central bankers very skeptical:
    - ⋆ A few rule out deposit dollarization.
    - ⋆ Most allow it, but only because otherwise dollars would go under mattresses .
- Politics
  - When a currency depreciates against dollar, businesses that borrowed in dollars have to transfer scarce national resources to 'rich foreigners'.

Findings

- Financial Dollarization is an *intra*-national insurance arrangement (Dalgic (2018))
  - Device for one group of people to insure others within countries.
  - Provide evidence from Peru and Turkey that intra- national insurance flows bigger than inter- national flows.
- We find no evidence that dollarization is associated with
  - Frequency of banking crises
  - Severity of banking crises
  - Cross country evidence from large number of countries for 1995-2018.
- Examine Peru (also, Armenia) as a Case Study
  - Is there evidence that firms with dollar liabilities experience balance sheet constraints after depreciation?
  - No. Complements results of Bleakley and Cowan (2008) on 5 Latin American economies.
  - Dollar-borrowing firms are the ones best able to absorb exchange rate shock.
- A simple model motivated by the evidence.

Figure: Local Currency and Dollar Deposits



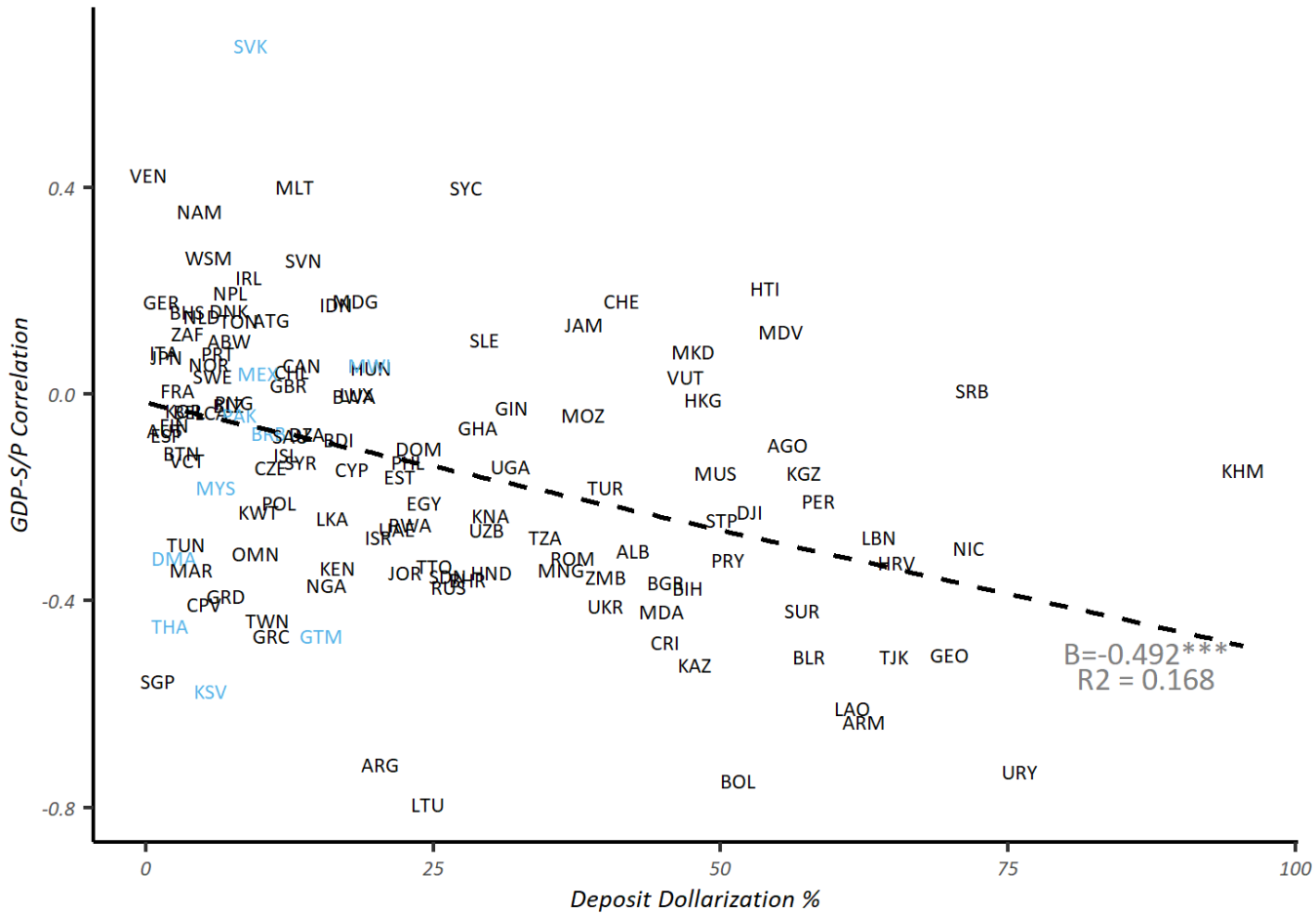
Deposit Dollarization

- 'Deposits': in Peru, December 2019, 94 percent of total bank non-equity liabilities to domestic residents.
- Measure of deposit dollarization for a particular country:

$$\frac{\text{value of dollar deposits held by domestic residents}}{\text{total deposits held by domestic residents}}$$

- Dollarization data:
  - Data for 140 countries, mostly from individual central banks

Countries in Which Exchange Rate Depreciates most in Recession Have Higher Deposit Dollarization

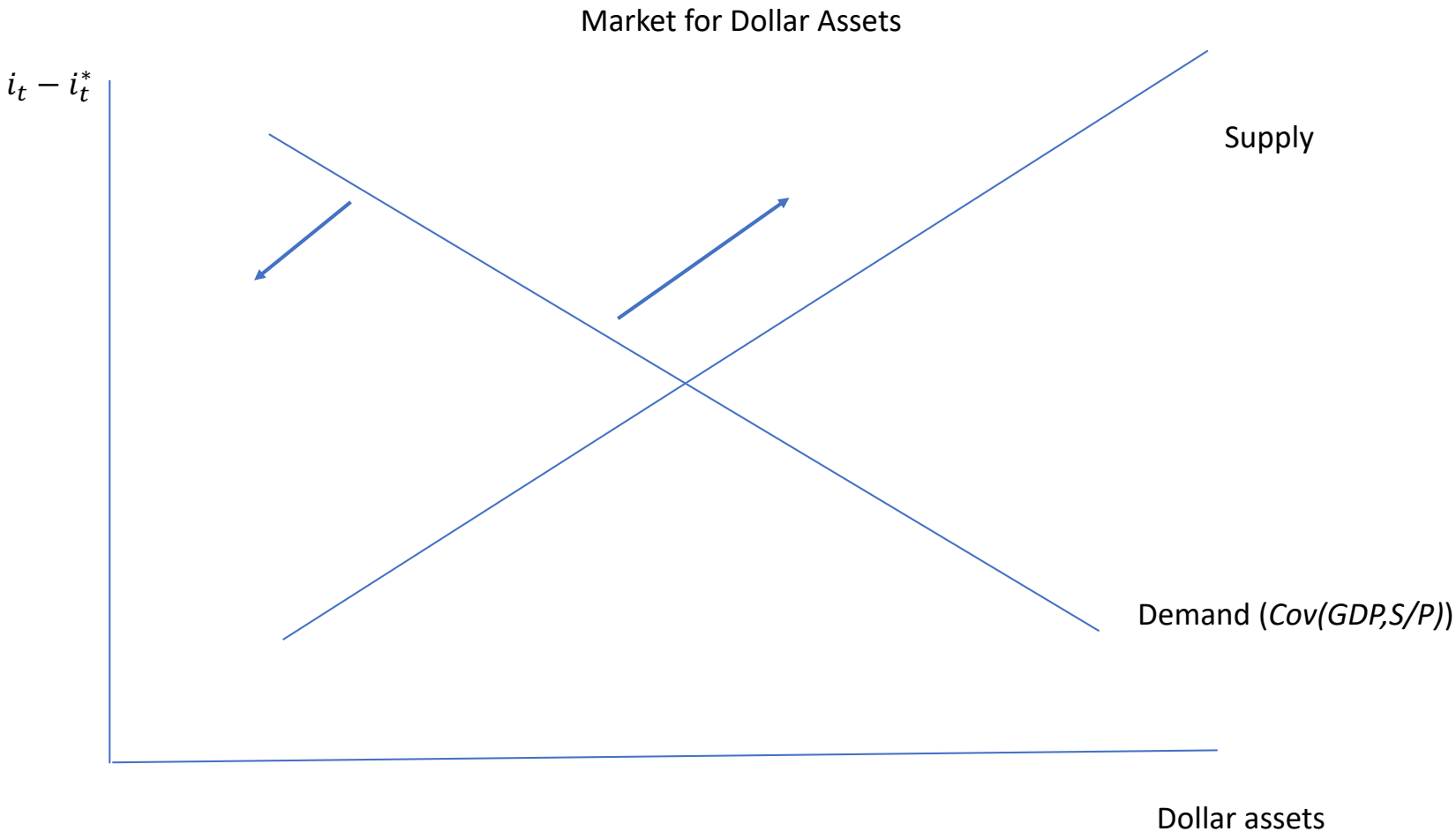


Data: 1995-2018

Insurance Interpretation

- Our hypothesis: previous scatter reflects causality from cross-country variation in $cov\,(GDP, S/P)$ to deposit dollarization.
  - Dollar deposits provide more insurance, if currency depreciates a lot in recession.
    - ⋆ i^* jumps in a recession, exactly when households have low income.
  - What would make currency depreciate a lot in a recession?
    - ⋆ Standard: Disturbances to export demand (Hassan (2011), Gopinath and Stein (2018), government irresponsibility, ▸ More US crises (Gourinchas, Rey, Govillot (2017)).
- Reverse causality hypothesis:
  - Sunspots: fear of financial crisis motivates deposit dollarization, resulting currency mismatch in banks/firms causes anticipated crisis.
  - Show evidence against this hypothesis.

Demand and Supply of Dollar Assets in Cross-section of Countries



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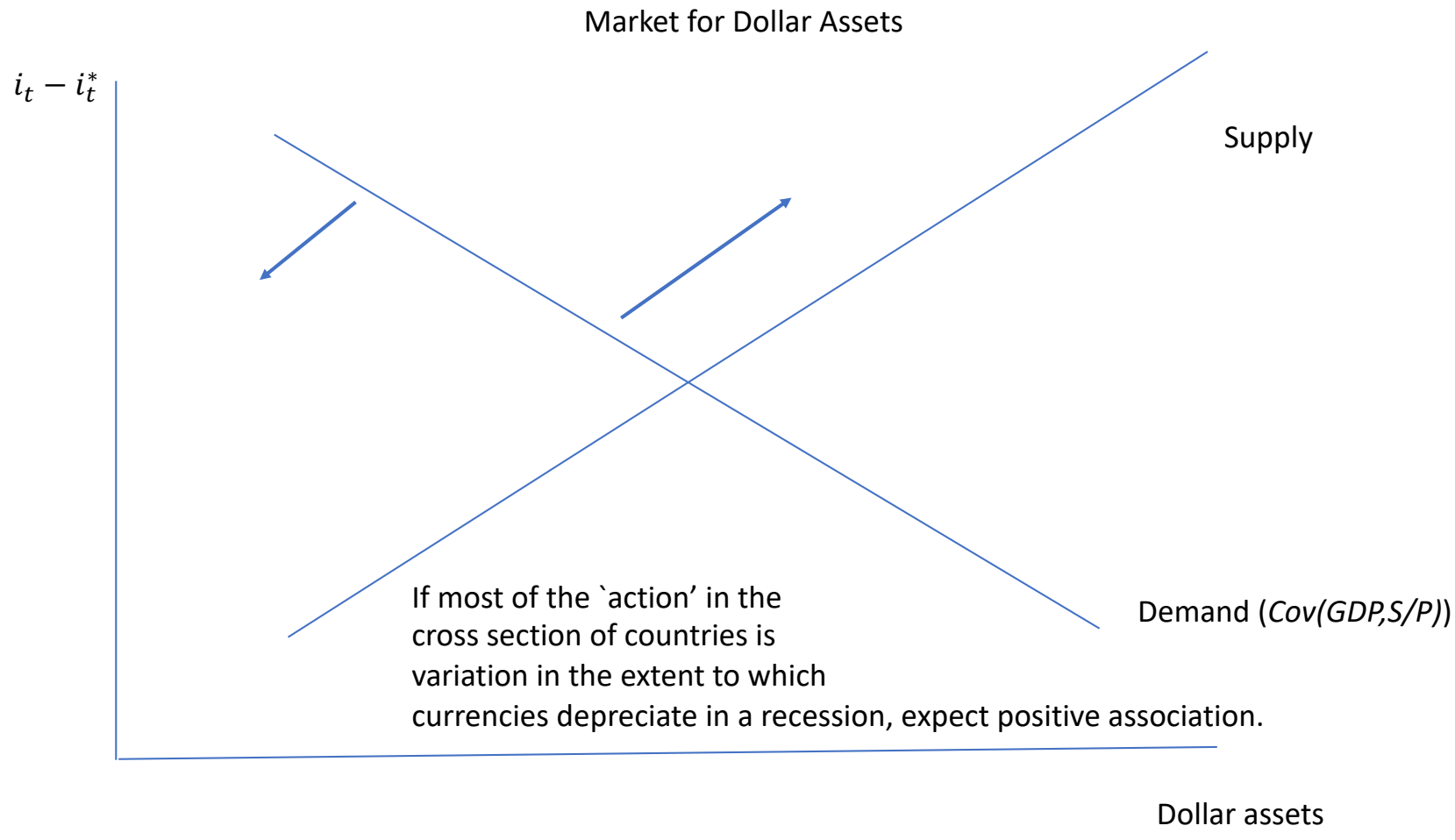
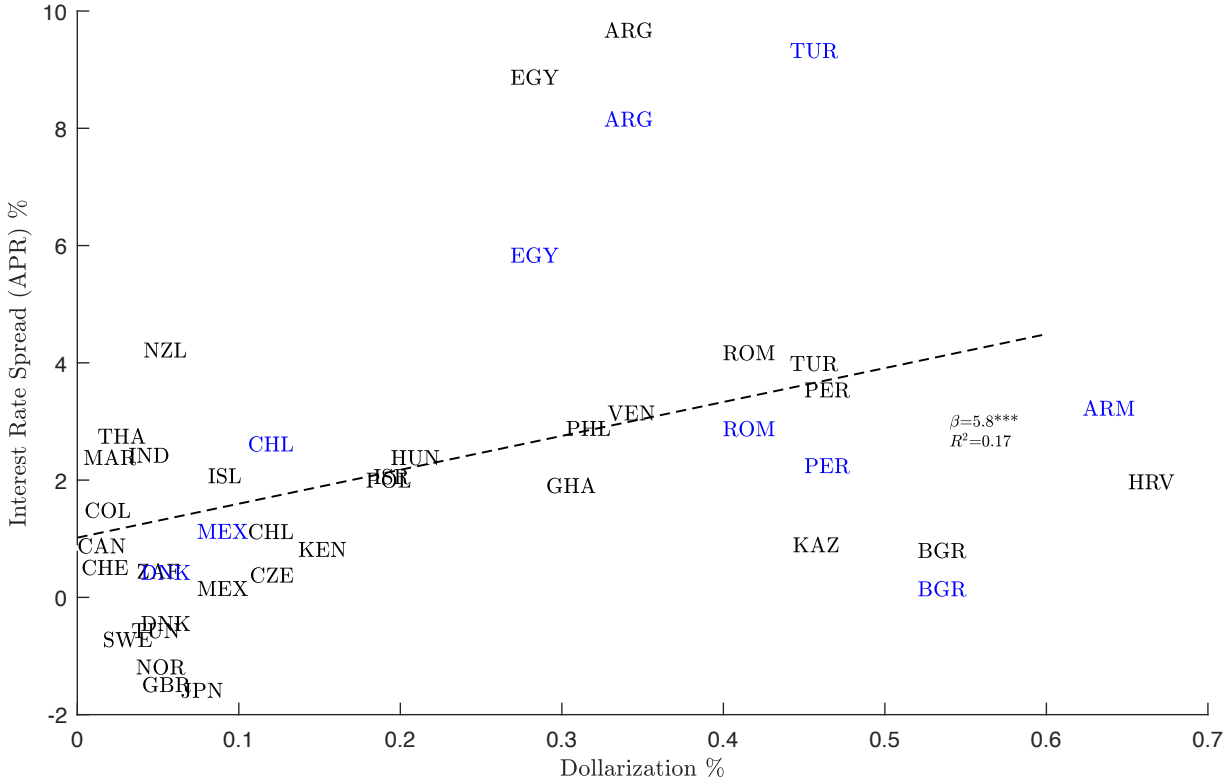


How Much is the Implicit Price on Dollar Deposits?



'Price' of holding dollars is high in countries with high deposit dollarization.

- People in high dollarization countries must be receiving a non-pecuniary benefit from dollar deposits.
- Our hypothesis: non-pecuniary benefit is business cycle consumption insurance.

Who is Providing the Insurance to Dollar Depositors?

- Does not appear to be the banks.
  - Since crises of 1980s and 1990s regulators have become averse to currency mismatch in banks.
- IMF evidence from 115 countries, 2005-2018

If Not the Banks, then Who is Providing the Insurance?

- Simple Scenario: household deposits \$100 in bank and bank makes dollar-denominated loan to local firms
  - Households that own the firms provide the insurance (compensated by $i > i^*$) .
- Variant of Simple Scenario: household deposits \$100 in bank and bank invests \$100 in T-bills; local firms issue dollar debt to foreigners
  - Local firms provide insurance.
- Another possibility: foreigners provide the insurance.
  - In the median country foreigners appear to play a small role.

If Not the Banks, then Who is Providing the Insurance?

- We consider a sample of 15 countries.
- The median country has the following properties:
  - Total non-financial firm dollar borrowing from banks/total non-financial firm dollar borrowing from everywhere $= 0.97$.
  - For every \$1 of deposits by residents (mostly households) into banks, firms borrow \$0.87 and households borrow back (mostly in mortgages) \$0.13.
- So, the losses to firms when the currency depreciates are roughly matched by the gains to depositors (mostly, households).
- Most of the gains/losses associated with exchange rate changes are within different people in the same country.

Decomposing International Versus Intra-national Insurance Flows

- Data on the currency composition of international flows from Benetrix et. al. (2020):

$$\overbrace{d_t^* + d_t^{*,f}}^{\text{supply of dollars by domestic residents and foreigners}}$$

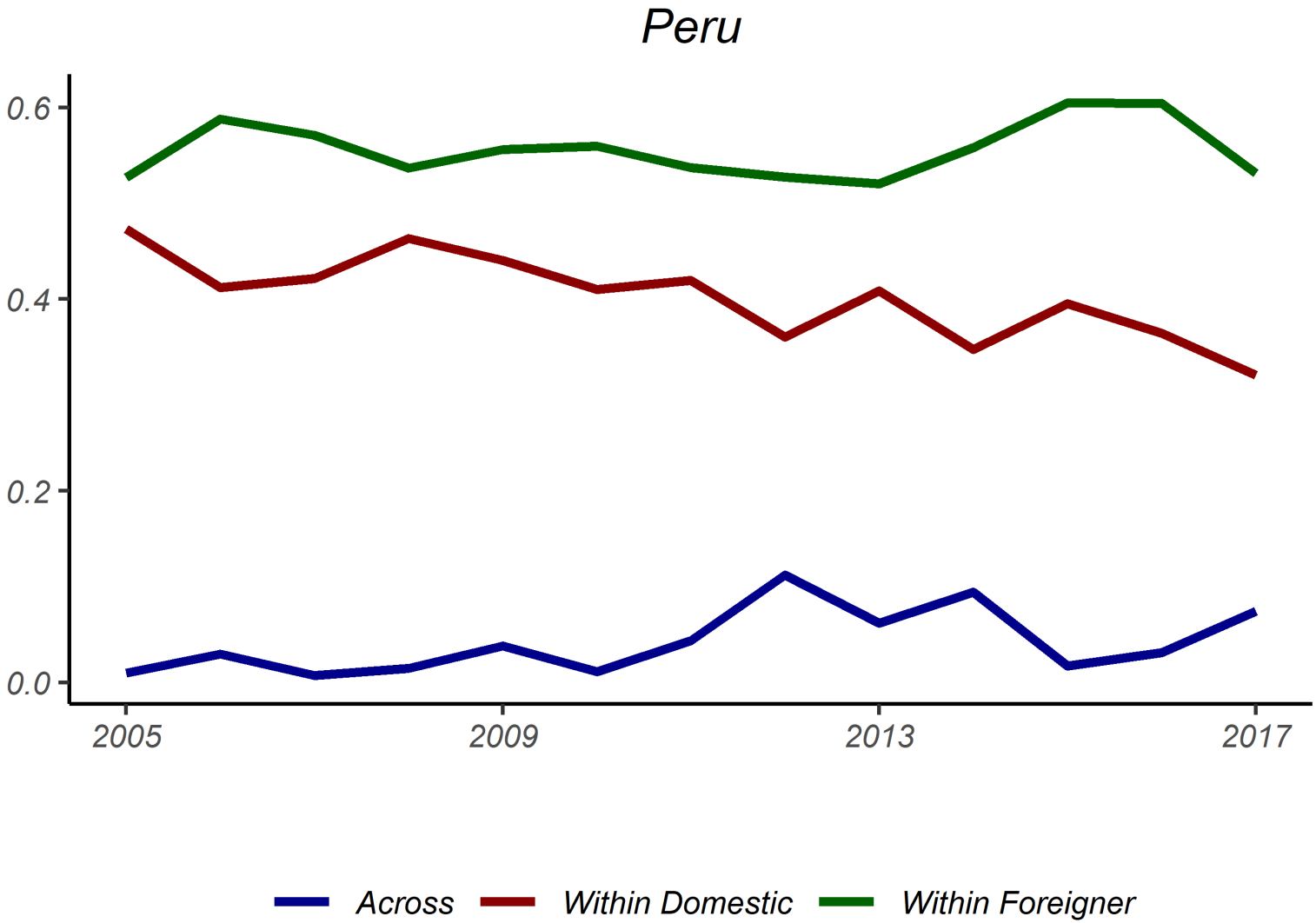
$$= \overbrace{b_t^* + b_t^{*,f}}^{\text{demand for dollars by residents and foreigners}}$$

- Then, we have the following decomposition:

$$\overbrace{\min\left[d_t^*, b_t^*\right]}^{\text{within country insurance}} + \overbrace{\min\left[d_t^{*,f}, b_t^{*,f}\right]}^{\text{within foreigner insurance}} + \overbrace{\left|b_t^* - d_t^*\right|}^{\text{across country insurance}} = b_t^* + b_t^{*,f}$$

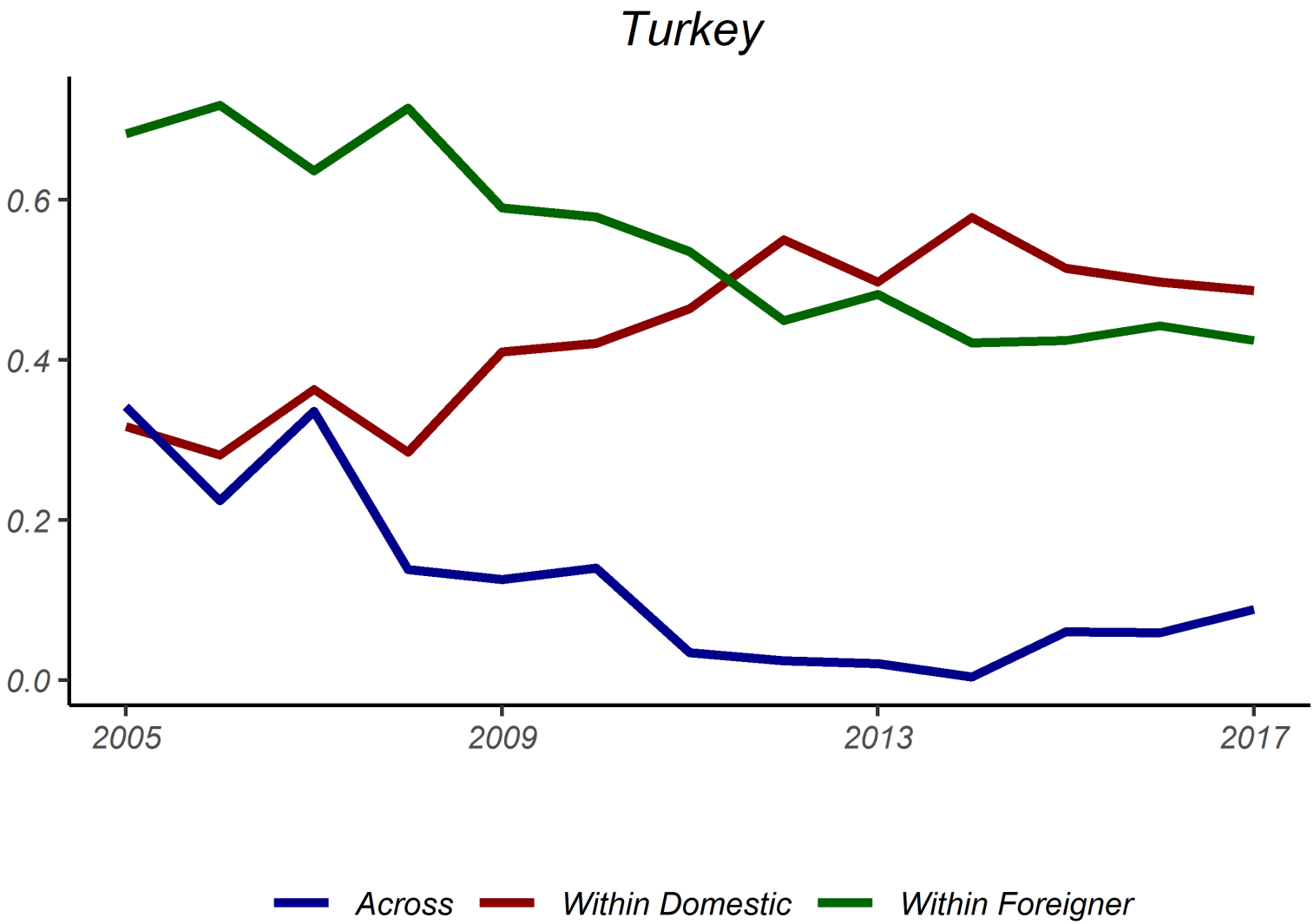
- Decomposition borrowed from Chari-Christiano (2020) for decomposing insurance flows in futures markets.

Financial Trade, Peru



Note: These data correspond to the three terms in the decomposition. They represent the share of dollar

Financial Trade, Turkey



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Deposit Dollarization as Insurance Arrangement

- Some people (ordinary households), by putting dollar deposits in banks, in effect receive business cycle insurance from others (non-financial firms).

- Dollarization of financial markets looks like many other markets (e.g., commodity futures) in which risk is reallocated among people.
  - In this respect, seems like deposit dollarization is Pareto improving.

Is Deposit Dollarization Destabilizing?

- For example, when a depreciation occurs in a recession (i.e., i^* is high), then
  - firms owe banks a lot of money just when they don't have very much.
  - if firms can't pay money back to banks, then banks in trouble.
- Bottom line: dollarization could (in principle) destabilize the financial system.
- Let's look at the facts....

Data

- Data on systemic banking crises taken from Laeven & Valencia, 2018, 'Systemic Banking Crises Revisited'
  - Crisis:
    - ⋆ Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations).
    - ⋆ Significant banking policy intervention measures in response to significant losses in the banking system.
- Data on Sudden Stops from Eichengreen and Gupta (2018).
- Data on cost of crisis: GDP growth from IMF.

Three Questions

- What is relation between deposit dollarization and *frequency* of systemic financial crisis?
- What is relation between deposit dollarization and *intensity* of a financial crisis when it happens?
- Does financial dollarization make business cycles more volatile because of presence of balance sheet effects?

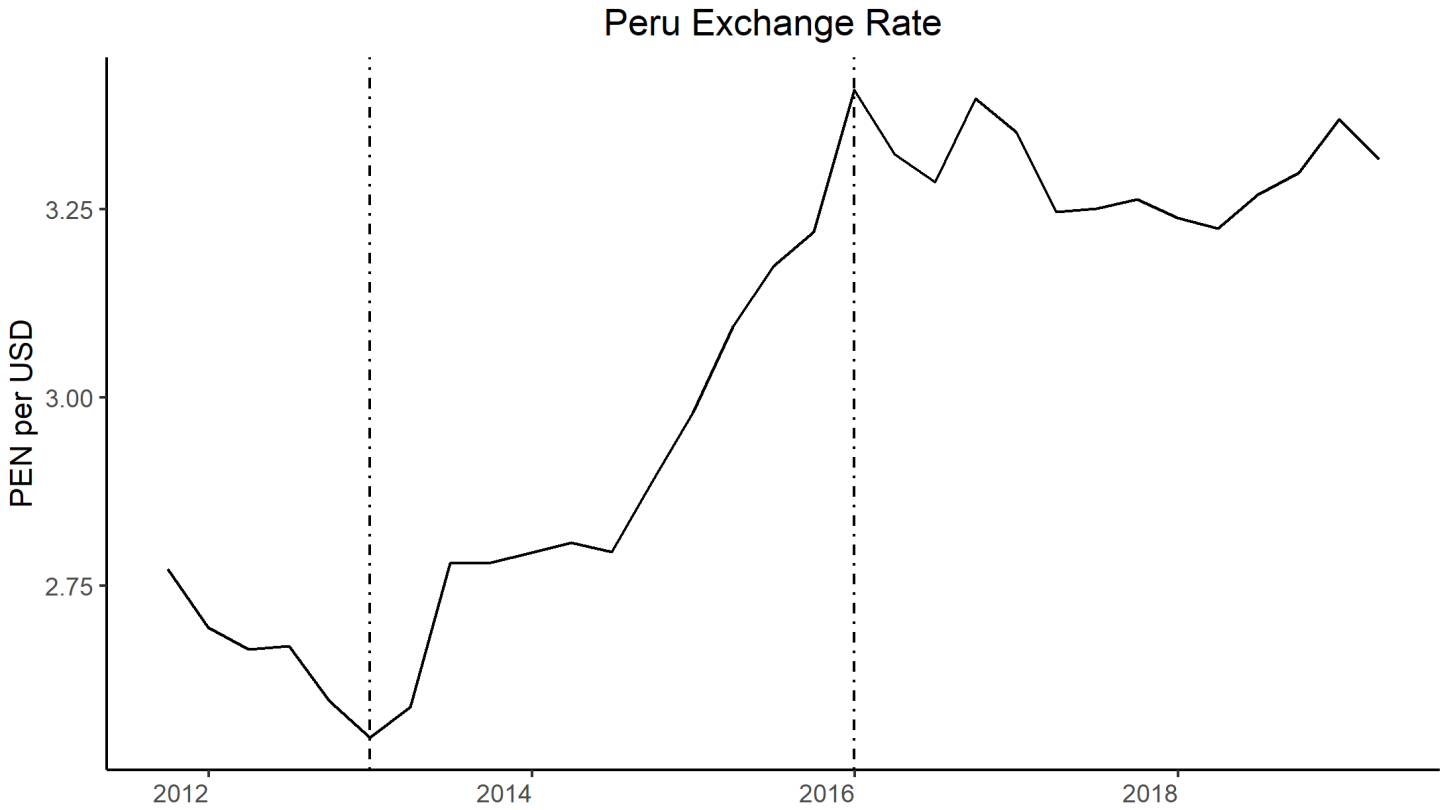
Dollarization and Frequency and Intensity of Banking Crises?

- We use bivariate and multi-country panel data methods.
- Dollarization does not predict banking crisis
  - Main predictor of crisis is
    - ⋆ Foreign debt, $\frac{\text{Foreign Liabilities of Banks}}{\text{Foreign Assets of Banks}}$, (Gourinchas and Obstfeld, 2012)
    - ⋆ Global financial cycle, VIX (Rey, 2015, Forbes and Warnock, 2012)
  - Too much external borrowing leads to crisis, not deposit dollarization.

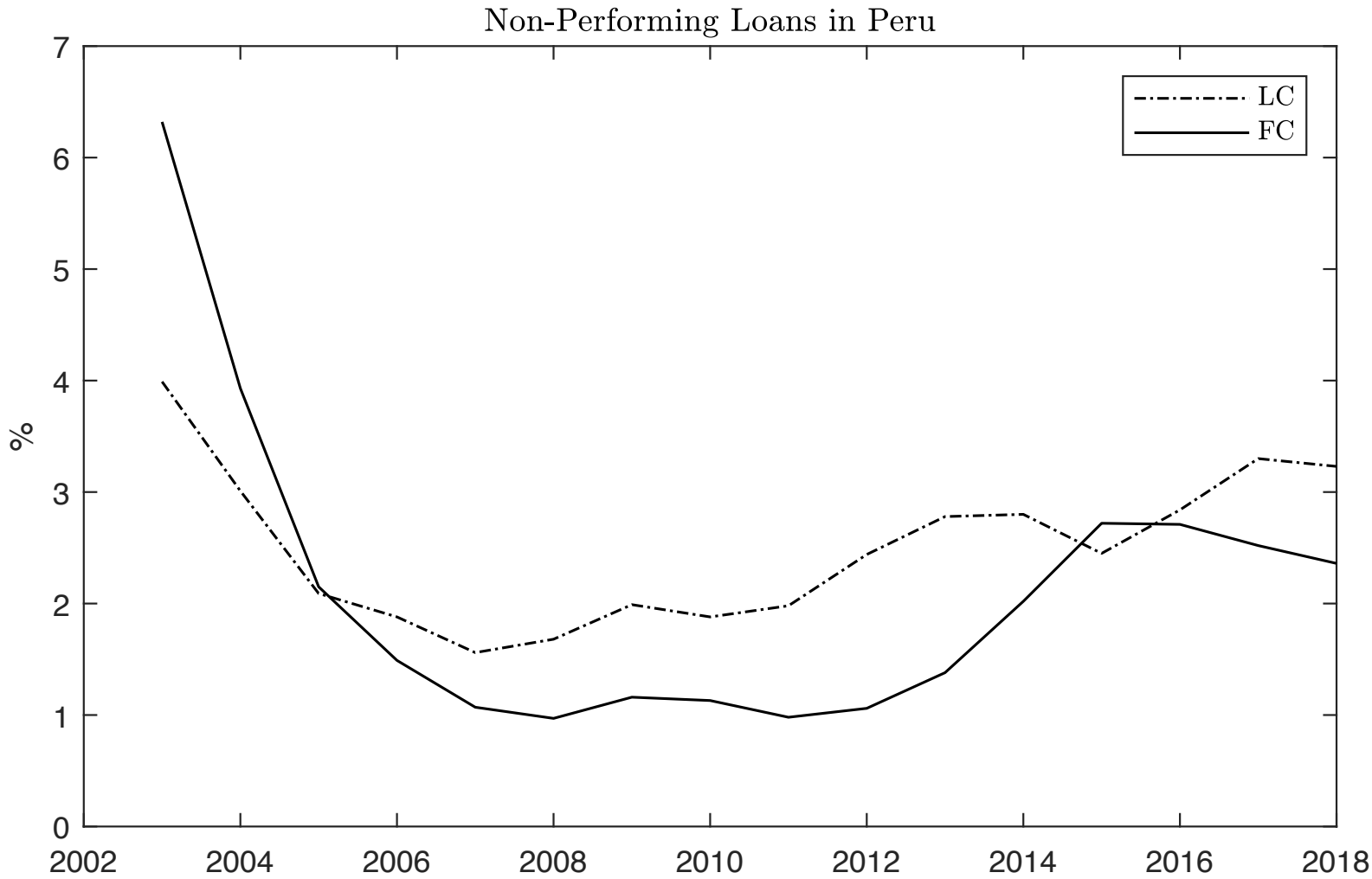
Peru: Balance Sheet Effects

- Even if dollarization does not lead to *crisis*,
  - Financial channel may inefficiently reduce investment after an exchange rate depreciation
- Evidence from two firm-level data sets from Peru:
  - Firms with dollar debt suffer initially after a depreciation, but recover quickly
  - Sales growth and GDP growth appear to be main drivers of investment
- Stress test
  - 100 percent depreciation $\longrightarrow$ the net worth of the bankrupted firms is less than 1.5 percent of total net worth
  - 200 percent depreciation $\longrightarrow$ less than 10 percent of total net worth.
- Results consistent with Bleakly and Cowan (RESTAT2008):
  - after looking at 450 firms in 5 Latin American Countries in 1990s, conclude "firms holding more dollar debt do not invest less than their peso-indebted counterparts following a depreciation."

Peru: Fairly Big Depreciation Recently



Peru: Non-performing Local Currency (LC) and Foreign Currency (FC) Loans



Source: Central Bank of Peru

Key empirical findings

1. Exchange rate depreciates a lot in a recession $\rightarrow$ high deposit dollarization
2. High deposit dollarization $\longrightarrow$ high interest rate spread
3. Deposit dollarization not systematically related to:
    1. likelihood of financial crisis
    2. intensity of a crisis if it occurs.

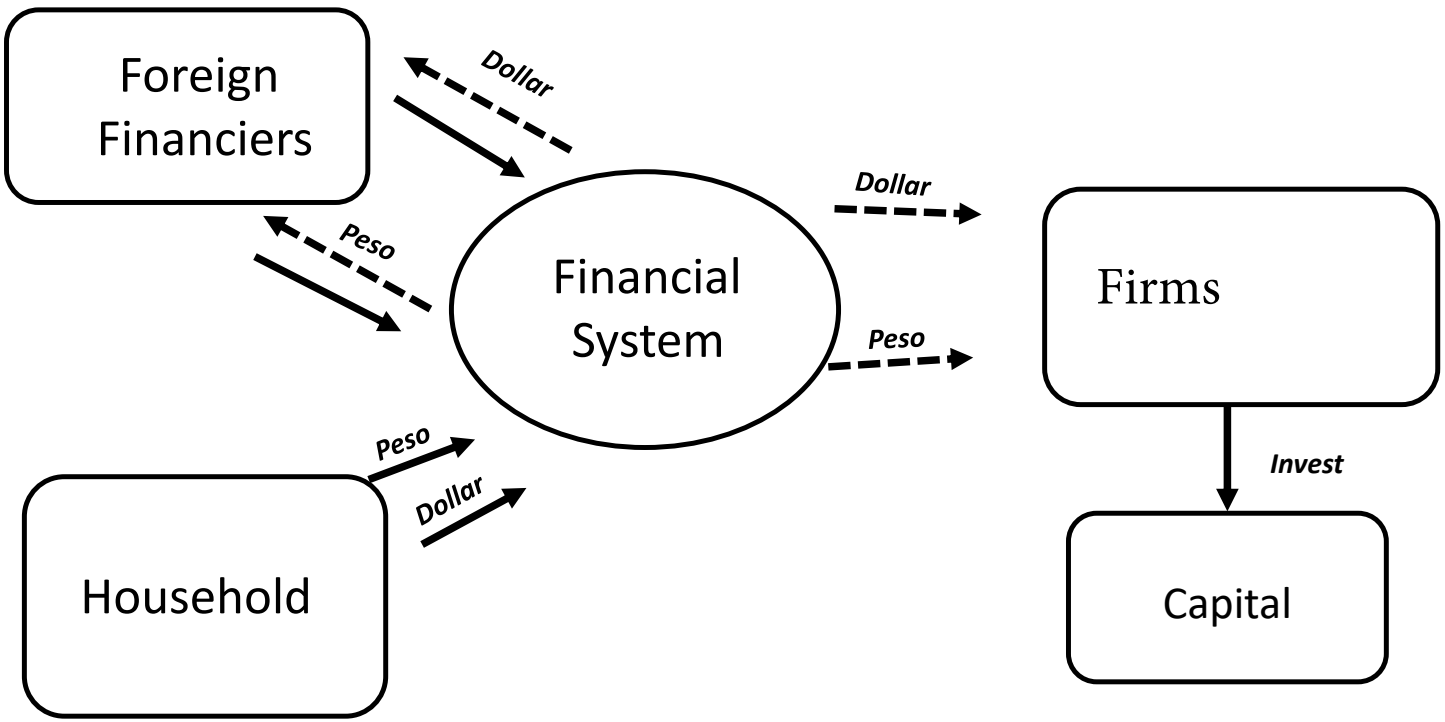
Requirements for Model

- Savers and Borrowers in Domestic Economy.
  - Necessary to think about insurance between residents of domestic economy.
- Foreigners:
  - To define exchange rate and participate in financial markets.
- All agents must have clear reasons to trade dollars and pesos.
- Incomplete financial markets, but no 'running away' or other frictions that could create a crisis.
- Time:
  - Participants in financial markets need to make their decisions before uncertainty is realized.
  - Two periods.
- Shocks:
  - Needed if there is to be uncertainty.

Model

- Agents:
  - Domestic households: Make deposit decision in period 1, Provide labor and consume in period 2.
  - Domestic firms: Borrow to produce capital in period 1, run it in period 2 using labor.
  - Foreign financiers: Borrow/lend in period 1, consume in period 2
  - All agents have similar problems, differentiated by sources of income, which produce different hedging needs.
- 2 goods
  - Home good: Produced locally, exported
  - Foreign good: Imported
- 2 assets
  - 'Dollar': Promises r^* unit of Foreign good in period 2, per unit of period 1 domestic good.
  - 'Peso': r units of Home good in period 2, per unit of domestic good.

Financial Market in Period 1



Worker Households

Period 1

- Households are endowed with Y units of Home good
- Save in dollar and peso assets

$$d + d^* = Y$$

Period 2

- Provides labor
- Consumption takes place

$$c_2^{house} = dr + d^* r^* e_2 + w_2 l_2$$

Worker Households

- Household problem,

$$\max_{d,d^*} Ec_2^{house} - \frac{\lambda}{2} var\left(c_2^{house}\right)$$

- Intertemporal budget constraint

$$c_2^{house} = \left(e_2 r^* - r\right) d^* + w_2 + Yr.$$

- Household portfolio choice

$$d^* = \overbrace{\frac{E\left(e_2 r^* - r\right)}{\lambda var\left(r^* e_2\right)}}^{\text{Speculative motive}} - \overbrace{\frac{cov\left(r^* e_2, w_2\right)}{var\left(r^* e_2\right)}}^{\text{Hedging motive}}$$

Firm-Households

Period 1

- Firms lack internal funds
- Borrow to invest
- Need foreign goods to produce K and p^K is shadow price:

$$p^K K = b + b^*.$$

Period 2

- Production

$$Y_2^h = (A_2 K)^\alpha \, l_2^{1-\alpha}$$

- Consumption

$$c_2^{firm} = r_2^K K - (br + b^* e_2 r^*)$$

Firm-Households

- Firm problem,

$$\max_{b^*,b,K} E(c_2^{firm}) - \frac{\lambda}{2} var(c_2^{firm})$$

- Period $t = 2$ budget constraint

$$c_2^{firm} = \left(r_2^K - p^K r\right) K - b^* \left(e_2 r^* - r\right).$$

- Firm choice,

$$b^* = -\frac{E\left(e_2 r^* - r\right)}{var\left(e_2 r^*\right)\lambda} + \frac{cov\left(e_2 r^*, r_2^k\right)}{var\left(e_2 r^*\right)} K$$

Foreign Financiers

- Borrow in dollar asset market $\longrightarrow$ Make loans in domestic credit market
  - Dollar loans: $x^{\$}$, Peso loans: x^{D}
  - Loans are in units of foreign goods (e.g., 'dollars')
  - Total position: $x^{\$} + x^{D} = b^{f}$
- Exogenous income Y_2^f: correlated with export demand shifter Y_2^*
- Period 2 income (by arbitrage, $r^{\$} = e_1 r^*$):

$$x^{\$} e_1 r^* + \frac{x^D e_1 r}{e_2} - b^f r^{\$} + Y_2^f$$

- Foreign financier problem,

$$\max_{x^D} E\left(x^D e_1 \left(\frac{r}{e_2} - r^*\right) + Y_2^f\right) - \frac{\lambda^f}{2} var\left(x^D e_1 \left(\frac{r}{e_2} - r^*\right) + Y_2^f\right).$$

Foreign Financiers

- The solution to foreign financier problem,

$$x^D = \frac{\overbrace{E\left(\frac{r}{e_2} - r^*\right)}^{\text{Speculative Motive}}}{e_1 var\left(\frac{r}{e_2}\right)\lambda^f} - \frac{\overbrace{Cov\left(\frac{r}{e_2}, Y_2^f\right)}^{\text{Hedging Motive}}}{e_1 var\left(\frac{r}{e_2}\right)}$$

- If the exchange rate depreciates (e_2 high) when Y_2^f is low, covariance is positive
  - Financiers require risk premium to invest in peso assets (they are like the households).
- If the covariance is large, financiers do not want to invest in peso assets at all.
  - Related to large literature that suggests EME risk hard to diversify.

Equilibrium in Goods Market - Period 1

- Firms build capital K using domestic, k_h, and foreign, k_f, inputs

$$K = k_h^{\omega} k_f^{1-\omega}$$

- Foreigners demand c_1^*

$$c_1^* = \omega e_1^{\eta} Y^*, \ \eta > 0$$

- Goods market equilibrium

$$\overbrace{c_1^*}^{\text{Exports}} + \overbrace{k_h}^{\text{Domestic input}} = \overbrace{Y}^{\text{Endowment}}$$

Equilibrium in Financial Markets - Period 1

- Financial markets clearing,
  - Peso asset market

$$\overbrace{d}^{\text{Domestic savings}} + \overbrace{x^D e_1}^{\text{Foreign lending}} = \overbrace{b}^{\text{Total Borrowing}}$$

- Dollar asset market

$$d^* + x^\$ e_1 = b^*$$

- Balance of payments,

$$\overbrace{c_1^* - e_1 k_f}^{\text{Trade Balance}} = \overbrace{d + d^* - (b + b^*)}^{\text{Net Asset Acquisition}}$$

Equilibrium - Period 2

- Final consumption good

$$c_2 = A\left[\omega_c^{\frac{1}{\delta}}\left(c_2^h\right)^{\frac{\delta-1}{\delta}} + (1-\omega_c)^{\frac{1}{\delta}}\left(c_2^f\right)^{\frac{\delta-1}{\delta}}\right]^{\frac{\delta}{\delta-1}}, \quad A = \omega_c^{\omega_c}(1-\omega_c)^{1-\omega_c}$$

- Production

$$Y_2^h = (A_2 K)^{\alpha}$$

- Goods market equilibrium

$$Y_2^h = \overbrace{c_2^h}^{\text{Domestic Consumption}} + \overbrace{c_2^*}^{\text{Exports}}, \; c_2^* = \left(\frac{p_2^h}{e_2}\right)^{-\eta} Y_2^*$$

- Balance of Payments: $p_2^h c_2^* - e_2 c_2^f = (b-d)\, r + (b^*-d^*)\, r^* e_2$

Shocks - Uncertainty

- Export demand

$$Y_2^* = \xi + \nu$$

- Foreign financiers' income shock

$$Y_2^f = s\nu$$

- Export demand and foreign income shocks are correlated

$$Cov\left(Y_2^f, Y_2^*\right) = s \times \sigma_\nu^2$$

- Productivity shock A_2

Results

- We have an analytic result for an approximation to the model that is interesting, given the the data.
- Mainly focus on numerical results.
- We are able to construct a panel of countries in which bigger depreciations in recession lead to:
  - more deposit dollarization by worker-households
  - higher premium on domestic (Peso) interest rate.

Interest Rate Spread

- Household and firm choices

$$b^* = -\frac{E\left(e_2 r^* - r\right)}{var\left(e_2 r^*\right)\lambda} + \frac{cov\left(e_2 r^*, r_2^k K\right)}{var\left(e_2 r^*\right)}$$
$$d^* = \frac{E\left(e_2 r^* - r\right)}{\lambda var\left(r^* e_2\right)} - \frac{cov\left(r^* e_2, w_2\right)}{var\left(r^* e_2\right)}$$

Use facts $r_2^k K = \alpha GDP_2$, $w_2 = (1-\alpha)\, GDP_2$

- For the case $b^* - d^*$ small (100% intra-national insurance), we have the interest rate spread,

$$E\left(r - e_2 r^*\right) = -\frac{1}{2}\lambda cov\left(r^* e_2, GDP_2\right)$$

Calibration Targets

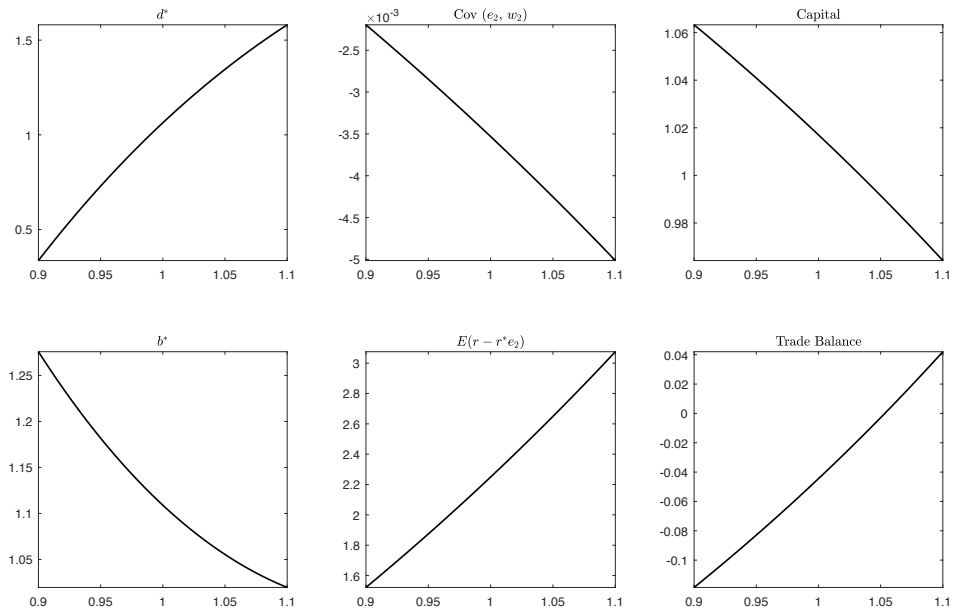
Variable	Description	Model	Peru
(a)	(b)	(c)	(d)
$\frac{b+b^*}{d+d^*}$	$\frac{\text{Total domestic borrowing}}{\text{Total domestic lending}}$	1.02	
$100 \times (r-1)$	Domestic Rate	-0.3%	-0.3%
$E\left(e_2 r^*\right)$	Expected Dollar Rate	0.975	
$100 \times E(r - e_2 r^*)$	Spread (domestic agents)	2.24%	2.20%[6]
$100 \times E(\frac{r}{e_2} - r^*)$	Spread (financier)	2.50%	
$d^* / \left(d^* + d\right)$	Deposit Dollarization	0.60	0.44[2]
$\frac{b-d}{b}$	Foreign Source of Peso Credit	0.04	0.01[3]
$\frac{d^*-b^*}{d^*}$	Foreign Absorption of Dollar Deposits	-0.00	-0.07[3]
$b^* / \left(b + b^*\right)$	Credit Dollarization	0.59	0.40[3]
$\frac{c_1^* - e_1 k_f}{Y}$	Scaled Trade Surplus	-0.02	-0.02[4]
$100 \times \frac{E(r-r^* e_2)}{r} \frac{d^*}{d^*+d}$	Implicit tax on dollar deposits	1.3%	1.5%[5]
ρ	Correlation, e_2, GDP	-0.23	-0.20[7]
$std(log(e_2))$	Standard Deviation, e_2	0.04	0.03[8]

Calibrated Parameters

Parameter	Description	Value
α	Capital Share, 15	0.38
λ	Risk aversion, domestic residents, 9, 19	1.55
λ^f	Foreign Financier Risk aversion, 29	1.55
η	Elasticity of demand for exports, 34, 39	3.28
Y^*	Period 1 trade demand, 34	1.35
s	Covariance parameter, financier income, 26	3.82
Y	Period 1 GDP, 7	3.17
μ_ν	Mean, ν shock to foreign demand, 24	2.97
μ_A	Mean productivity, 15	7.85
μ_ξ	Mean, ξ shock to foreign demand, 24	7.16
σ_A	Std dev, log productivity, 15	$0.22\mu_A$
σ_ξ	Std dev, log ξ shock to foreign demand, 24	$0.68\mu_\xi$
σ_ν	Std dev log u shock to foreign demand, 24	$0.22\mu_\nu$

Increase in Volatility of Export Demand

- Increase standard deviation of export demand shock
  - $Cov(r^* e_2, GDP)$ becomes more negative, households save in dollars.
  - Firms more averse to dollar loans, shift into (higher interest) local currency loans.
    - ★ Firms scale back, K falls.
  - Premium on domestic interest rate rises.
  - Higher net asset accumulation, $d + d^* - (b + b^*)$, trade surplus rises (BOP).

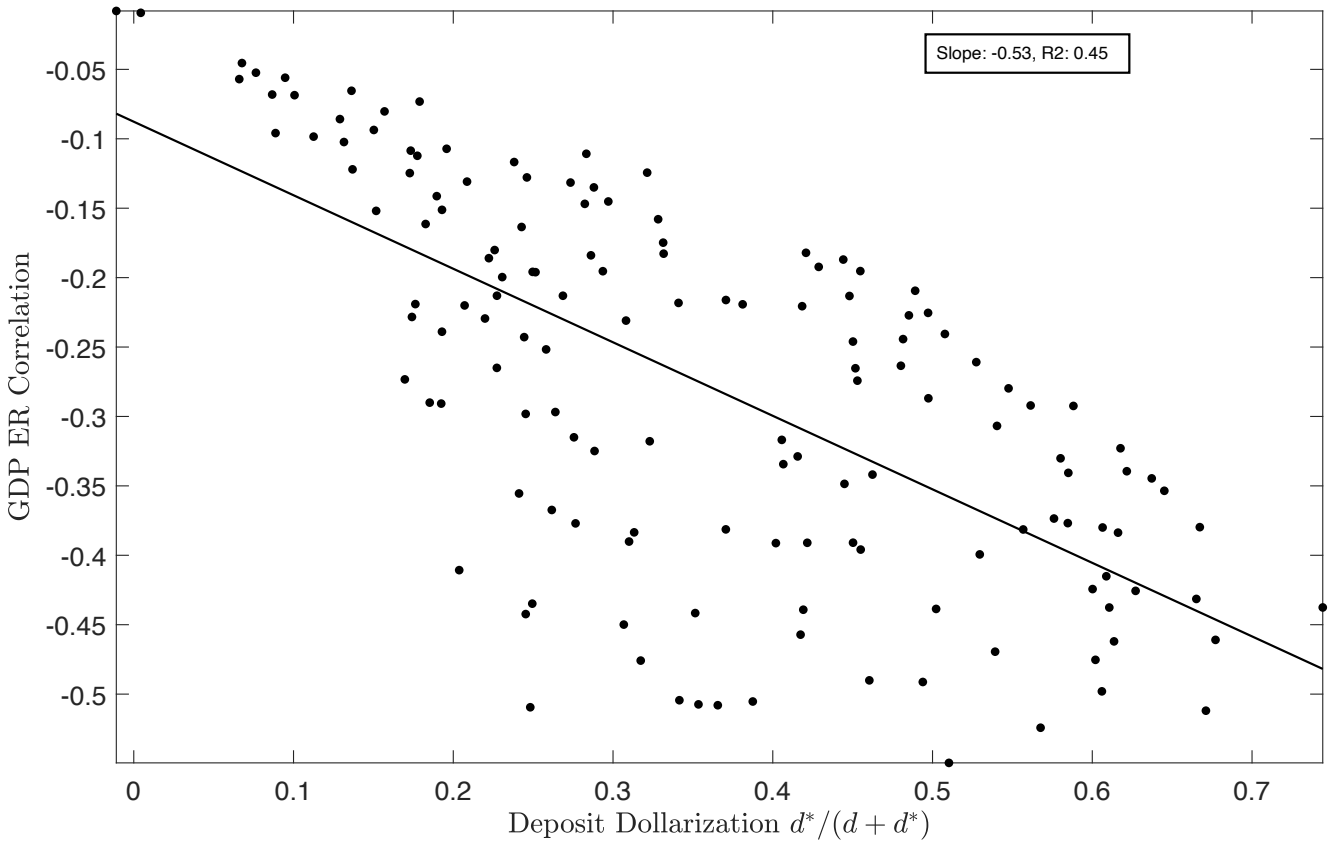


Other Experiments

- Increase volatility of technology shock:
  - Results change substantially, exchange rate appreciates in recession, so households don't want dollar assets.
- Increase risk aversion of foreign financiers:
  - increase λ^f (Miranda-Rey, RESTUD, 2020).
  - increase, s, $Cov\left(Y_2^f, Y_2^*\right) = s \times \sigma_\nu^2$

Dollarization vs GDP-ER Correlation

- Simulate different countries by simulating different values for model parameters
  - Standard deviation of trade, foreign income, productivity shocks



Concluding Observations

- Empirical results drawn mainly from 2000s, and so are conditional on the regulatory environment of this time.
  - We do not question the wisdom of most of this regulation.
  - Examples: good idea to minimize currency & dollar maturity mismatch in banks.
- We question the skepticism about credit and deposit dollarization:
  - Dollarization may have important, unrecognized benefits (intra-national insurance mechanism).
  - Financial risks associated with may not be as large as many think.

Crisis: Message of Preceding Example

- The example is extreme.
  - In practice, firms borrow long-term and a crisis depreciation is partially reversed.
  - In the case of Korea: depreciation 110% from January 1997 to January 1998.
    - ⋆ Depreciation from January 1997 to January 1999 'only' 50%.
  - Dalgic, et al's 2017 study of Turkey suggests it is large firms and firms with exports that borrow the bulk of dollar credit.
    - ⋆ These firms are relatively resilient to exchange rate changes.
- Message:
  - Insist that banks have no currency mismatch.
  - Allow some mismatch in firms, which have lower leverage and can handle exchange rate shocks better.
  - In this case, dollarization may not be so dangerous.

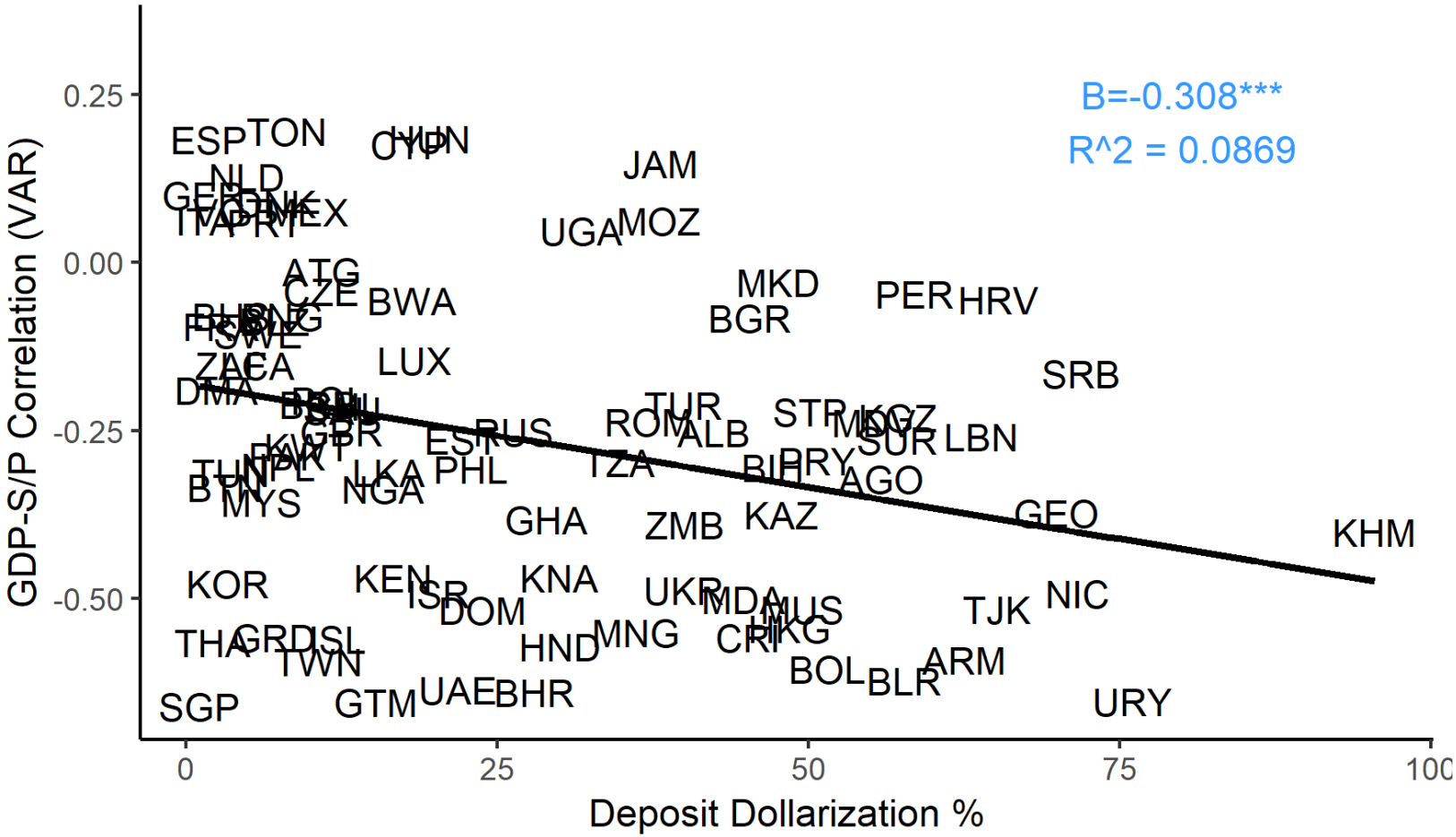
Did We Get the Causality Backwards?

- We have argued that exchange rate depreciations in recessions drive the demand for deposit dollarization.
  - That in turn (due to regulations) drives credit dollarization.

- But, is it possible that causality goes the other way around?
  - Could it be that deposit dollarization is the *cause* of recessions accompanied by currency depreciation?
  - That possibility seems inconsistent with the evidence that deposit dollarization is uncorrelated with:
    - ⋆ frequency of sudden stops and financial crisis.
    - ⋆ the severity of recessions that follow a sudden stop and/or financial crisis.

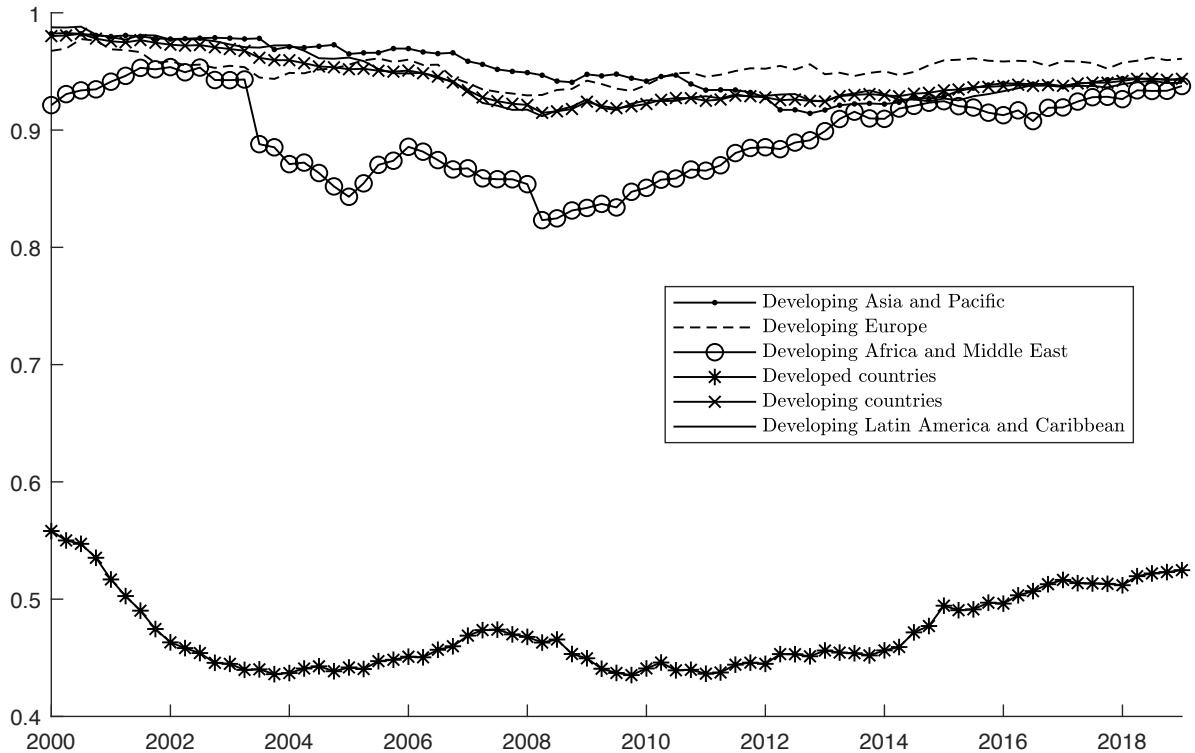
- So, we are (cautiously) comfortable with the causality assumptions implicit in our analysis.

Deposit Dollarization versus How Much S_t/P_t Jumps in Recession: 2000-2018 (Bivariate one-lag VAR)



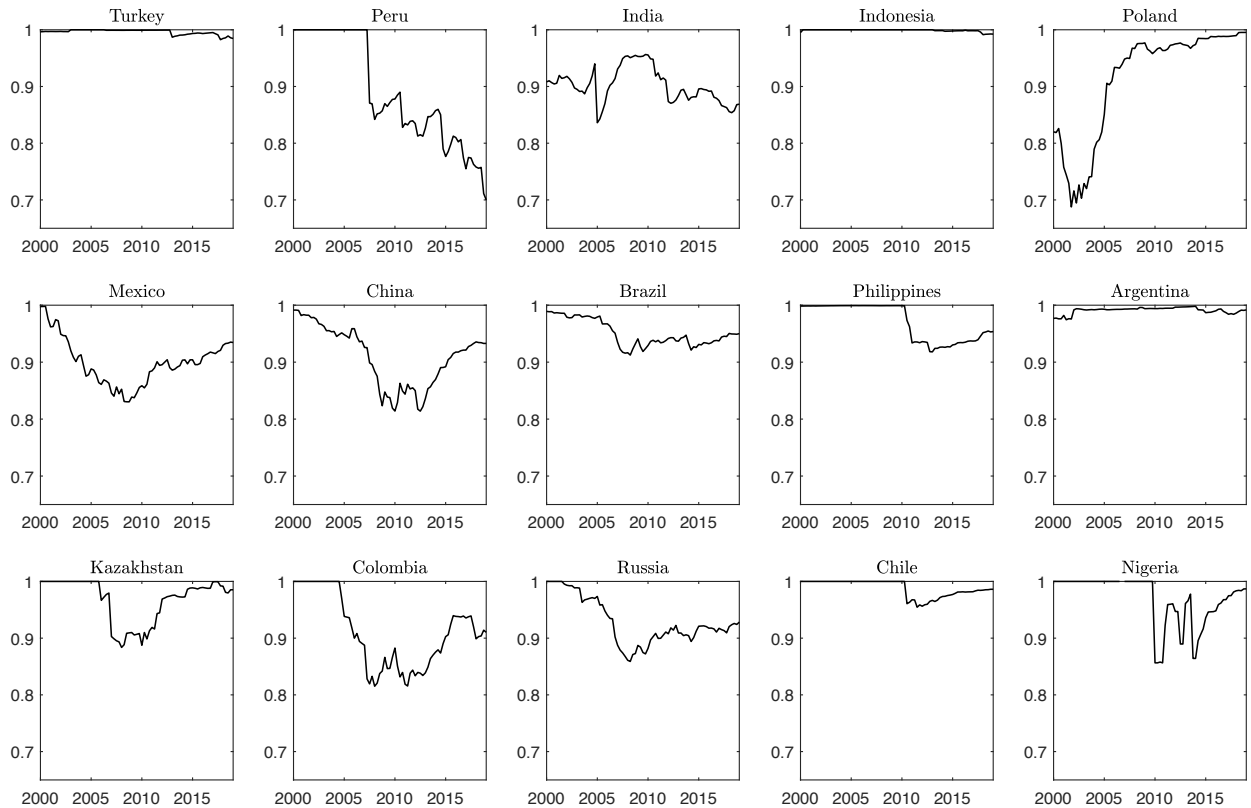
Go Back

Foreigners Lend Little Domestic Currency into EME's



Note: foreign currency debt issued into international securities markets divided by total debt issuance (e.g., including debt denominated in domestic currency). Issuers include *all* entities of the given nationality. Debt is of all ratings, maturities, etc. Importance of measuring debt issuance by nationality rather than residence stressed in Hyun Shin, 'The Second Phase of Global Liquidity...', November, 2013). Data source: BIS.

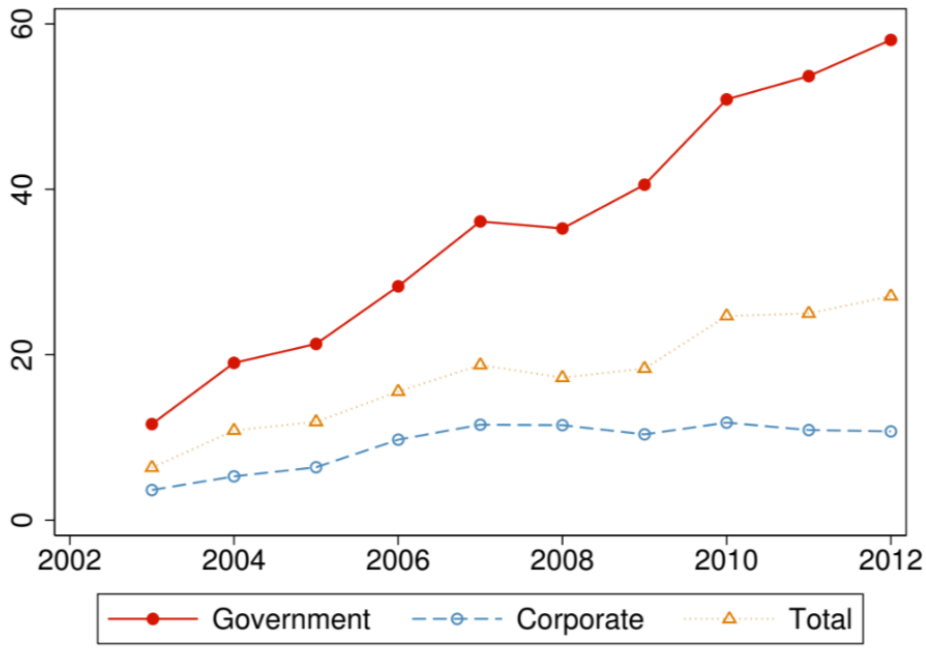
Share of Foreign Currency Borrowing By Selected Countries



Note: there is substantial variation in this share across countries. In two (Turkey and Indonesia) there is essentially no change.

Sov's and Non-Financial Firms (Du and Schreger 2017)

Figure 3: Share of External Debt in LC (Mean of 14 sample countries)



Notes: This figure plots the cross-country mean of the share of external debt by sector in LC. The cross-country mean gives each country in the sample an equal weight. Within each country, the share of total debt in LC is the weighted average of the share of sovereign and corporate debt in LC, weighted by the amount of each type of debt outstanding. The countries included in the sample are Brazil, Colombia, Hungary, Indonesia, Israel, Malaysia, Mexico, Peru, Poland, Russia, South Korea, South Africa, Thailand and Turkey.

Domestic currency share of sov'n debt growing. But, sovereigns don't borrow much in emerging countries.

Note that the although the total is rising, it reaches a rather low max of 20%.

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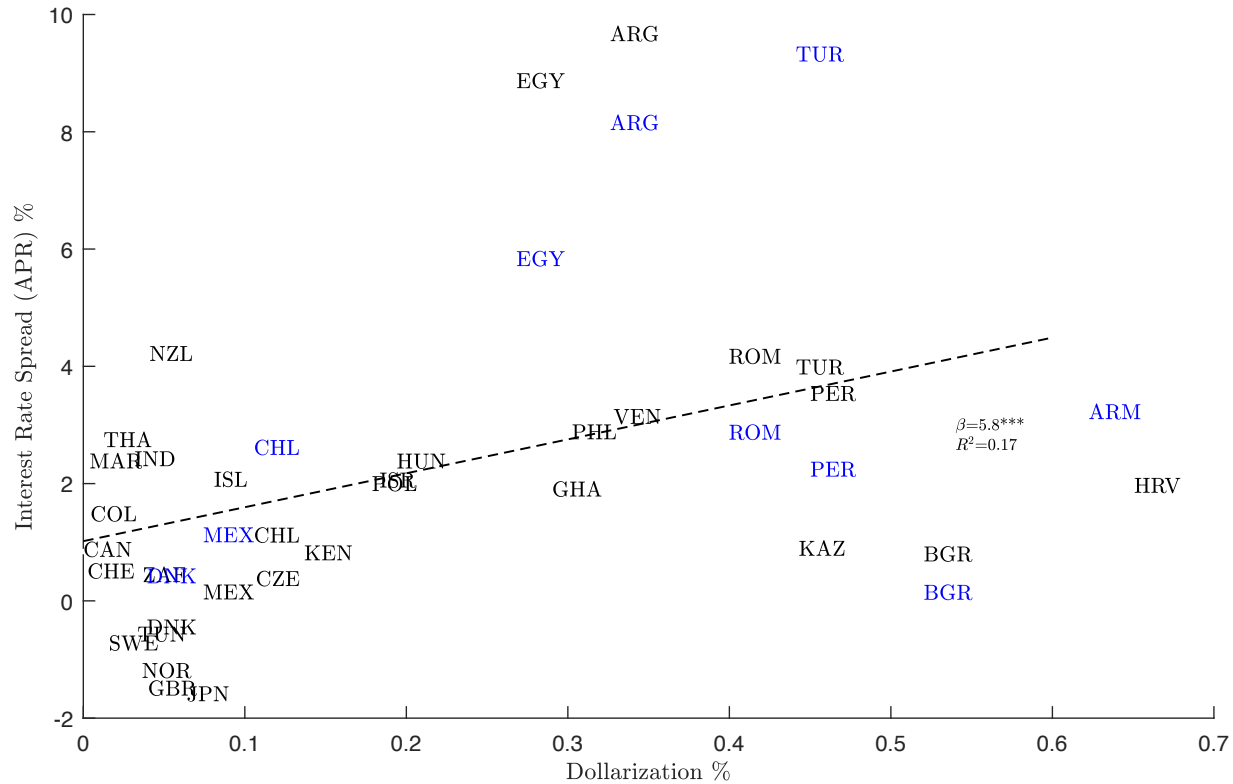
Computing $i - i^*$

- We use data for roughly 30 countries, on which we have observations from currency futures markets.
- For the foreign (risk-free) interest rate, we use the EURO for European Emerging markets and the US dollar for the others.
  - Foreign interest rate: $i^* = \frac{R^* S'}{S}$, S, S' denote current and next month's realized spot exchange rate; R^* foreign nominal rate (e.g., three month US gov't securities).
- For domestic risk-free interest rate we use Covered Interest Parity and Futures markets: $i = \frac{R^* F}{S}$
- So, the spread (APR) is: $i - i^* = 1200 \times \frac{R^*}{S} [F - S']$ we will only take averages for this object, so that S' is the expected exchange rate if forecast error in S' orthogonal to current variables.
- The only uncertainty in our measure of the spread is exchange rate uncertainty.

Computing $i - i^*$



$i - i^*$ Blue: i interest rates on domestic deposits (central bank websites), Black: i our constructed deposit rate.

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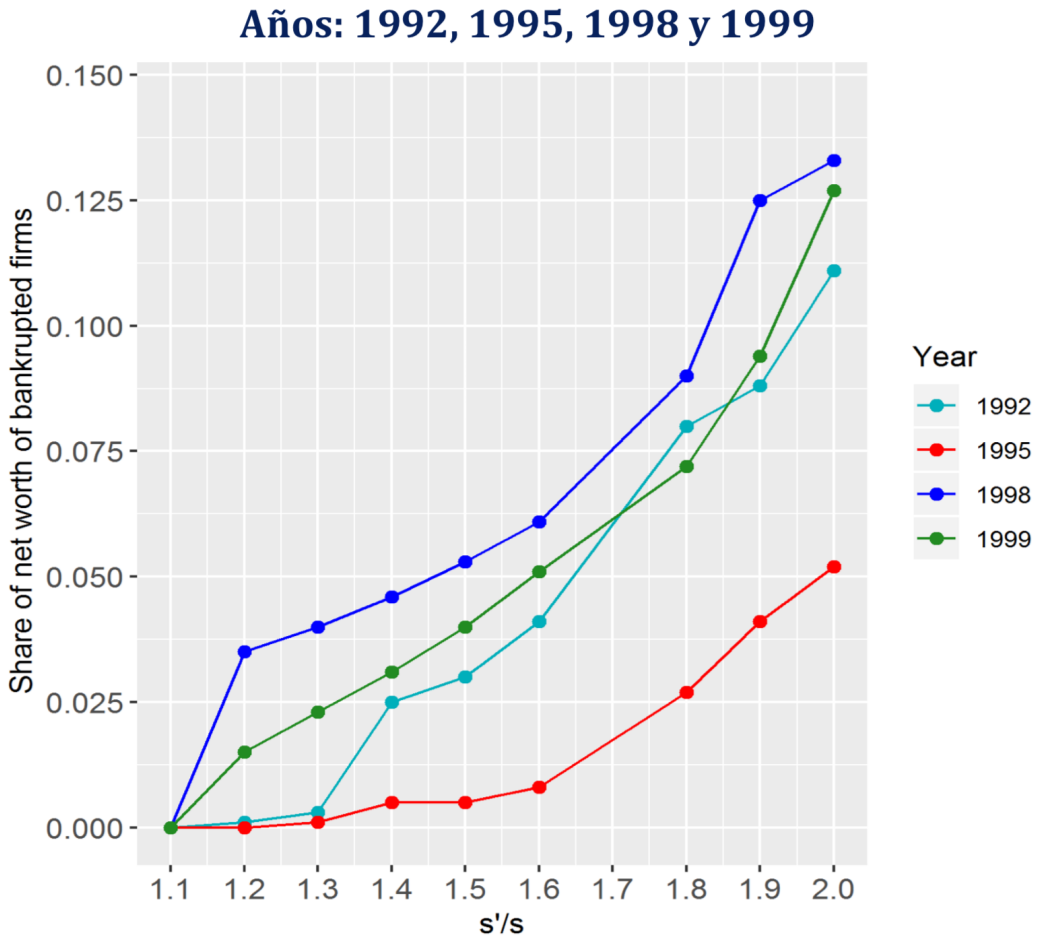
Peru: Firms in 2000s Much More Robust to Stress

Figure 3. Share of net worth of bankrupted firms



Source: Estados financieros de empresas. Vademécum bursátil de la BVL

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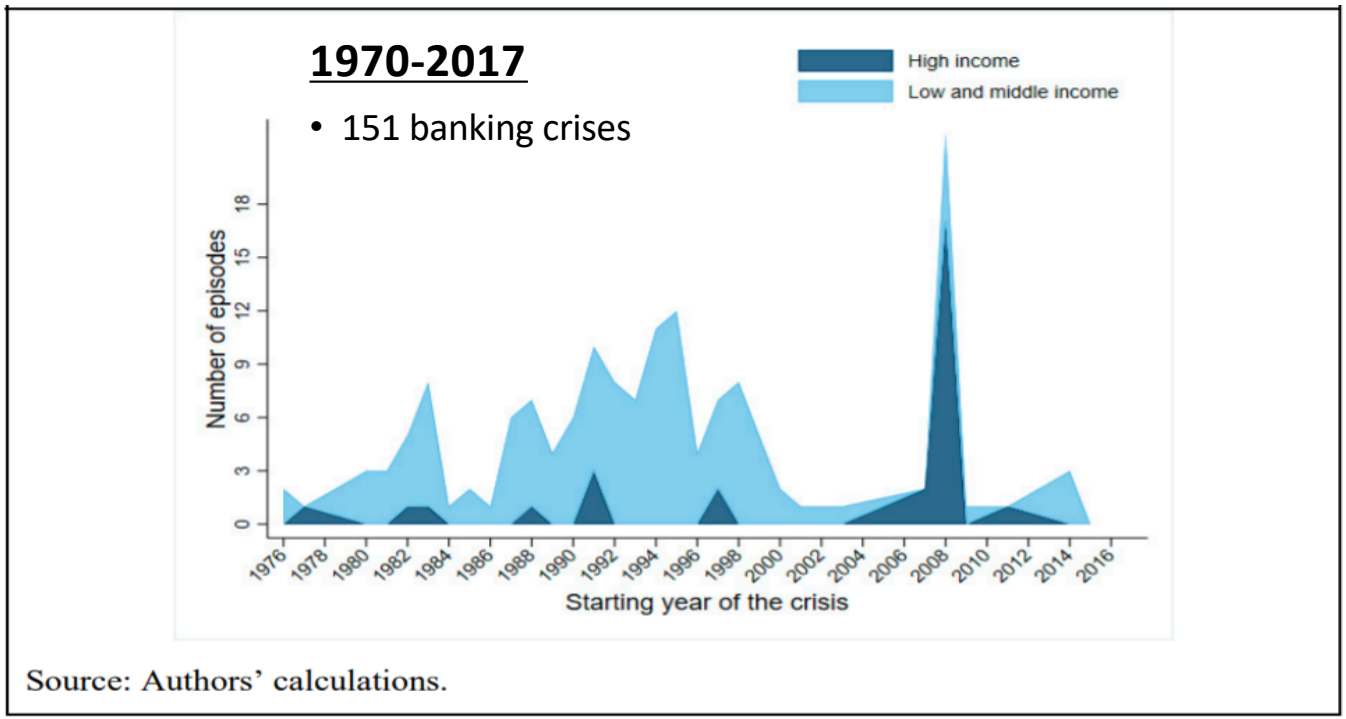
Systemic Banking Crises by Laeven & Valencia 2018



Source: L. Laeven & F. Valencia "Systemic Banking Crises Revisited" IMFWP 2018

Selected Asian-Crisis Countries (Malaysia and Thailand do not allow Deposit Dollarization Now)

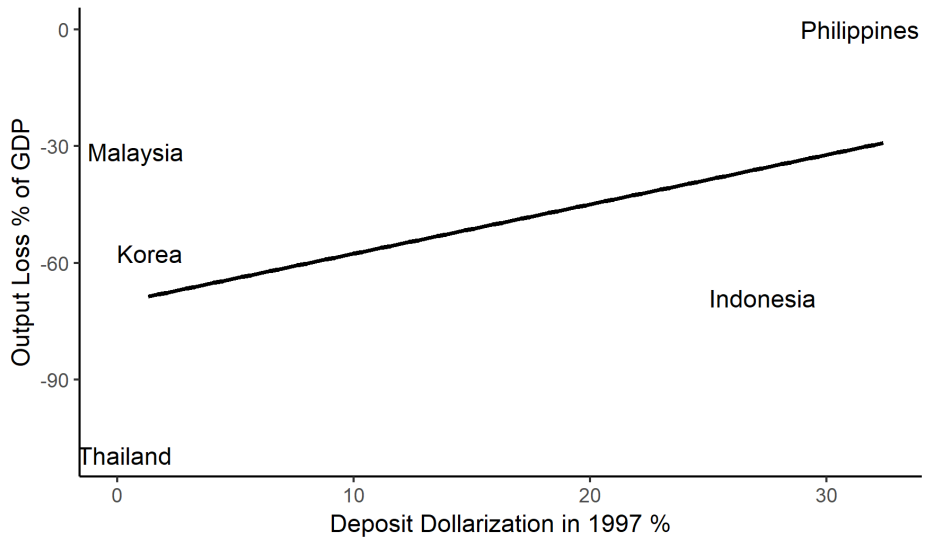


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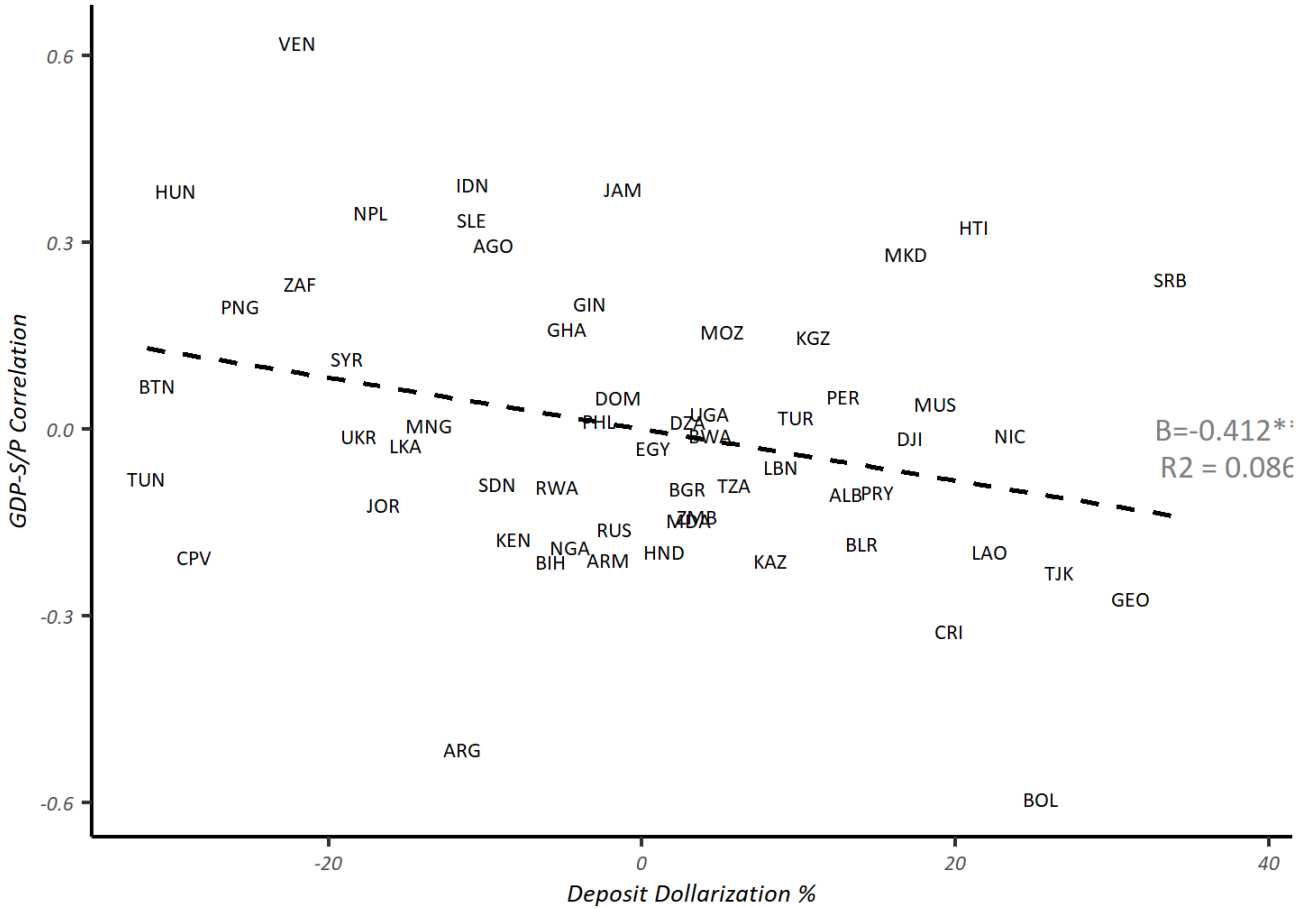
Table 1: Determinants of Dollarization

	Dependent variable:				
	Dollarization				
	(1)	(2)	(3)	(4)	(5)
Corr($\Delta GDP, \Delta S/P$)	-33.680^{***}	-25.988^{***}	-28.673^{***}	-31.411^{***}	-22.019^{**}
	(6.853)	(8.327)	(8.794)	(12.122)	(9.850)
Av Inflation		0.028^{***}	0.028^{***}	0.022^{***}	0.023^{***}
		(0.006)	(0.006)	(0.008)	(0.007)
Gini			0.188	−0.015	-0.461^{*}
			(0.210)	(0.405)	(0.250)
Fuel Export			−0.123	-0.298^{***}	-0.212^{***}
			(0.080)	(0.103)	(0.060)
Reserves/GDP			0.031^{*}	0.031	0.002
			(0.016)	(0.028)	(0.014)
Institutions				-18.736^{***}	
				(4.897)	
External Debt					0.512
					(2.119)
Constant	21.644^{***}	21.642^{***}	11.454	82.793^{***}	48.583^{***}
	(1.894)	(2.294)	(8.236)	(18.248)	(12.080)
Observations	120	112	94	35	64
R^2	0.164	0.206	0.315	0.499	0.313
Adjusted R^2	0.157	0.192	0.276	0.391	0.241
Residual Std. Error	19.610 (df = 118)	19.458 (df = 109)	18.117 (df = 88)	15.915 (df = 28)	17.413 (df = 57)
Note:					*p<0.1; **p<0.05; ***p<0.01

Dependent variable is the average dollarization between 2000-2018. Right hand variables are average inflation in the 90s ('Av Inflation'); average Gini index (1995-2018), ('Gini'); fuel exports (as a share of total exports) (1995-2018), ('Fuel Export'); reserves (as a share of GDP) (1995-2018), ('Reserves/GDP').
Political institutions ('Institutions') are proxied by World Bank Country Policy and Institutional Assessment, "Transparency, accountability, and corruption in the public sector rating (1=low to 6=high)". Heteroskedasticity consistent standard errors are calculated.

Figure: Countries in which the Currency Depreciates More in a Recession Have Greater Deposit Dollarization even after controlled for other determinants



Notes: x-axis and y-axis variables are the residuals from regressing the raw variables on the x and y axes on the controls in Table 1, column 3.

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Inflation (in 1990s) Versus Dollarization (post 2000)

Note: strong positive correlation between inflation in 1990s and dollarization in 2000s.

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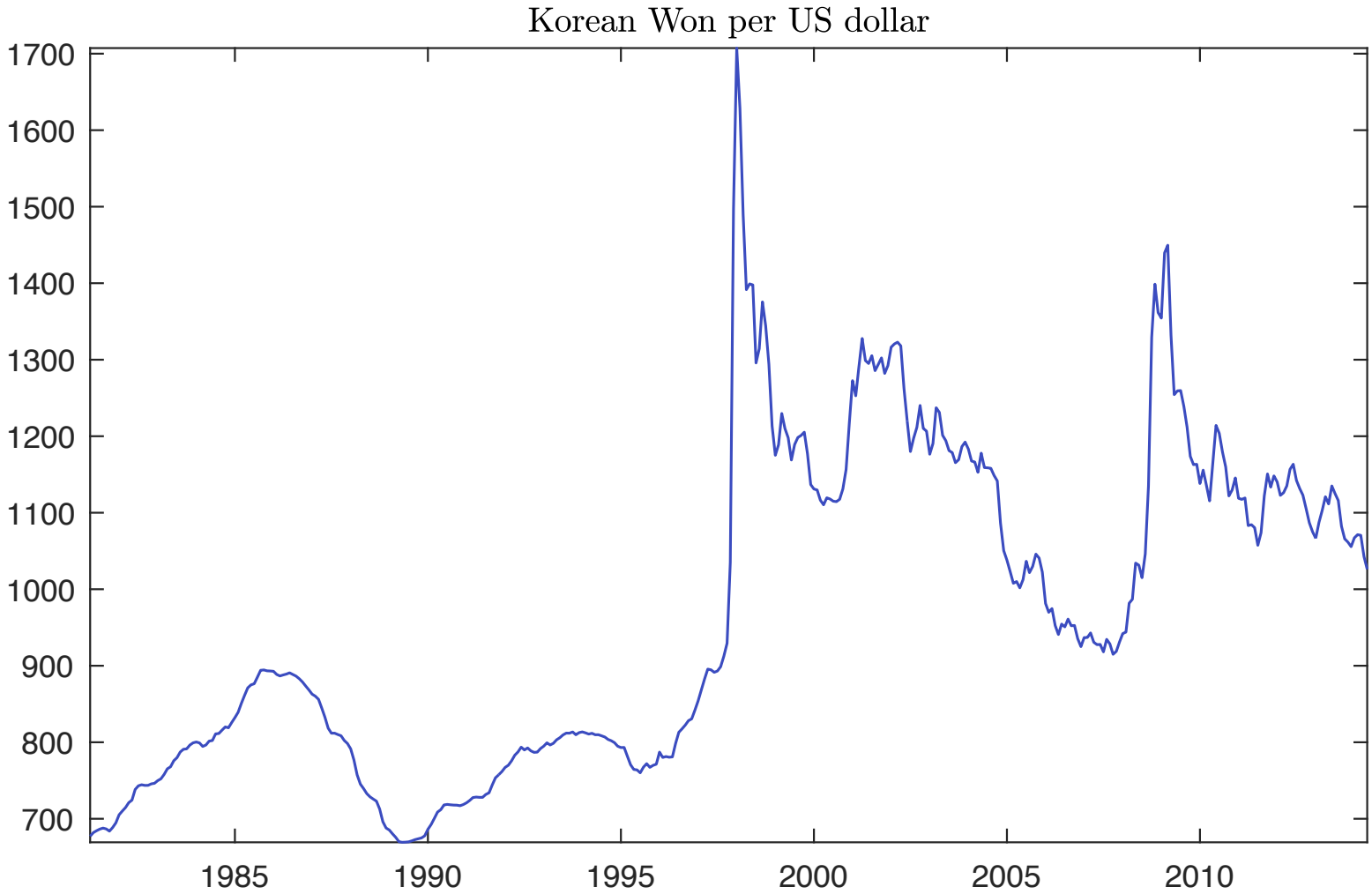

Note: in 1998 crisis, Won depreciated by a factor of 2. Later, depreciation partially offset.

Crisis When Currency Mismatch is Held by Firms

- Korean Won depreciated by a factor of 2.1 from 800 to 1,700 during Asian Financial Crisis.
- Suppose:
  - Leverage is 2 (this is the US and, arguably, Turkey (see Dalgic, et al)).
  - Credit dollarization is 50%.

Table: Assets and Liabilities of a Firm (all numbers in Won)

Before Crisis	
Assets	Liabilities
200	50 local currency debt
	50 dollar debt
	100 equity

After Crisis	
Assets	Liabilities
200	50 local currency debt
	100 dollar debt
	50 equity

- The firm can weather this storm.

Crisis When Currency Mismatch is Held by Banks

- Banks have much higher leverage, maybe 10.
- Suppose bank has 50% dollar credit.

Table: Assets and Liabilities of a Bank (all numbers in Won)

Before Crisis		After Crisis	
Assets	Liabilities	Assets	Liabilities
200	90 local currency debt	200	90 local currency debt
	90 dollar debt		180 dollar debt
	20 equity		-70 equity

- This bank is now insolvent!

Levy-Yeyati Evidence

- Levy-Yeyati: with deposit dollarization, financial dominates expenditure switching channel.
- We find: Levy-Yeyati's results fragile.
  - not statistically significant using improved new econometric methods Mitchell Petersen (Review of Finance, 2009) used. ▸ SE
  - Very sensitive to exactly how 'deposit dollarization' is measured. ▸ DD
  - Point estimates reversed when post-2003 data are used. ▸ post
  - Interest on Foreign Debt/GDP included drives out dollarization, exchange depreciation, etc. .
    - ⋆ Message if you borrow a lot, you could get into trouble. ▸ return

Different Standard Errors

left hand variable: Crisis Dummy	*(1)*	*(2)*	*(3)*
	OLS SE	*Country Cluster*	*Country-Year Cluster*
Δer_1	*-0.829*	*-0.829*	*-0.829*
	(1.263)	*(0.706)*	*(0.799)*
FL/FA_1	*0.00348*	*0.00348***	*0.00348***
	(0.00303)	*(0.00139)*	*(0.00137)*
$dollar\_1$	*0.674***	*0.674**	*0.674*
	(0.333)	*(0.359)*	*(0.429)*
$FL/FA \times \Delta er\_1$	*0.0715*	*0.0715***	*0.0715***
	(0.0619)	*(0.0312)*	*(0.0313)*
$dollar \times \Delta er\_1$	*1.310*	*1.310**	*1.310*
	(1.250)	*(0.695)*	*(0.834)*

Standard errors in parentheses

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

Different Standard Errors

Notes on previous table.
These are logit regressions. Δer_{-1} log change in exchange rate (depreciation if positive), lagged one period.
FL/FA_{-1} ratio, foreign liabilities to foreign assets (whether to residents or non-residents) in domestic banking system.
$dollar_{-1}$ 1 if dollarization was greater than 10% in previous period; 0 otherwise
Sample period: 1975-2002
Column 2 exactly reproduces L-Y results (thanks to LY for sending us his code and data). Country Cluster standard errors assume dependence of error term over time within countries and independence across countries.
Column 1 computes standard errors assuming errors independent over time and across countries.
Column 3 implements Peterson's method which allows, in addition to dependence over time, dependence across countries for a given point in time. Crisis have a tendency to be correlated across countries.
If a crisis (i.e., '1') persists for more than one year, observations on subsequent years are dropped. The dropped data are treated as 'missing observations by STATA'. We follow L-Y in this procedure.

Note sensitivity of results to method of computing standard errors. Arguably, Peterson's approach is more appealing in this setting because of the cross-country 'contagion' associated with crises. ▸ Go Back

Deposit Dollarization

Table: Different Measures of Deposit Dollarization in Levy-Yeyati's Table 5 Results

	10 Percent	*15 Percent*	*20 Percent*
Crisis Dummy			
Δer	*-0.829*	*0.0781*	*0.0364*
	(0.706)	*(0.371)*	*(0.356)*
FL/FA	*0.00348***	*0.00268****	*0.00259****
	(0.00139)	*(0.000568)*	*(0.000550)*
dollar	*0.674**	*0.569**	*0.335*
	(0.359)	*(0.333)*	*(0.321)*
*FL/FA*Δer*	*0.0715***	*0.0533****	*0.0517****
	(0.0312)	*(0.0136)*	*(0.0132)*
*dollar*Δer*	*1.310**	*0.433*	*0.503*
	(0.695)	*(0.460)*	*(0.451)*
Observations	*1104*	*1104*	*1104*

Deposit Dollarization

Notes on previous table:

First column reproduces Levy-Yeyati's second column in 'Different Standard Errors' table. The other two columns in this table define the 'dollarization dummy' as 1 when deposit dollarization exceeds 15 and 20 percent, respectively.

Levy-Yetati's results depend on using a dummy that is unity when deposit dollarization exceeds 10 percent.

Note that significance of produce of dummy and exchange rate depreciation sensitive to definition of dollarization. Go Back

Levy-Yeyati Analysis on Post-2003 Data

Table: Our Data: Levy-Yeyati Table 5, Column 2

	(1)	(2)	(3)	(4)
	Whole Sample	Without Armenia, 1994	2003 and Before	After 2003
LV Crisis Dummy				
dollar$_{-1}$	0.0954	0.141	0.547*	-0.408
	(0.334)	(0.332)	(0.314)	(0.530)
Δer_{-1}	-0.795**	-0.795**	-1.075	-0.777***
	(0.366)	(0.366)	(1.920)	(0.293)
dollar $\times$ Δer_{-1}	1.436***	0.923	1.632	-6.659**
	(0.420)	(0.660)	(2.046)	(2.659)
Constant	-4.001***	-4.001***	-4.007***	-3.989***
	(0.589)	(0.589)	(0.367)	(1.009)
Observations	2861	2860	1161	1700

Standard errors in parentheses

Levy-Yeyati Analysis on Post-2003 Data

Notes on previous table. Here, we use our data set, which we extended to 2018. Interestingly, when we extend L-Y's analysis to the end of our sample (column 1), we get his result. In particular, the coefficient on $dollar * \Delta er_{-1}$ is statistically significant and it is larger than the coefficient on Δer_{-1}. This means that an exchange rate depreciation in a country with above 10% deposit dollarization raises the probability of crisis by $1.436 - .795 > 0$. An exchange rate depreciation in a country without deposit dollarization reduces the probability of a crisis by 0.795, presumably because in the absence of dollarization only the expenditure switching channel works, so that an exchange rate depreciation improves the health of all economic entities, not just banks. We see from column 2, however, that the results are driven by one single data point, Armenia in 1994. In that period there was a gigantic change in the exchange rate associated with Armenian independence from the Soviet Union (that was actually formally declared on September 21, 1991). So, if we drop the one outlier data point, the whole sample completely reverses L-Y's results. We suspect that's because many of the crises in the pre-2003 period occurred in emerging markets where deposit dollarization tends to be relatively high while the post -2003 crises occurred in developed economies where deposit dollarization is low (see columns 3 and 4). This is why analysis using only the later period seems to indicate that deposit dollarization immunizes you from crisis. Our inference is that deposit dollarization actually has little to do with crisis.

Levy-Yeyati Analysis on Post-2003 Data

Table: Our Data: Levy-Yeyati Table 5, Column 2

	(1)	(2)	(3)
	Whole Sample	External Debt Available	External Debt Available
LV Crisis Dummy			
dollar	0.0954	0.694	0.675
	(0.334)	(0.429)	(0.439)
Δer_1	-0.795**	-0.0958	0.524
	(0.366)	(1.139)	(0.773)
$dollar \times \Delta er\_1$	1.436***	0.851	0.758
	(0.420)	(1.268)	(0.896)
Interest Paid on External Debt$_1$			0.252***
			(0.0745)
Interest Paid on External Debt $\times \Delta er\_1$			-0.578
			(0.357)

Levy-Yeyati Analysis on Post-2003 Data

Notes on previous table. The results in Table 4 do not include Levy-Yeyati's variable, FL/FA, because we have not yet been able to find that variable for the post 2003 period. The table attempts to shed (preliminary) light on whether the omission of FL/FA in our Table 4 biases our results against Levy-Yeyati's hypothesis: when deposit dollarization is high, the financial channel dominates the expenditure switching channel of an exchange rate change. The results in the previous table go against the hypothesis. The first column in the table of the previous page reproduces the first column of Table 4 (so, we include the 1994 observation on Armenia). We found a variable that is not the same as FL/FA but which may in practice carry the same information. It is "Interest payments on external debt (% of GNI)", obtained from the World Bank. A difficulty is that we could find this variable for only 60% of our sample (the variable is available for major developing countries, but not advanced economies or very small ones). Column 2 redoes the calculations in column 1 using only the countries for which we have data on 'Interest payments on external debt'. Note that the L-Y results (the coefficient on $dollar \times \Delta er_{-1}$) are less significant on this sample. Column 3 reports the same econometric analysis, but also includes the 'interest payments on external debt' variable. We see little difference between columns 2 and 3 in terms of the major parameter of interest, $dollar \times \Delta er_{-1}$. This is the basis for our preliminary conclusion that excluding FL/FA has not biased our results against L-Y's hypothesis.

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Our Table: Deposit Dollarization Does not Affect Probability of Crisis, External Debt Does

Table 1:

	Dependent variable:
1(5<Dollar<=20)	0.189
	(0.354)
1(5<Dollar<=20)ΔER	1.088
	(1.437)
1(20<Dollar<=50)	0.021
	(0.325)
1(20<Dollar<=50)ΔER	1.523
	(0.953)
1(Dollar>50)	−0.102
	(0.386)
1(Dollar>50)ΔER	0.022
	(1.266)
ΔER	−1.804**
	(0.815)
Real GDP Growth	−0.010
	(0.018)
Reserves/GDP	−1.700
	(1.264)
Imports/GDP	−0.0003
	(0.001)
Interest on External Debt/GDP	0.100**
	(0.046)
Constant	−1.849***
	(0.409)
Note:	*p<0.1; **p<0.05; ***p<0.01

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Peru: 28 Largest Firms in Recent Depreciation

- For each firm, have data on $Assets and $Liabilities, and S/ Assets and S/ Liabilities.
- Compute 'currency mismatch' for each firm, at start of 2014:

$$Currency\ Mismatch = \frac{\$Assets - \$Liabilities}{Total\ Assets}$$

- Compute, for 2014Q2-2016Q4 and as percent of firm equity
  - FX losses
  - Net Earnings
  - Growth in total assets (proxy for investment)

Peru: 28 Largest Firms in Recent Depreciation

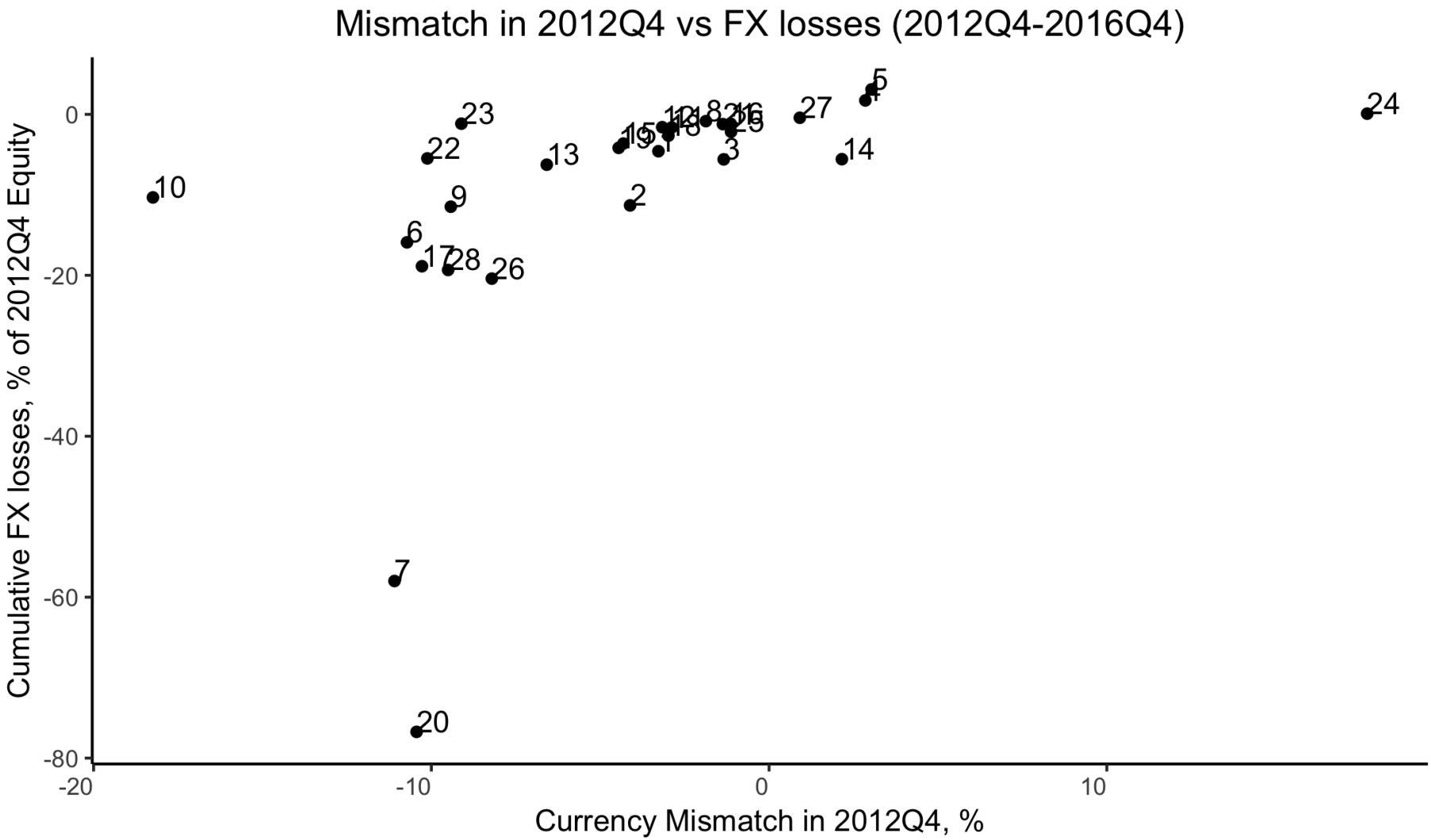

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Figure: FX Losses, 2014Q2-2016Q4, vs Currency Mismatch in 2012Q4

Peru: 28 Largest Firms in Recent Depreciation

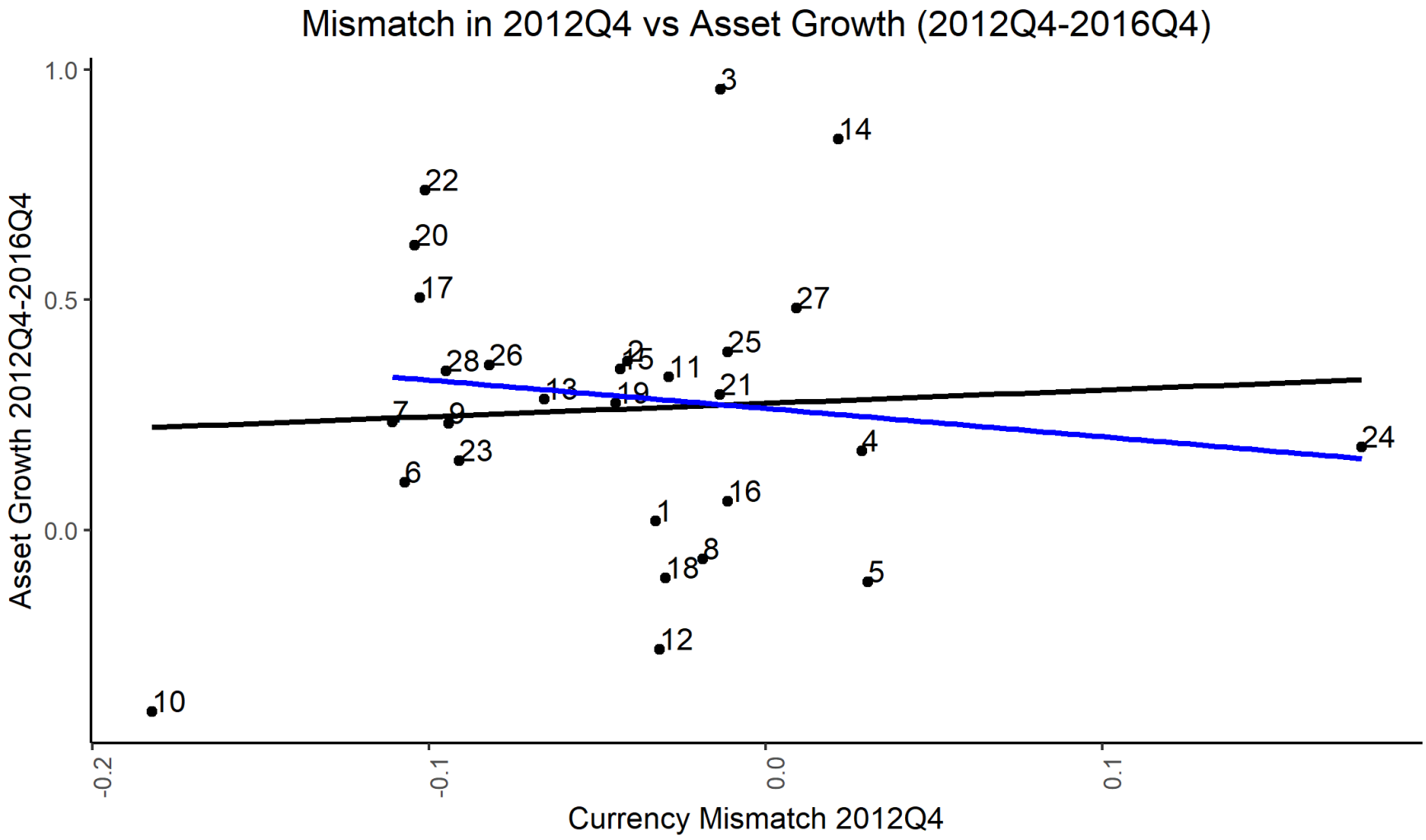


Figure: Investment, 2014Q2-2016Q4, vs Currency Mismatch in 2012Q4

Stress Testing

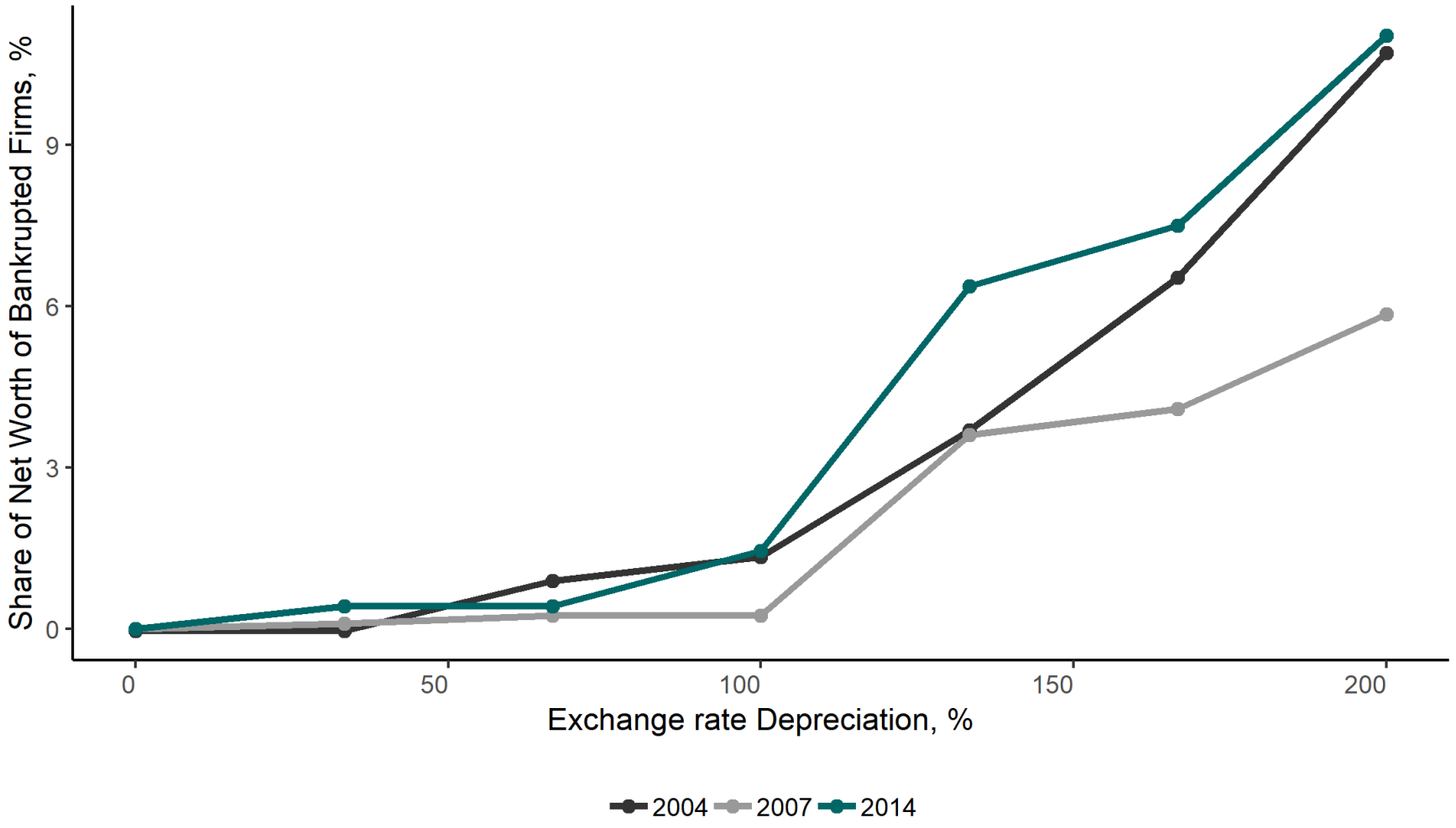
- What would be the effect of a 100% depreciation on firms?
- Data for unbalanced sample of Peruvianv 118 firms covering the years 1999-2014
  - N. R. Ramírez-Rondán (*Empirical Economics*, May 2018))
- Data on dollar denominated assets and liabilities
  - $A^{\$}, A^{S}$ $L^{\$}, L^{S}$
  - $E_{t,i}^{S'} = A^{S} + A^{\$}S' - L^{S} - L^{\$}S'$

$$I_{t,i}^{S'} = \begin{cases} 1 & \text{if } E_{t,i}^{S'} < 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\frac{\sum_i I_{t,i}^{S'} \times E_{t,i}}{\sum_i E_{t,i}}.$$

- 100 percent depreciation $\longrightarrow$ the net worth of the bankrupted firms is less than 1.5 percent of total net worth
- 200 percent depreciation $\longrightarrow$ less than 10 percent of total net worth.

Peru: Stress Test for Exchange Rate Depreciation



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