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

Lawrence Christiano, Husnu Dalgic and Armen Nurbekyan

Northwestern University, University of Mannheim and Central Bank of Armenia

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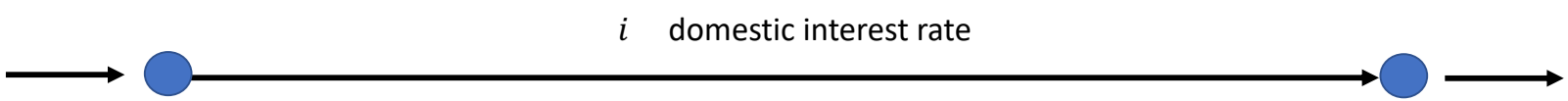
- Some policy implications.

Figure: Local Currency and Dollar Deposits



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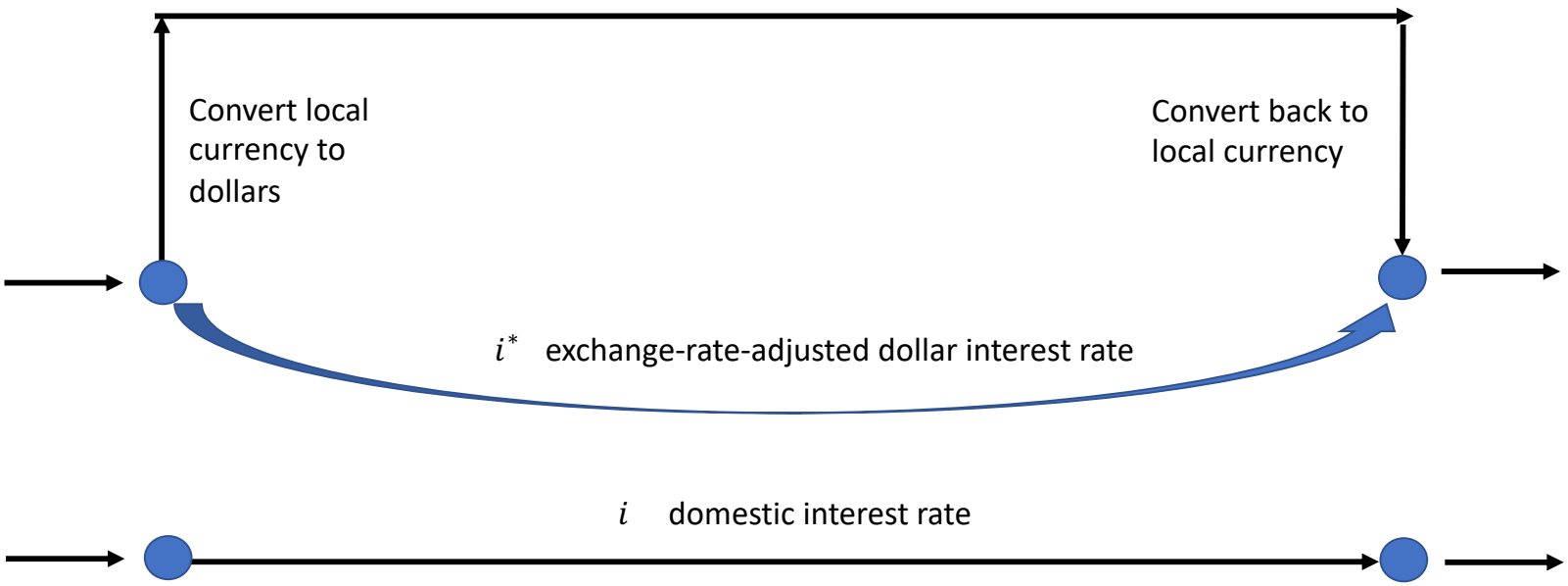

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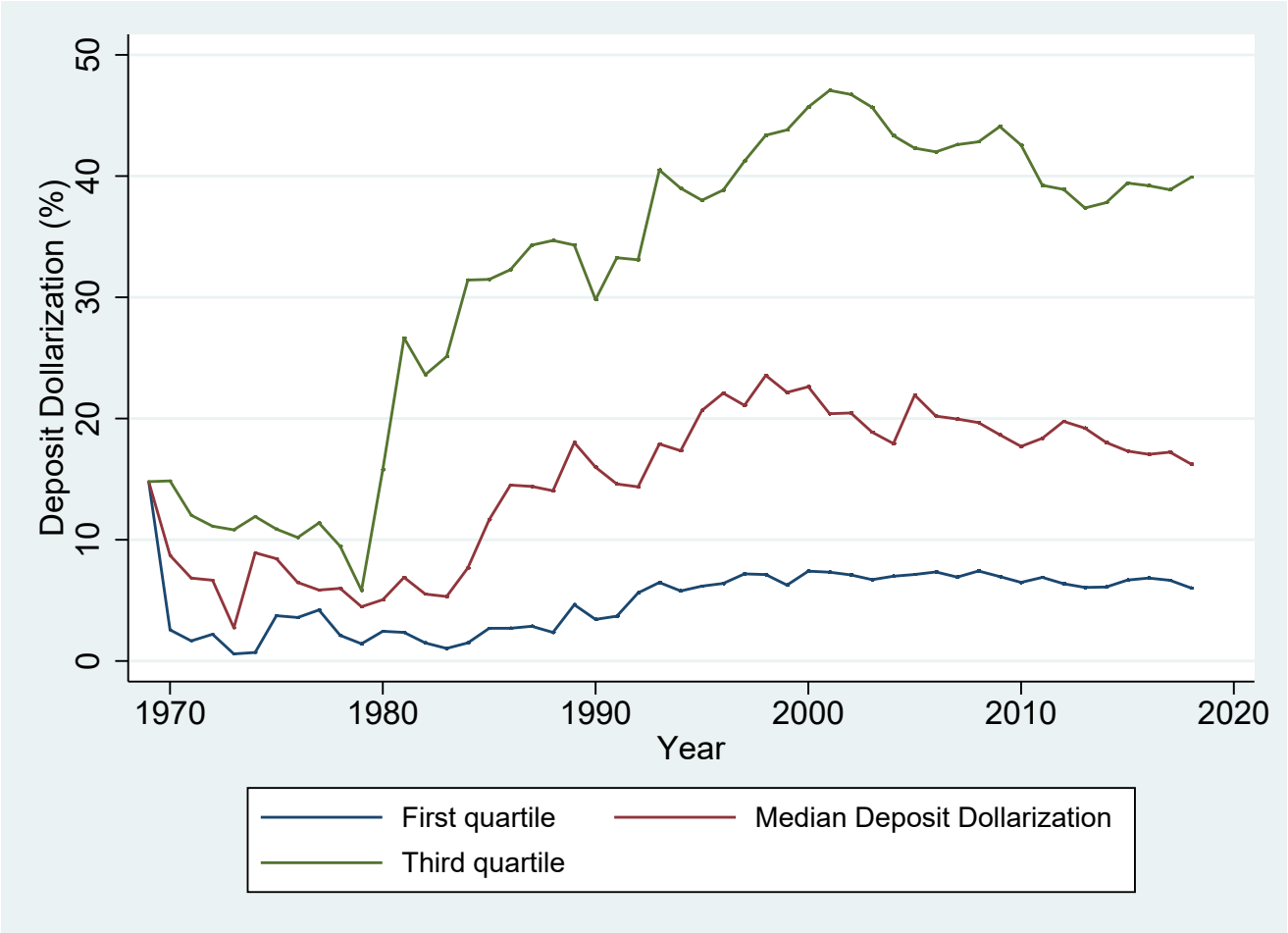
Deposit Dollarization Still Important



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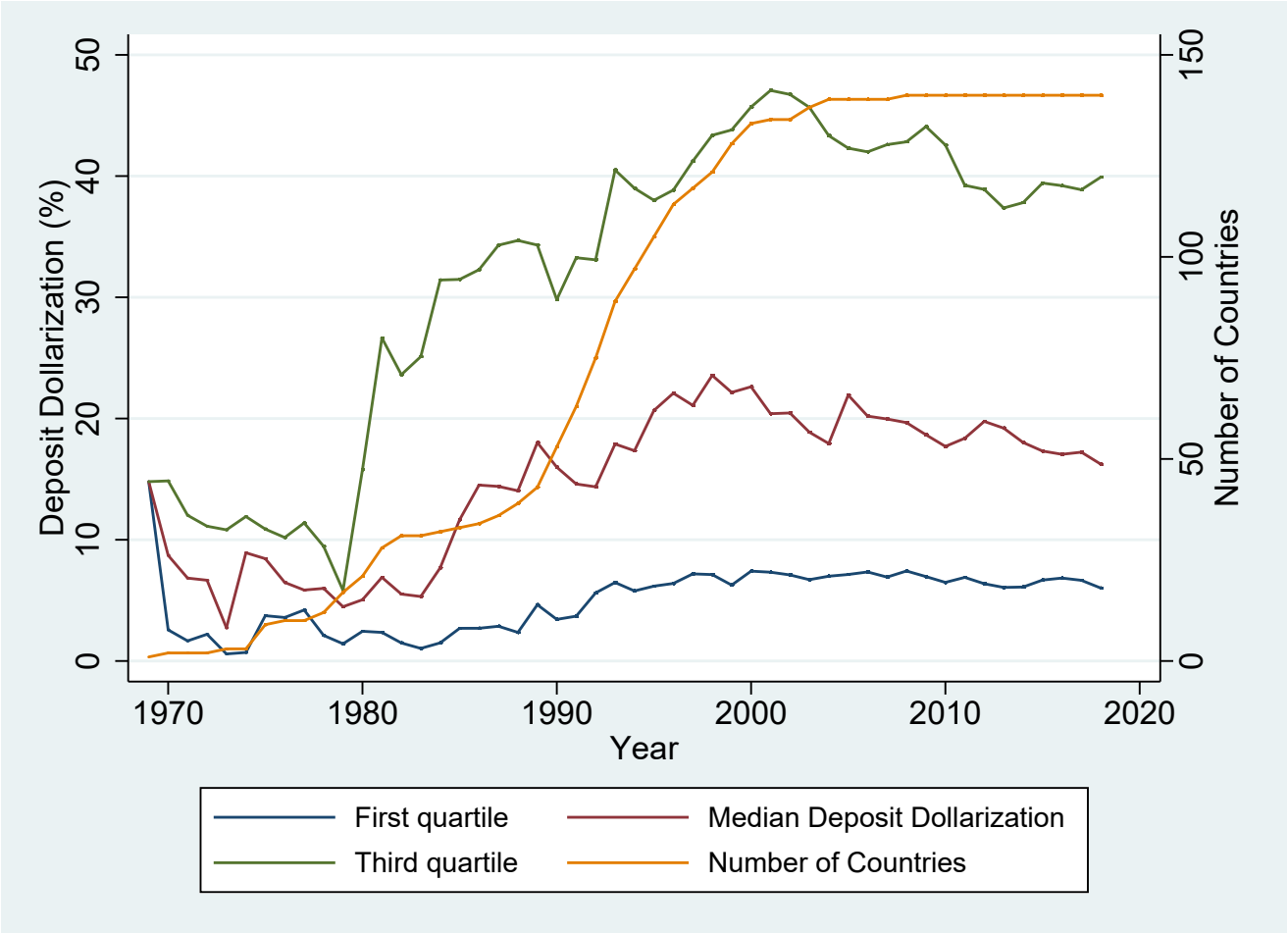

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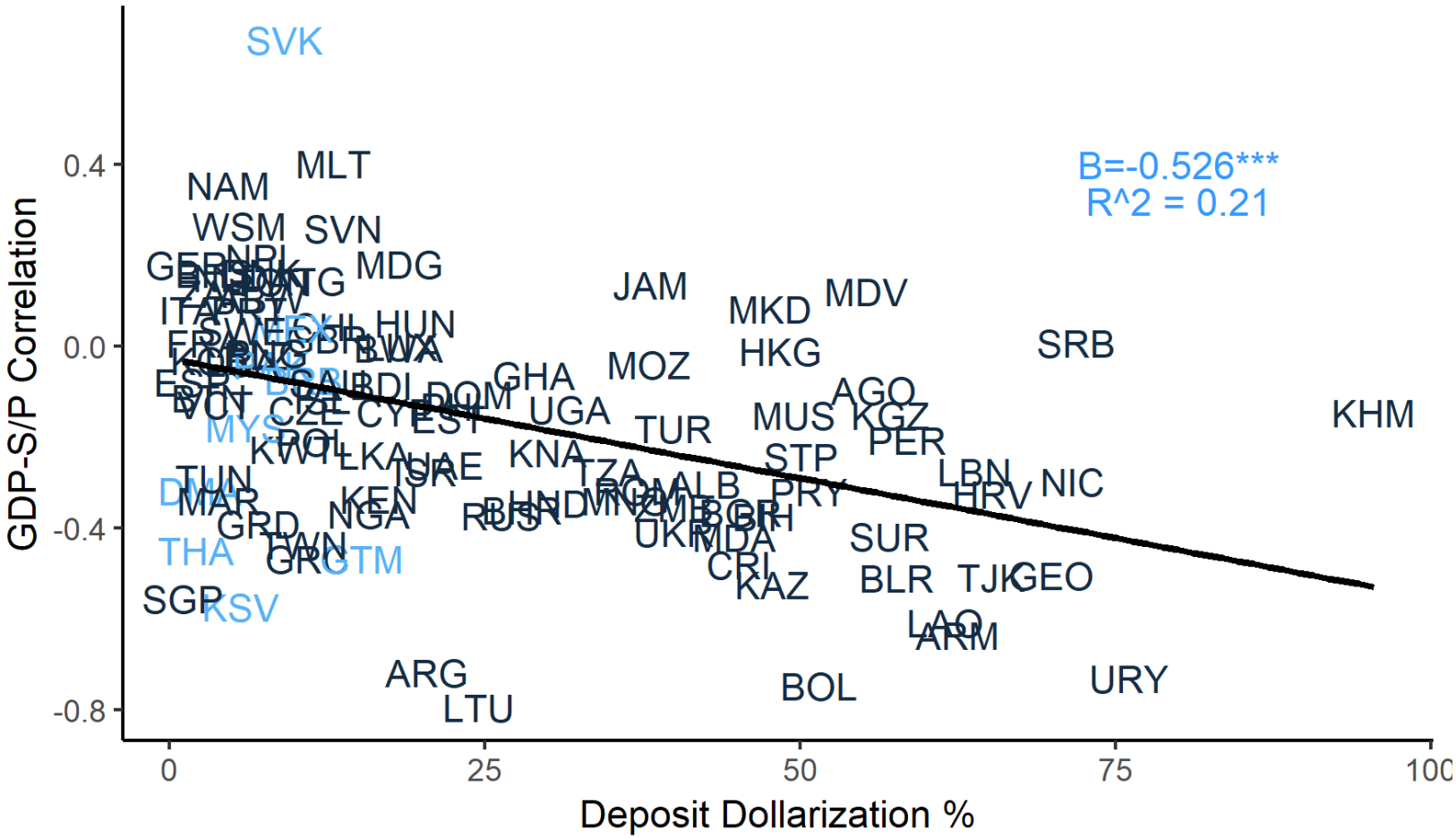

AsiaCrisis VAR

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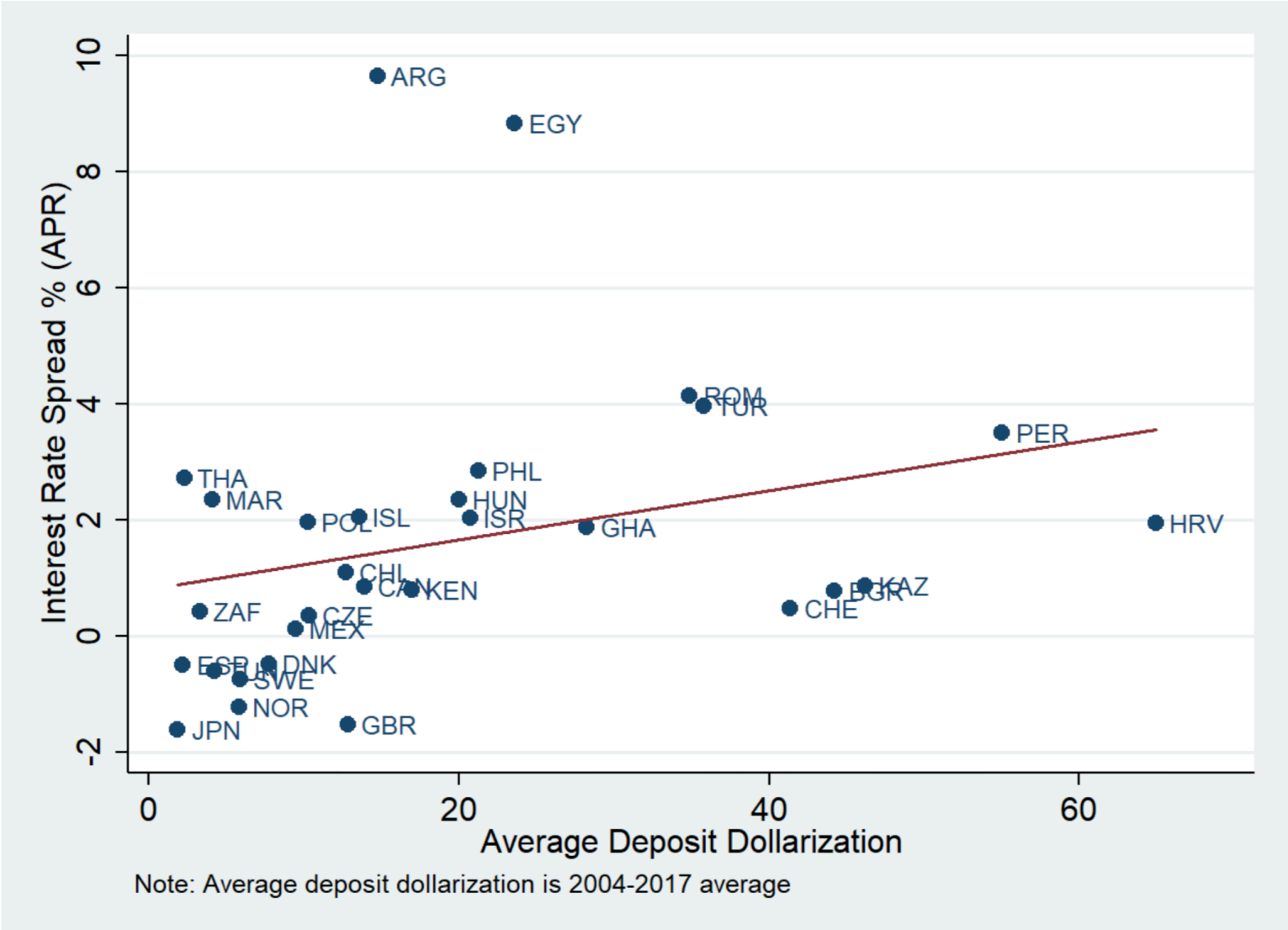
  - Interest rate spread, $i - i^*$, high.

Interest Rate Spread, $i - i^*$, Against Dollarized Deposits



compute

Implicit tax for Dollar Deposits

- Earnings on local deposits:

$$i^* \overbrace{d^*}^{\text{dollar deposits in local currency units}} + i \overbrace{d}^{\text{local deposits}}$$

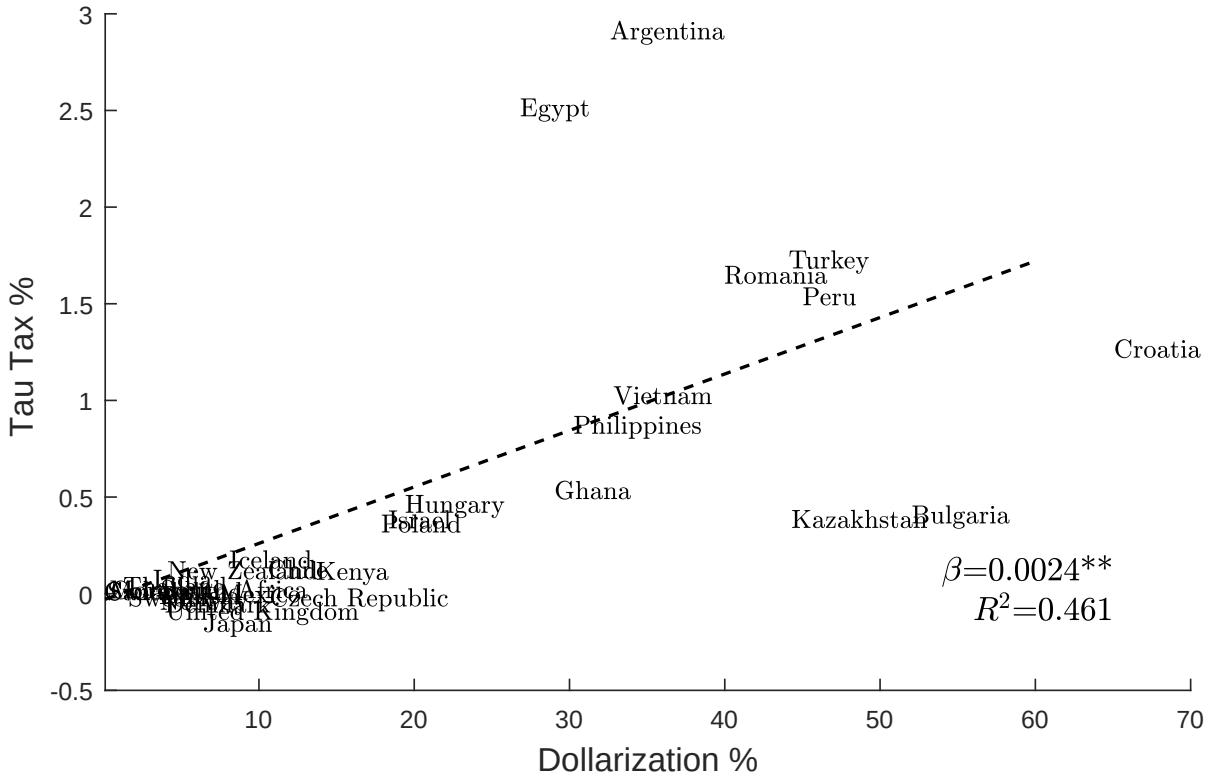
- Pay an implicit tax, τ, to obtain income insurance:

$$(d^* + d)\, i\, (1 - \tau) = d^* i^* + di,$$

solving:

$$\tau = \frac{(i - i^*)\, d^*}{i\, (d^* + d)}.$$

How Much is the Implicit Tax Paid by People that hold Dollar Deposits?



People in countries with high dollarization are paying 0.5 - 1.5 percent on their deposits for income insurance. That's close to what hedge funds make in management fees.

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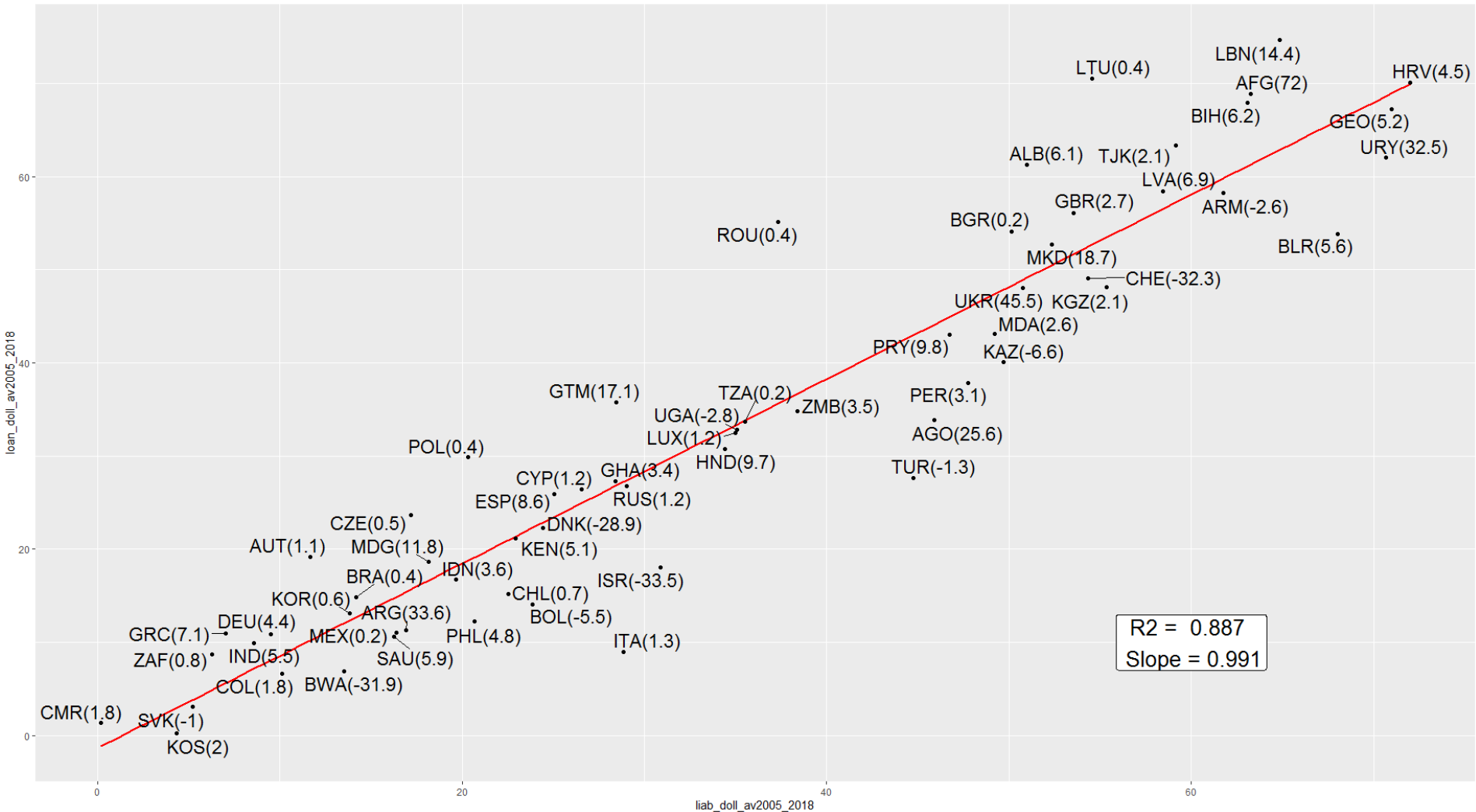
- Since crises of 1980s and 1990s regulators seem to have been averse to currency mismatch in banks.

Little Currency Mismatch in Banks, 2005-2018



Deposit Dollarization as Insurance Arrangement

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- Dollarization of financial markets looks like many other markets (e.g., commodity futures) in which risk is reallocated among people.

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- This could destabilize the financial system.
- Let's look at the facts....

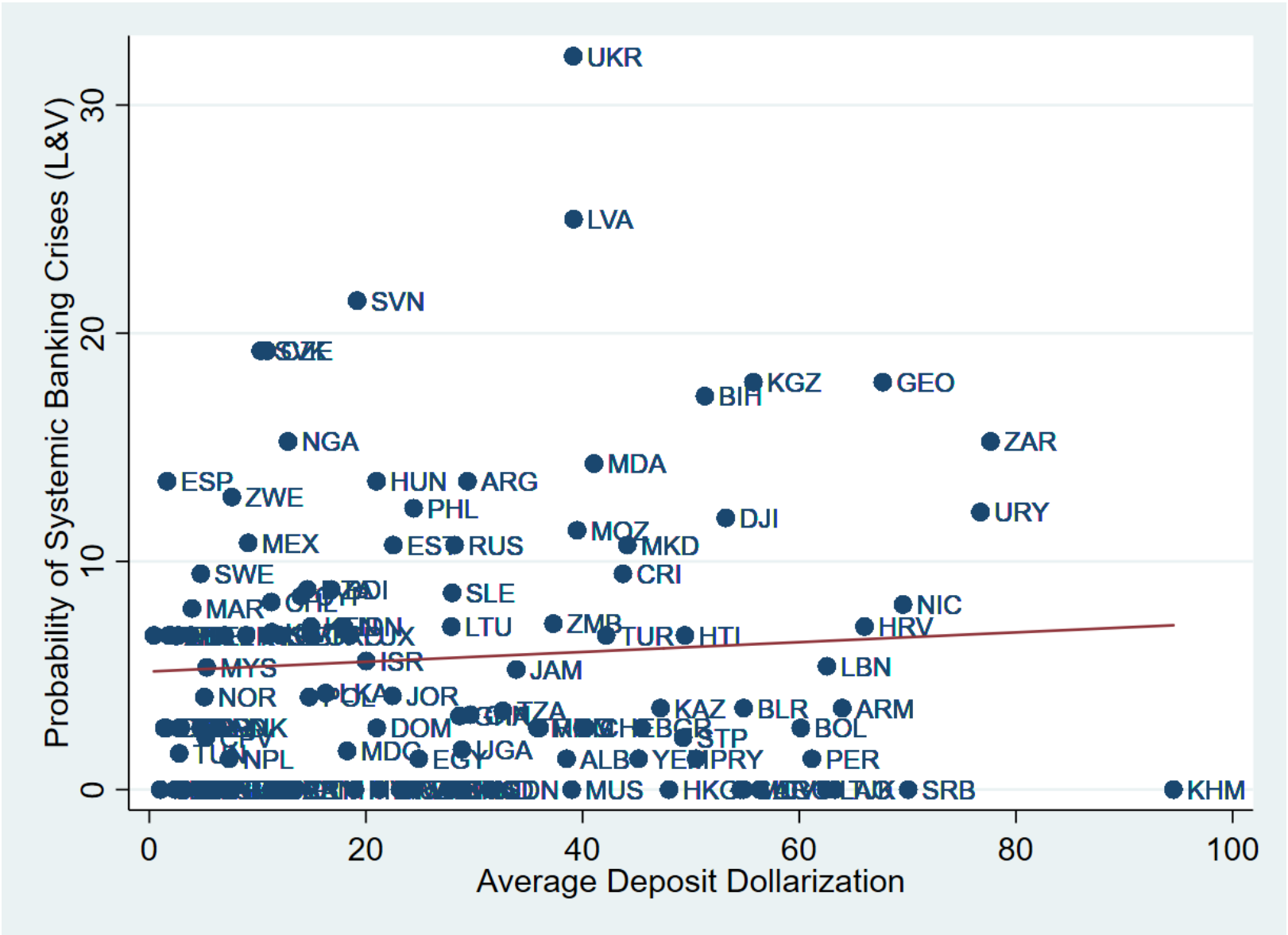
Data

- Data on systemic banking crises taken from Laeven & Valencia, 2018, 'Systemic Banking Crises Revisited'
  - '1' in crisis, '0', not in crisis.
  - 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 Reinhart and Rogoff (2009).
- Data on cost of crisis: GDP growth from IMF.

Two Questions

- What is relation between deposit dollarization and *frequency* of crisis?
- What is relation between deposit dollarization and *intensity* of crisis when it happens?

Probability of a Banking Crisis versus Deposit Dollarization



Note: 1994-2018

Probability of a Sudden Stop versus Deposit Dollarization

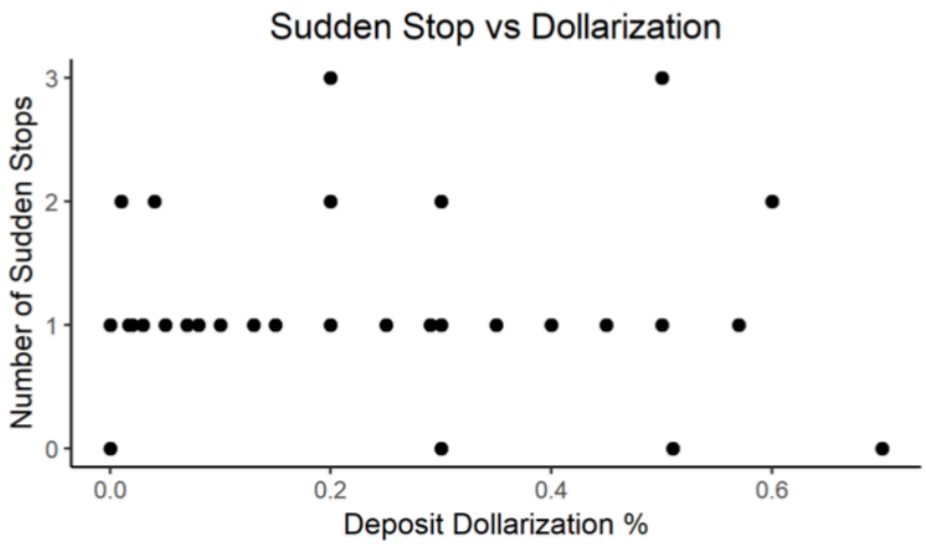


Figure 1: Frequency of Sudden Stops and Dollarization

Note: Each point corresponds to a country. There are 34 countries in the data and 43 observed sudden stops between 1990-2014. In case of more than one sudden stop, I took the average deposit dollarization. I did not observe any country where deposit dollarization changed significantly over the years.

Intersection of 66 Reinhart and Rogoff (2009) countries for Sudden Stops and the countries for which we have dollar deposit data.

Loss of Output In a Banking Crisis versus Deposit Dollarization

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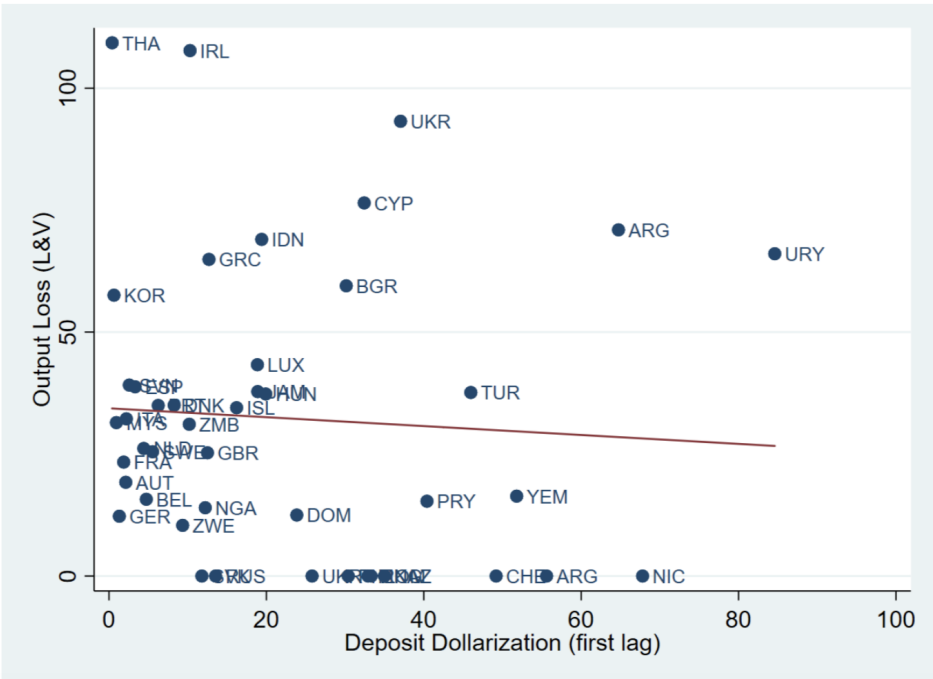

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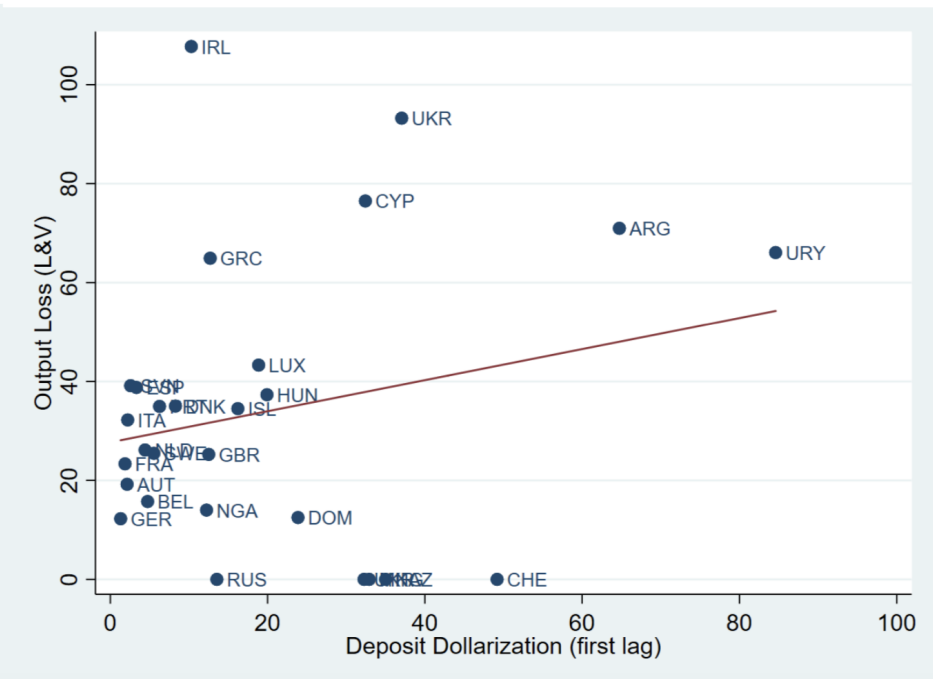

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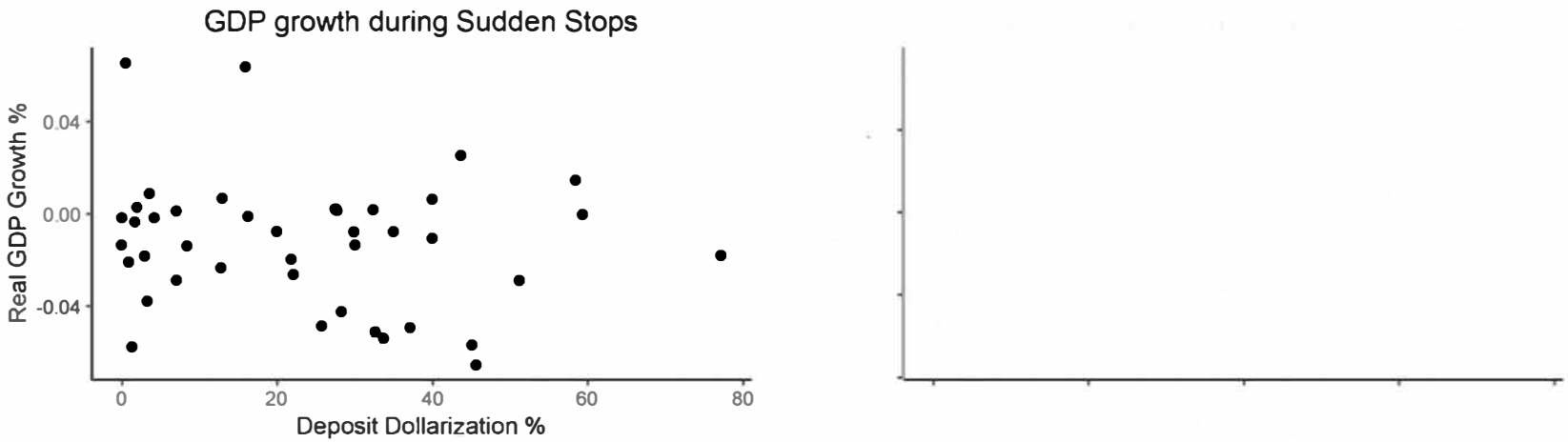

Figure 3: Severity of Sudden Stops and Dollarization

Note: Each point corresponds to an individual sudden stop. There are 34 countries in the data and 43 observed sudden stops between 1990-2014. I took log difference between average annual GDP (Consumption) one year before and after the observed sudden stop. From that number, I subtracted decade average growth to remove trend.

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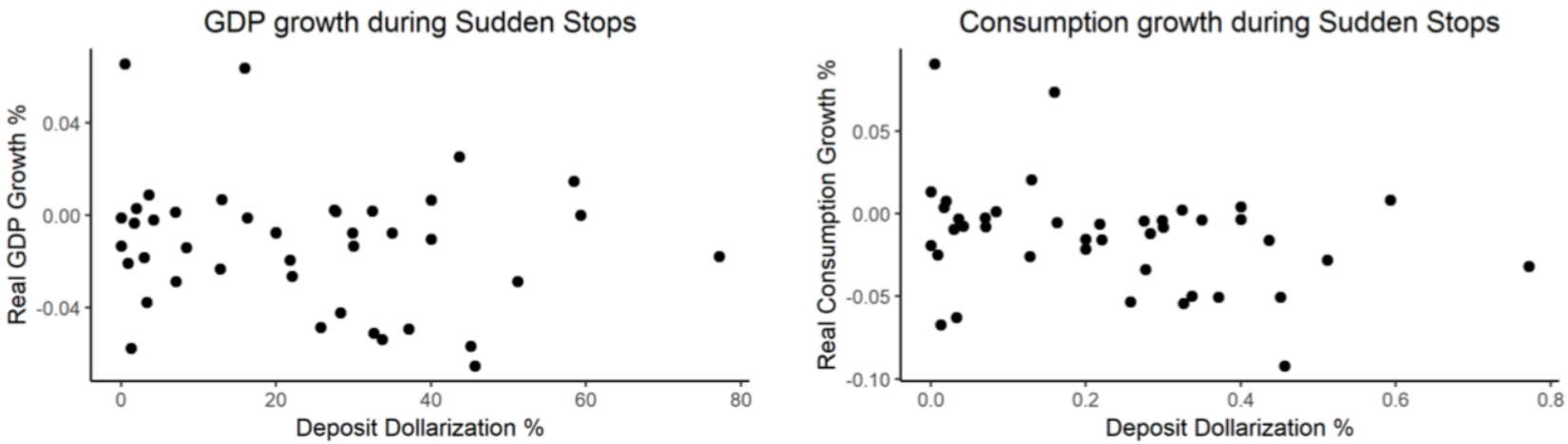

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- Using our data, we do not find that an exchange rate depreciation is significantly more likely to lead to crisis if he economy has dollarized deposits. ▸ finding

Dollarization: Another Possible Pitfall

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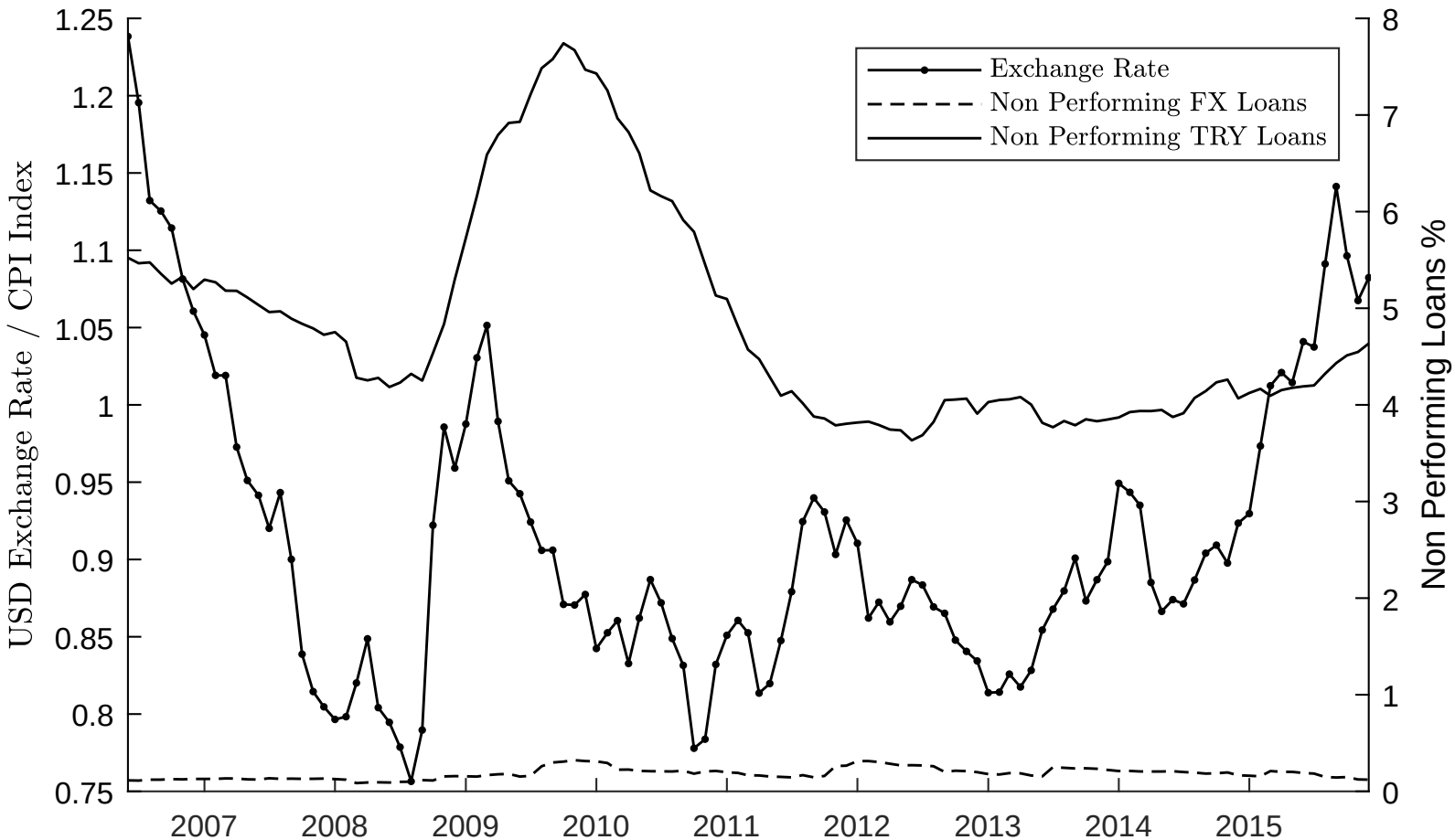
  - We are looking more closely at non-financial firms in individual countries, such as Turkey, Peru and others.

Turkey: Foreign Currency Loans to Firms Apparently Not a Source of Instability



Note: Share of non-performing loans over total loans. FX loans represents loans in foreign currency; TRY loans represents loans in Turkish Lira. Data source: Central Bank of Turkey.

Peru: Fairly Big Depreciation Recently

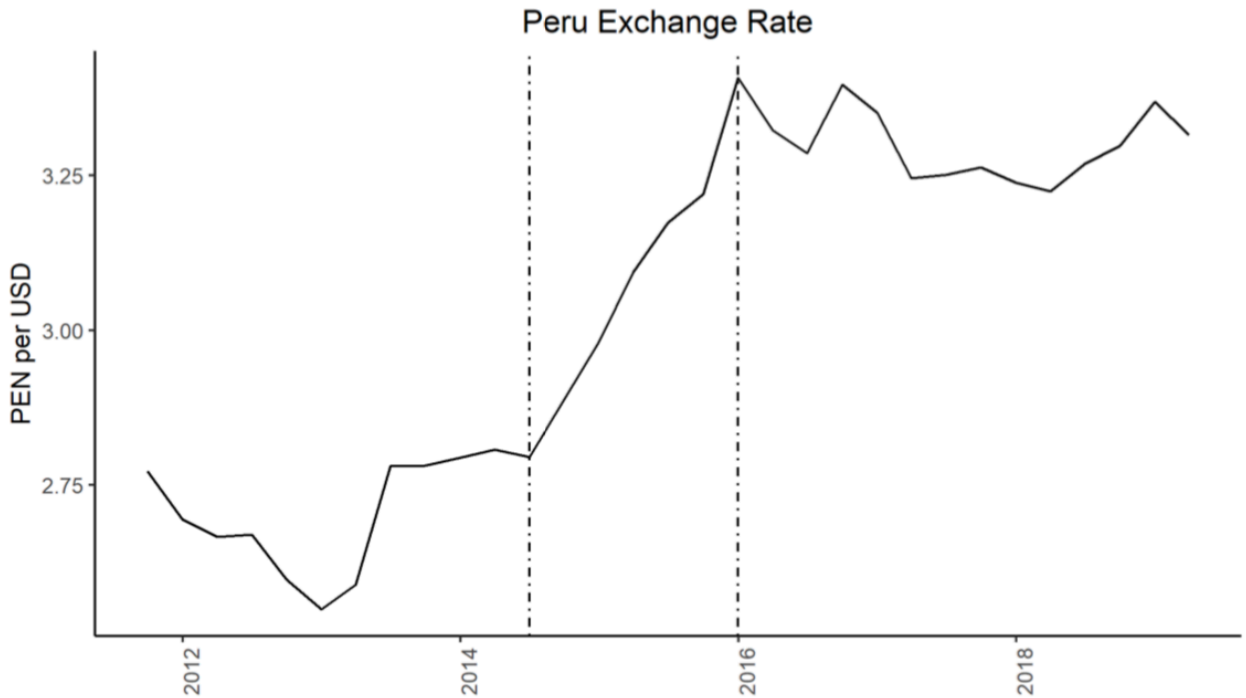
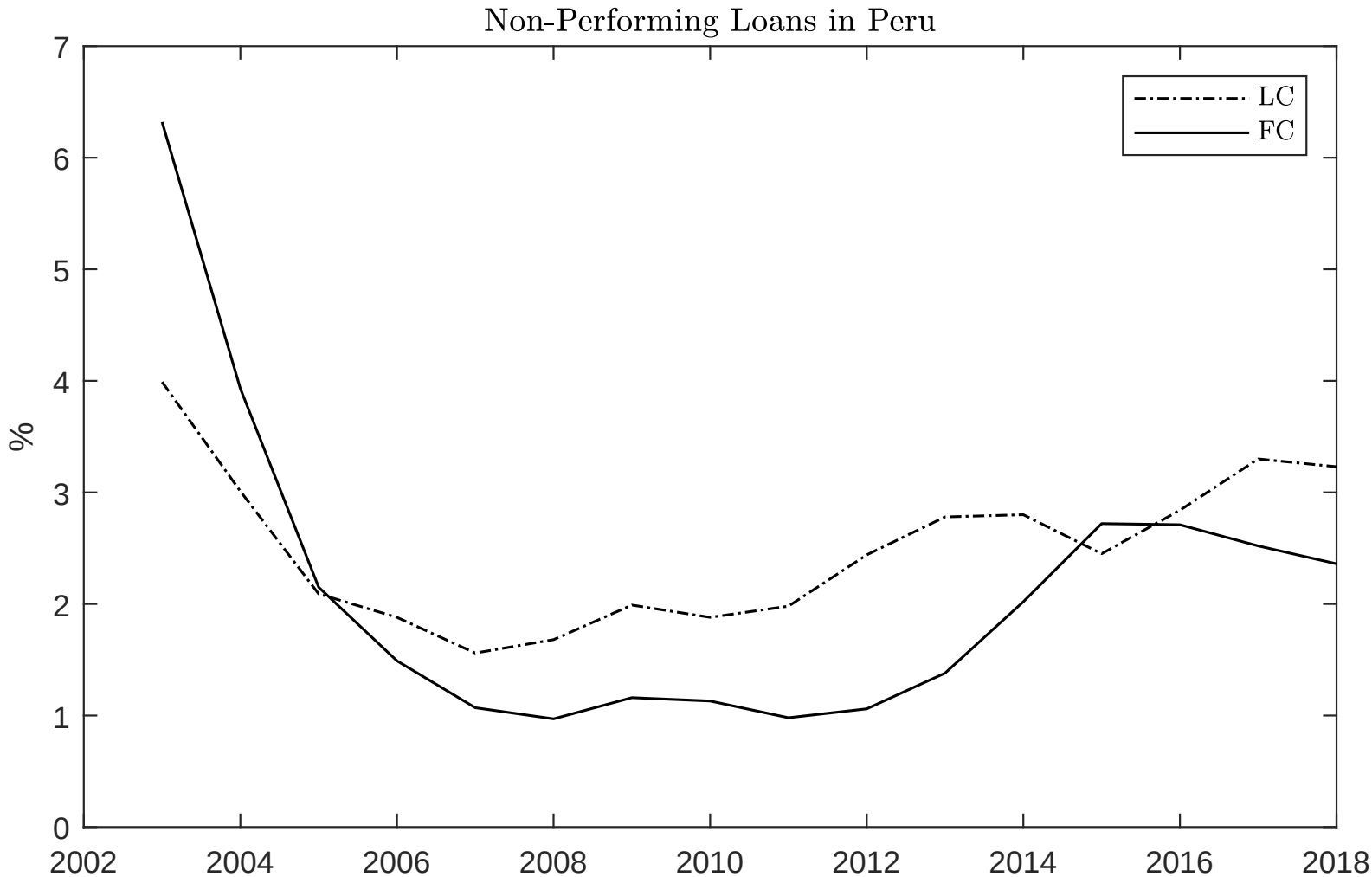


Figure 1: Nominal Exchange Rate in Peru

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



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- Compute, for 2014Q2-2017Q4 and as percent of firm equity
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GoPeru

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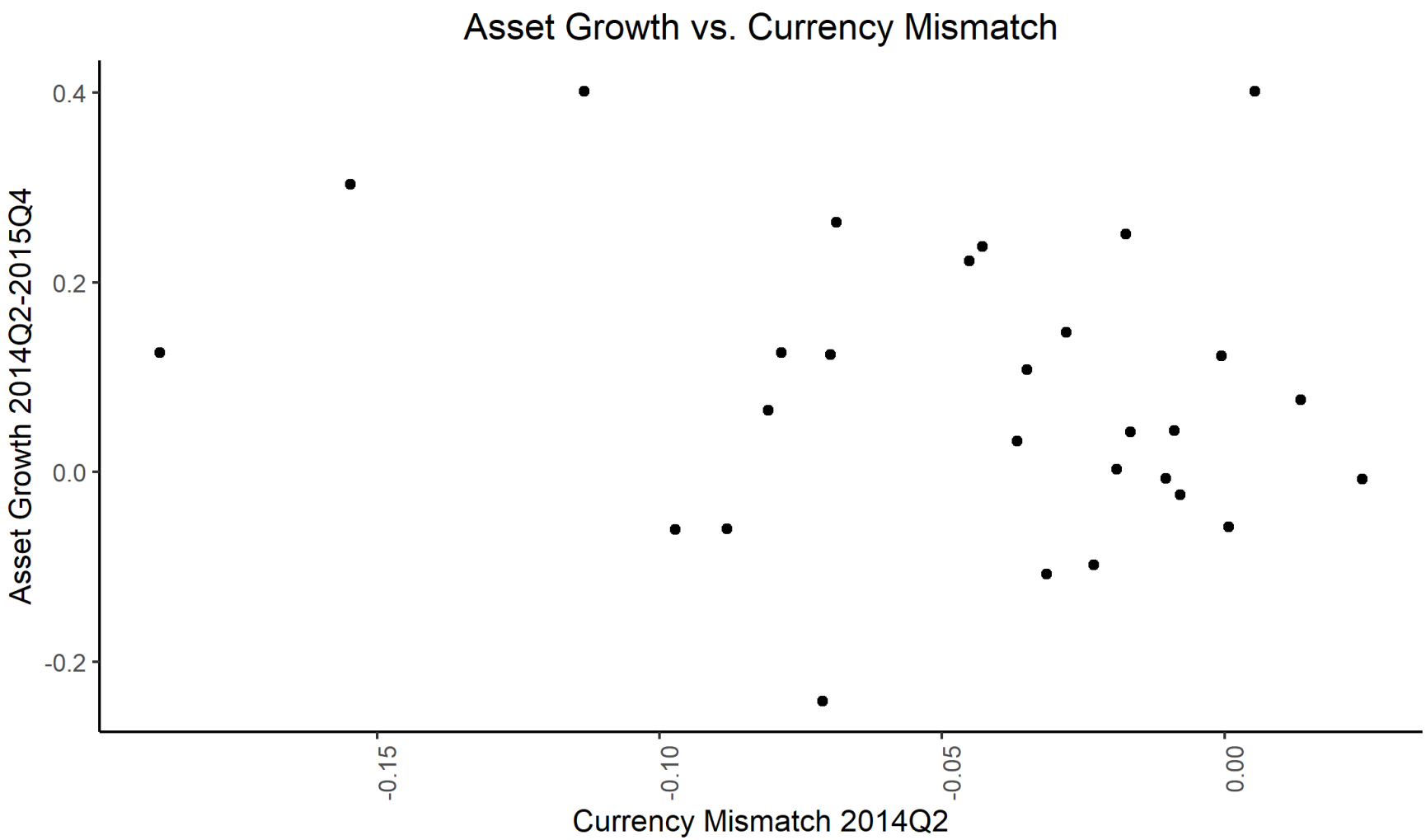

Figure: Credit Dollarization vs Asset Growth 2014Q2-2015Q4

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- Local insurance story: losses for 28 biggest firms + losses of other firms + losses paid by government, 'paid' for the capital gains experienced by households.

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  - In this case, dollarization may not be so dangerous.

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

Levy-Yeyati Evidence

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- We find: Levy-Yeyati's results fragile.
  - not statistically significant using improved new econometric methods Mitchell (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 ▸ 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)
$dollar \times \Delta er\_1$	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

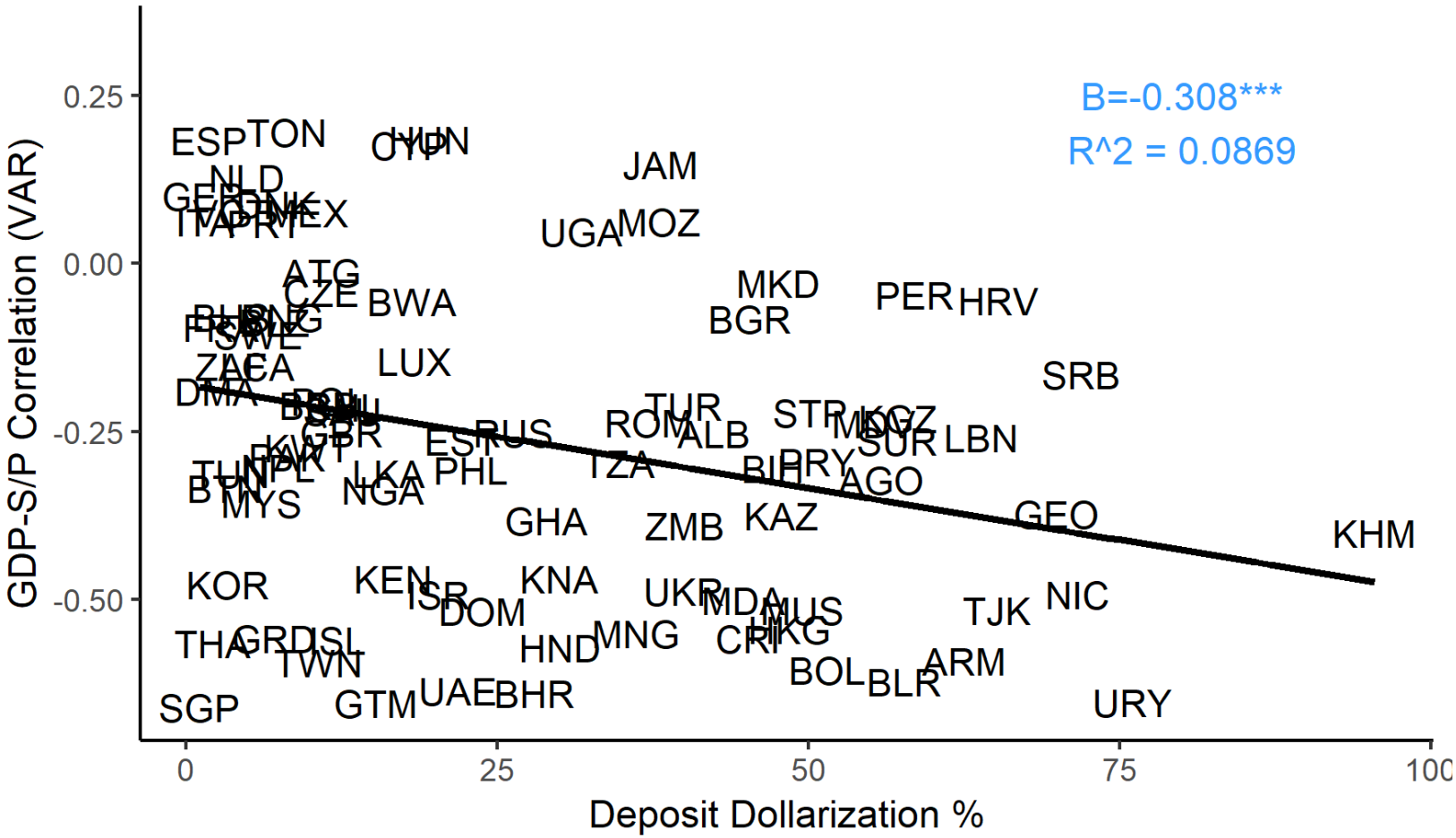
	(1)	(2)	(3)
	Whole Sample	External Debt Available	External Debt Available
LV Crisis Dummy			
dollar	0.0954	0.694	0.675
	(0.334)	(0.429)	(0.439)
Δer_1	-0.795**	-0.0958	0.524
	(0.366)	(1.139)	(0.773)
$dollar \times \Delta er\_1$	1.436***	0.851	0.758
	(0.420)	(1.268)	(0.896)
Interest Paid on External Debt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

Go Back

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



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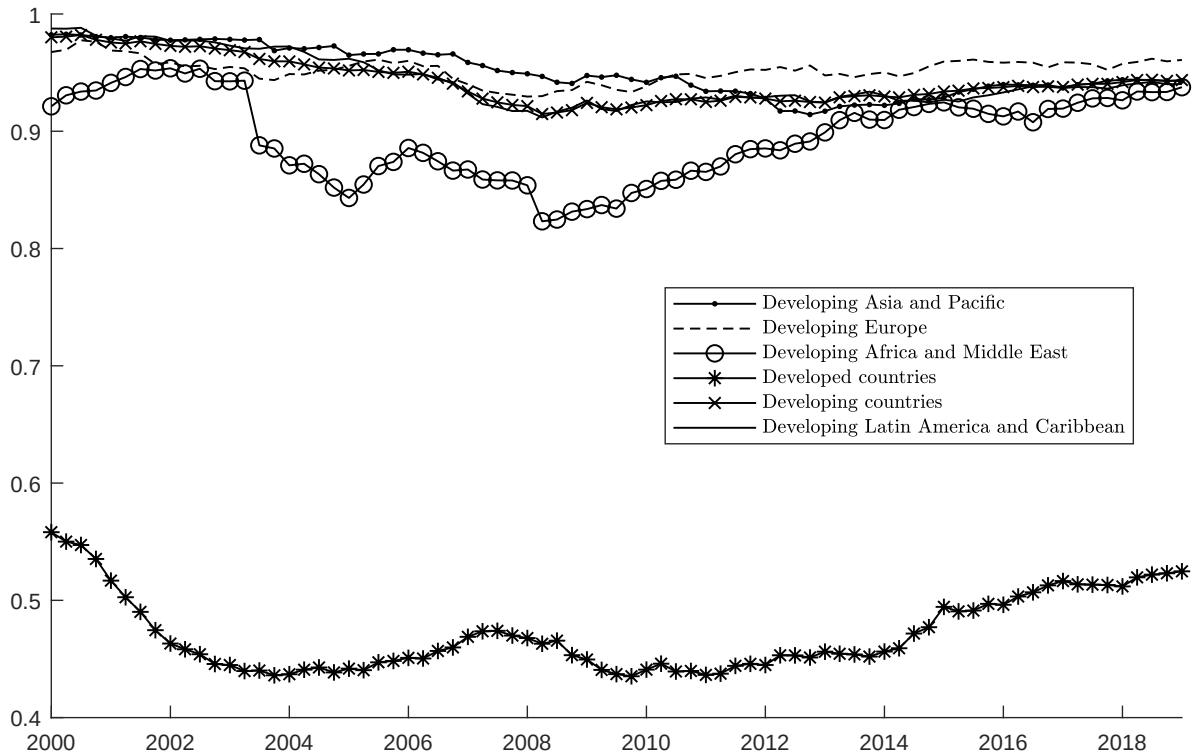
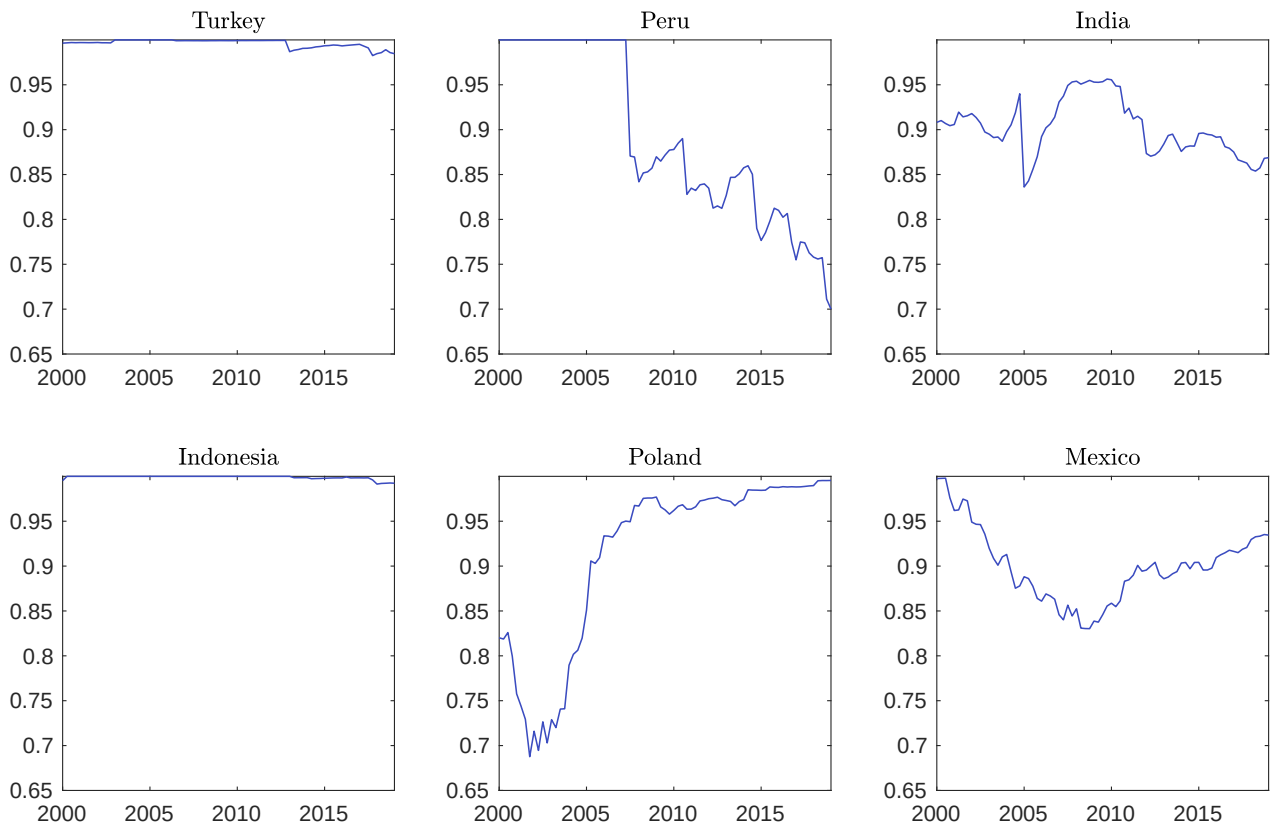
Foreigners Lend Little Domestic Currency into EME's



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.

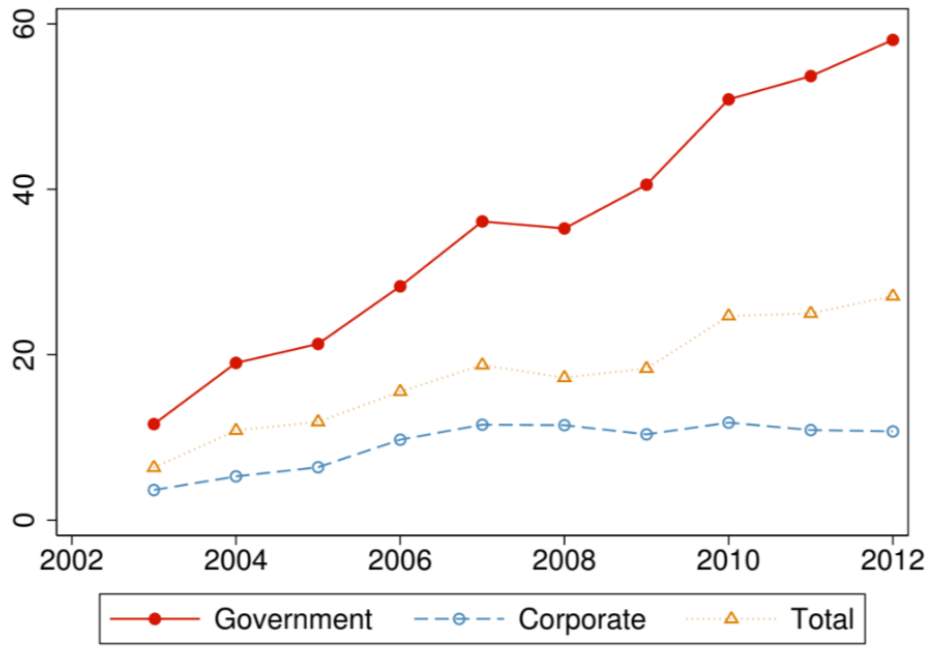
Share of Foreign Currency Borrowing By Selected Countries



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%.

Go Back

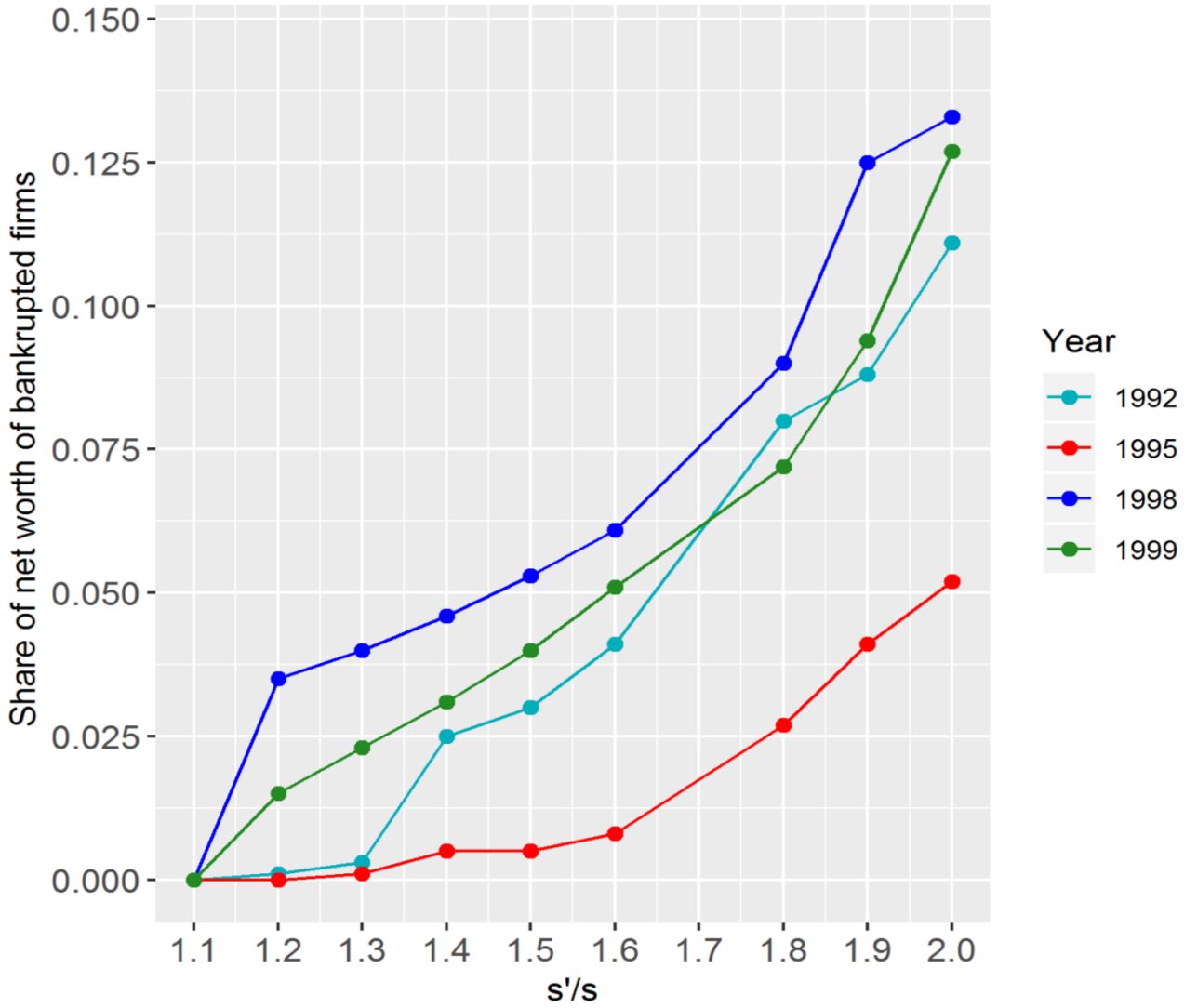
Computing $i - i^*$

- 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. Go Back

Peru: Stress Test for Exchange Rate Depreciation

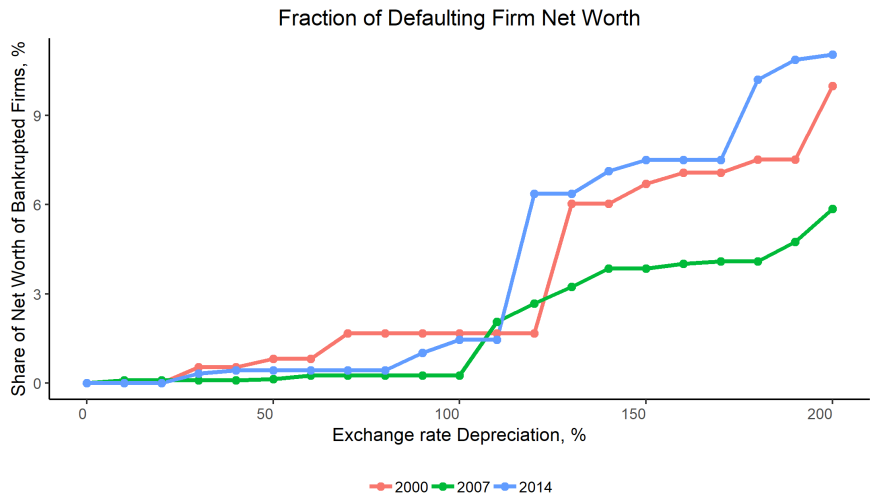
Figure 3. Share of net worth of bankrupted firms

Años: 1992, 1995, 1998 y 1999



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

Peru: Firms in 2000s Much More Robust to Stress



Note: Data for unbalanced sample of Peruvian 80-100 firms covering the years 1999-2014 (the data were kindly passed on to us by Paul Castillo; they were constructed for the work in N. R. Ramírez-Rondán (*Empirical Economics*, May 2018)). Results are reported for the three indicated years. Vertical axis: net worth of all firms in the sample that are bankrupted by the (counterfactual) exchange rate depreciation on horizontal axis (50 means a 50 percent depreciation). Analysis uses data on local and foreign denominated assets and liabilities. According to the results, with a 100 percent depreciation the net worth of the bankrupted firms is less than 1.5 percent of total net worth. With a 200 percent depreciation, the net worth of bankrupted firms is less than 10 percent of total net worth.

Peru: 28 Largest Firms in Recent Depreciation

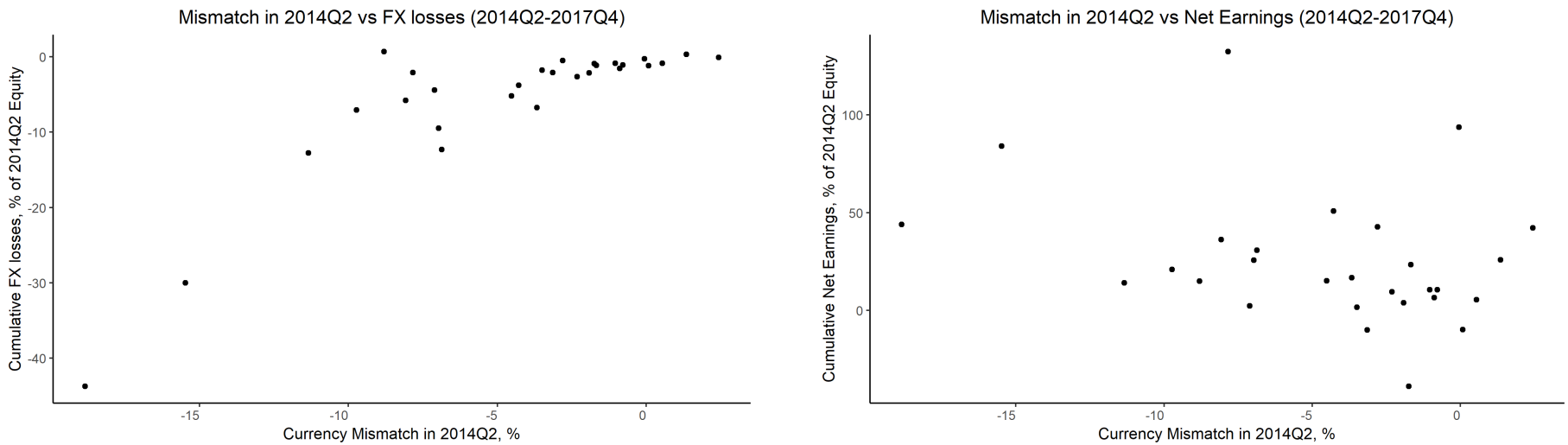


Figure: Cumulative FX losses and Net Earnings between 2014Q2 and 2017Q4

▸ Go Back

Is Likelihood of Crisis Higher if Currency Depreciates in an Economy with Dollarized Deposits? Seemingly, not.

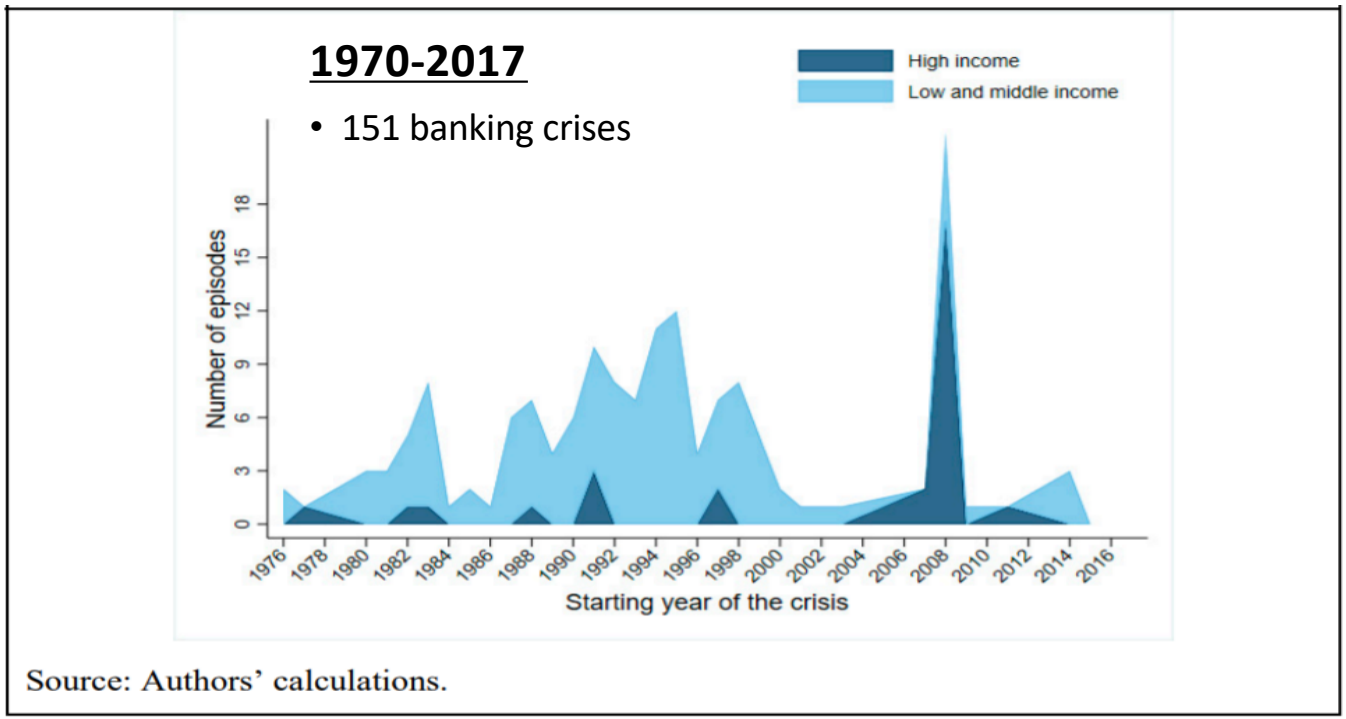
Table: Expenditure Switching versus Balance Sheet Effects: OLS

	Left Hand Variable, Probit regression: LV crisis dummy		
	Whole Data Set	2003 and Before	After 2003
$dollar_{-1}$	0.141	0.547*	-0.408
	(0.332)	(0.314)	(0.530)
Δer_{t-1}	-0.795**	-1.075	-0.777***
	(0.366)	(1.920)	(0.293)
$dollar_{t-1} * \Delta er_{t-1}$	0.923	1.632	-6.659**
	(0.660)	(2.046)	(2.659)
Observations	2860	1161	1700

Note: Annual data; standard errors in parentheses (robust to error correlation across years and across countries);

Δer_{t-1} is the lagged exchange rare change; 'dollar' $= 1 >$ 10%; constant term not displayed; * p$<$0.1, ** p$<$0.05, *** p$<$0.01

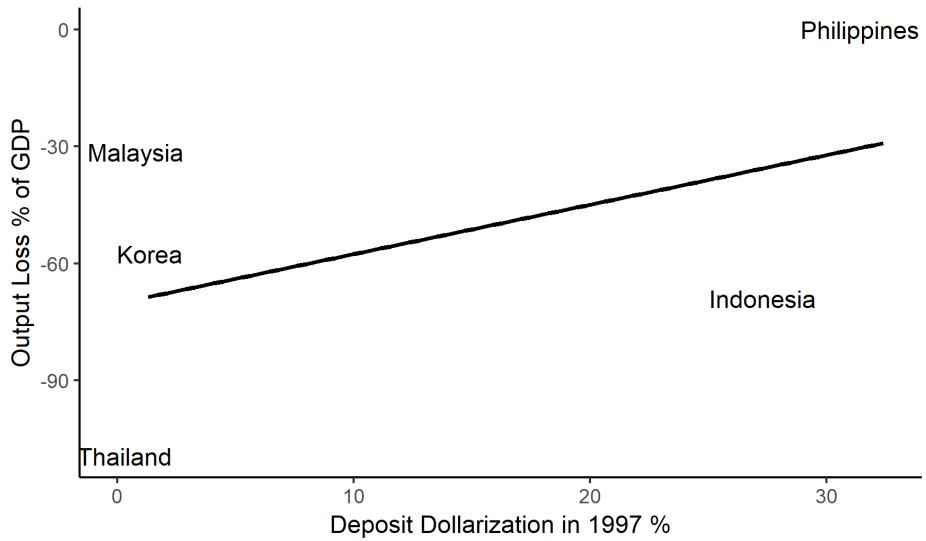
Systemic Banking Crises by Laeven & Valencia 2018



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

Go Back

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



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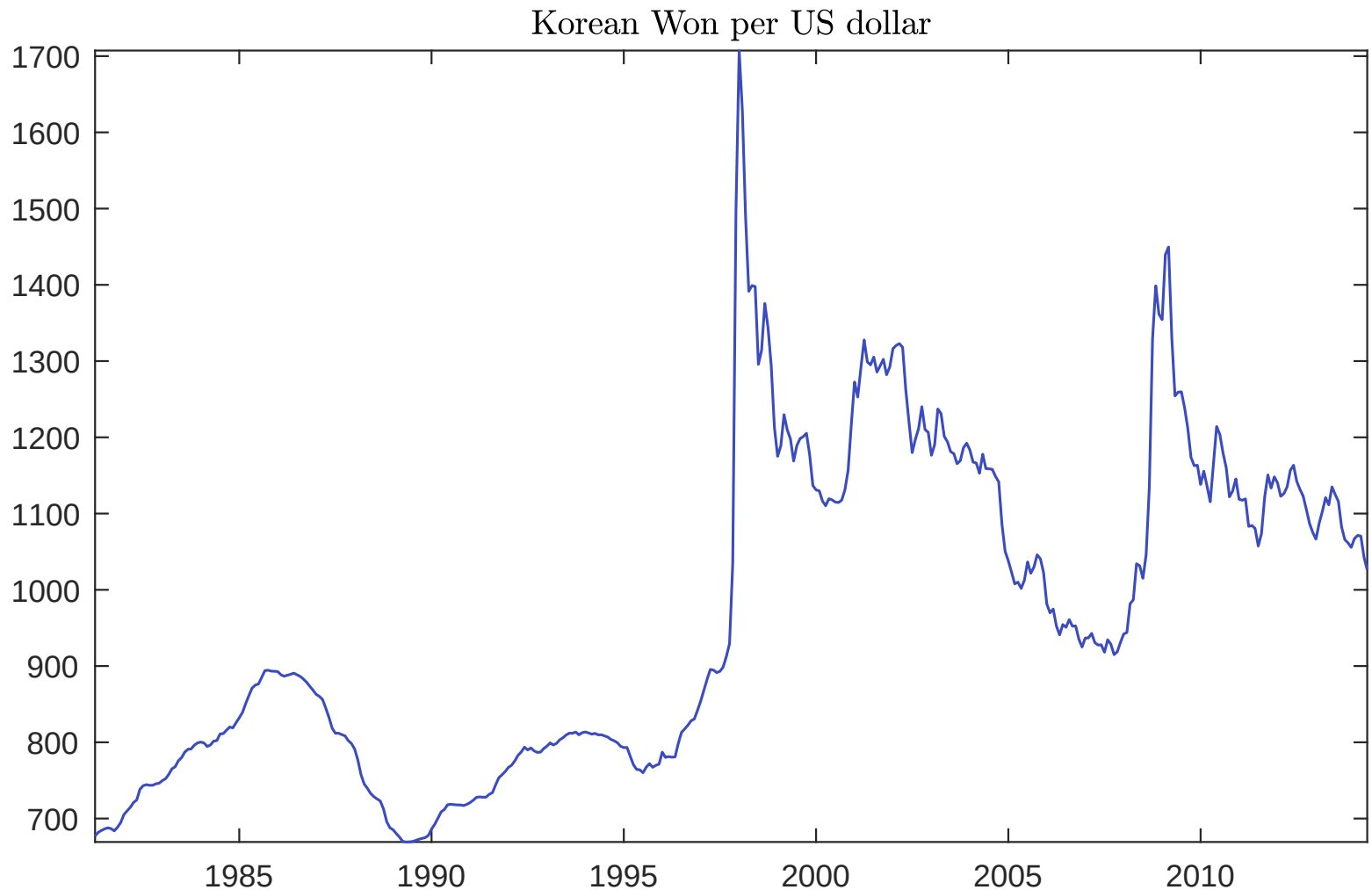

Note: in 1998 crisis, Won depreciated by a factor of 2. Later, depreciation partially offset.

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.

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  - 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

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.

Crisis When Currency Mismatch is Held by Banks

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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

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)

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- This bank is now insolvent!