Macroprudential FX Regulations: Shifting the Snowbanks of FX Vulnerability?

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NBER Conference, Capital Flows, Currency Wars & Monetary Policy
April 5-6, 2018

Definitions

Macroprudential FX Regulations

- Regulations that discriminate based on the currency denomination of a capital transaction
- Directed at broader financial system, usually banks
- Can include some microprudential regulations
- Not capital controls

Snowbank

Motivation

- **GFC prompted interest in strengthening financial systems & country resilience**
  - Key: macroprudential policy
- **Rapidly growing body of research & evidence**
  - On direct effects and leakages/spillovers
  - Less attention: macroprudential regulations on foreign currency exposure (FX)
- **Despite long-standing research on risks related to foreign currency borrowing & mismatch**
  - "Original sin"
  - Increases vulnerability to sudden stops & currency movements
  - Limits ability to use monetary policy

This Paper (and today)

- **Assess direct and indirect effects of macroprudential FX regulations**
  - Theoretical framework: 4 testable hypotheses
  - Build rich dataset on FX regulations
  - Direct effects on banks
  - Indirect effects on other sectors
  - Ability to reduce sensitivity to currency movements

Key Results

- **Macropru FX regulations accomplish direct goal of reducing FX exposure of banks**
  - Effect is significant and large
- **A portion of this risk shifts to other sectors of the economy**
  - Effect is significant and meaningful
  - But smaller than reduction in bank FX borrowing
- **Broader effects on currency sensitivity**
  - Banks: significantly less sensitive to currency movements
  - Corporates & broader economy: smaller impact
- **"Shifting snowbanks" of vulnerability**
  - Aggregate reduction in FX borrowing
  - Risk shifts outside regulatory perimeter
  - Costs and benefits of shifting risks to other sectors?

Shifting Snowbanks….

The Best Way to Clear the Snow Pile at the End of Your Driveway

Here's how to attack what the municipal snow plow leaves behind

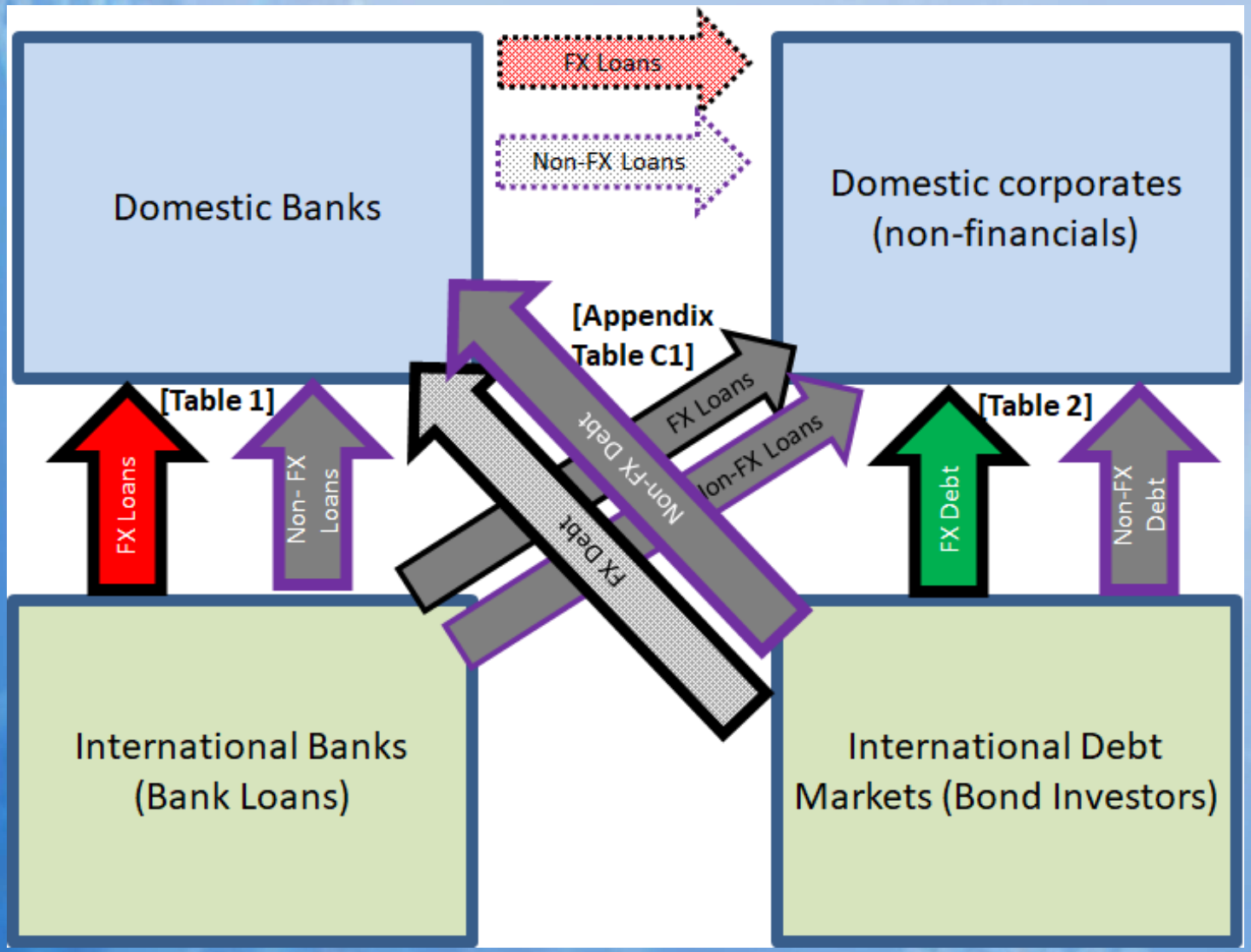
By Mary H.J. Farrell

Consumer Reports, December 08, 2017

Sketch of Model

- **Framework:** builds on Holmstrom and Tirole (1997)
  - Banks use screening technology to reduce negative impact of asymmetric information
- **Domestic firms** have private information on their productivity (high, low or 0)
  - Borrow in domestic (*D*) or foreign (*F*) currency
  - Seek funding from lenders: banks (loans) or investors (debt issuance)
- **Banks** can screen (at a cost) to identify firm's productivity
  - Investors can not screen
- **Currency risk**
  - Funding in *F* is cheaper but subject to FX risk
  - After depreciations, low productivity firms & associated banks default
- **Macroprudential regulations**
  - Increase cost of funding in FX and lending rate
    - Banks reduce FX lending
    - Low quality firms shift borrowing in FX from banks to investors (FX debt issuance)
  - Benefit: reduces bank failures after depreciations
  - Cost: less efficient allocation of FX lending causes TFP↓

Model & Empirics Overview



Key Hypotheses

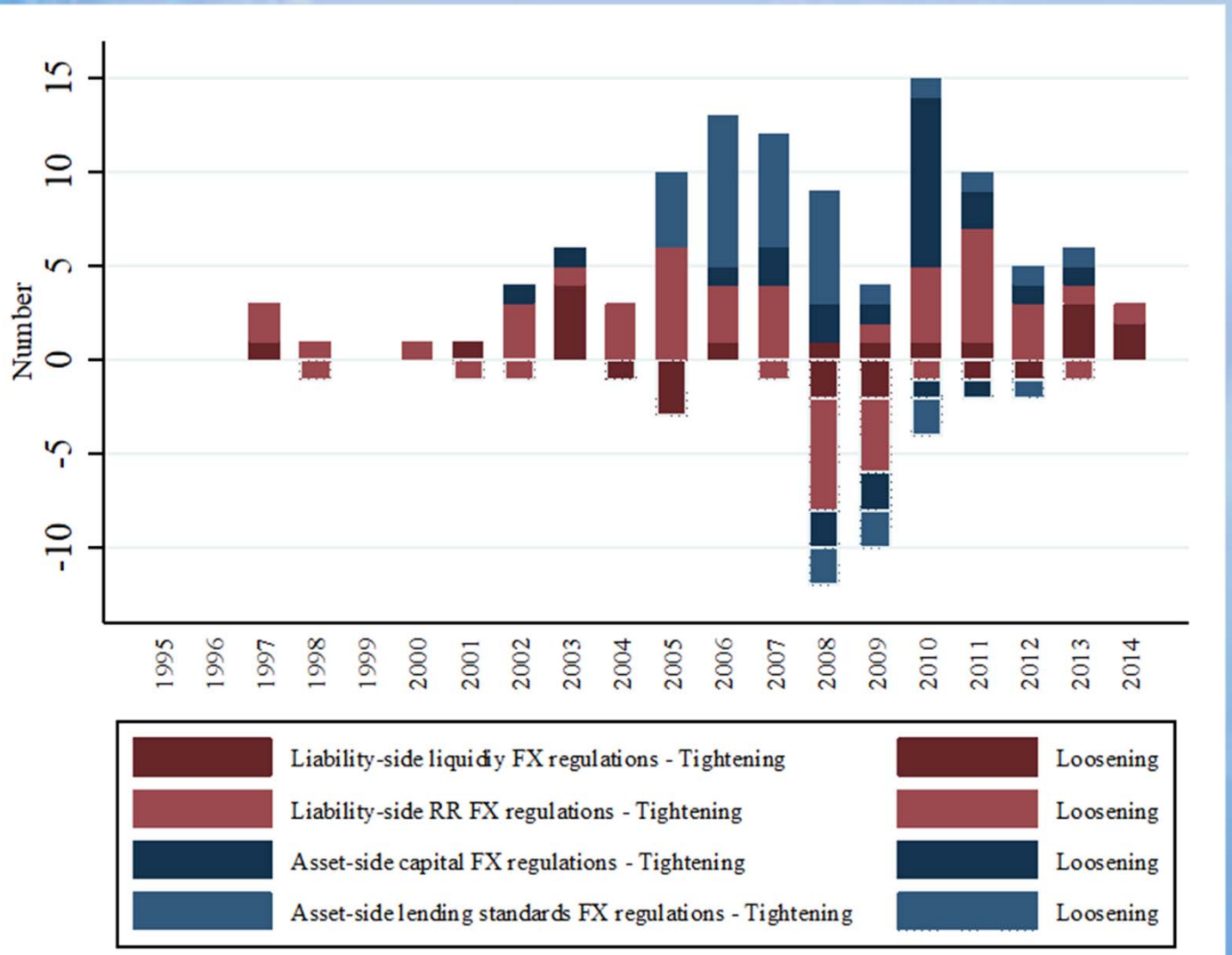
- **After an increase in FX regulations:**

1) banks borrow and lend less in foreign currency (no change in their borrowing in local currency);
2) firms shift away from bank borrowing and increase their FX debt issuance (with no increase in firm and bank non-FX debt issuance);
3) banks are less exposed to exchange rate movements (so that their stock returns are less sensitive to exchange rate movements); and
4) firm exposure to exchange rate movements (and their sensitivity to the exchange rate) is less affected.

Data

- **Rich dataset on broad range of macroprudential FX regulations**
  - 48 countries, 1995-2014
  - Excludes reserve-issuing countries & financial centres
  - Documents tightening (+1) and loosening (-1)
- **Draws from 4 datasets with different coverage and focus:**
  - Shim *et al.* (2013)
  - Vandenbussche *et al.* (2015)
  - Cerutti *et al.* (2015)
  - Reinhardt and Sowerbutts (2017)
- **Key attribute: disaggregation of FX regulations**
  - "Asset-based": aimed at shifting currency composition of lending away from FX (capital regs & lending standards)
  - "Liability-based": aimed at reducing share of FX in funding of domestic banks (reserve requirements & liquidity requirements)

Changes in FX Regulations



Estimation

- **Test how FX regulations affect cross-border bank and corporate borrowing**
  - Build on Forbes and Warnock (2012), Bruno & Shin (2015), Avdjiev *et al.* (2016)

$$F_{i,t} = \alpha + \sum_{k=0}^{3} \beta_1 \quad FXMP_{t-k} + \delta_t + \gamma' X_{i,t-1} + \delta_i + \varepsilon_{i,t}$$

  - *Fi,t* : quarterly gross cross-border capital inflows to the respective sector of country *i* in quarter *t*
    - *BIS International Banking Statistics or Debt Statistics*
  - $FXMP_{t-k}$: macroprudential FX regulations (+1/0/-1)
  - δ_t : global time effects
  - $X_{i,t-1}$: control variables
    - weight some by financial exposure (Lane and Shambaugh, 2010)
    - includes controls for non-FX macroprudential measures
  - δ_i : country fixed effects and
  - Sample period is 1996 Q1– 2014 Q4

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Hypothesis #1:
Impact on Cross-Border Bank Borrowing

		FX Inflows	FX Share	Non-FX Inflows
FX regulation (t to t-3)		**-0.662****	**-0.997****	**0.0540**
	p-value	***0.0123***	***0.0104***	***0.637***
Non-FX regulation (t to t-3)		0.222	-0.152	0.150
	p-value	*0.186*	*0.450*	*0.135*
Real GDP Growth (t-1)		0.0624***	0.0181	0.0196**
		(0.0165)	(0.0145)	(0.0079)
Volatility of exchange rate (FW, t-1)		-0.1925	0.0778	0.0837**
		(0.1168)	(0.1664)	(0.0329)
IR differential (Changes, FW, t-1)		0.0043	0.0109	-0.0104
		(0.0164)	(0.0612)	(0.0072)
Sovereign Ratings (t-1)		0.0741***	-0.0629*	0.0494***
		(0.0261)	(0.0357)	(0.0173)
Financial Openness (Changes, t-4)		0.4452	0.4567	0.0406
		(0.2910)	(0.7909)	(0.1643)
Time Fixed Effects		Yes	Yes	Yes
Observations		3,381	3,348	3,368
Adj. R-squared		0.090	0.011	0.051
Countries		48	47	48

Notes: Dependent variable is estimated exchange rate-adjusted changes in the stock of cross-border loans from international banks to domestic-resident banks, expressed as % of annual GDP. Coefficient on FX regulations are reported as the sum of the quarterly coefficient estimates over 4 quarters, with a *p*-value instead of standard error. Estimates are panel regressions with country and time fixed effects. Sample period is 1996Q1-2014Q4. Robust standard errors clustered at country level. See notes to Table 1 in paper for more details. Constant is included but not reported. (*** p<0.01, ** p<0.05, * p<0.1)

Cross-check:
Impact on Cross-Border Loans to Non-Banks

	FX Inflows	FX Share	Non-FX Inflows
FX regulation (t to t-3)	**0.0748**	**-0.209**	**0.00422**
p-value	***0.721***	***0.370***	***0.914***
Non-FX regulation (t to t-3)	0.0778	-0.106	0.0140
p-value	*0.105*	*0.500*	*0.567*
Real GDP Growth (t-1)	0.0141***	-0.0176	0.0051**
	(0.0032)	(0.0120)	(0.0021)
Volatility of exchange rate (FW, t-1)	-0.0110	0.2827**	-0.0114
	(0.0305)	(0.1238)	(0.0125)
IR differential (Changes, FW, t-1)	-0.0032	0.0037	0.0010
	(0.0057)	(0.0219)	(0.0023)
Sovereign Ratings (t-1)	0.0525***	-0.0620**	0.0119***
	(0.0126)	(0.0260)	(0.0042)
Financial Openness (Changes, t-4)	0.2450	0.3266	0.0334
	(0.2159)	(0.3640)	(0.0593)
Time Fixed Effects	Yes	Yes	Yes
Observations	3,381	3,345	3,360
Adj. R-squared	0.118	0.042	0.061
Countries	48	48	48

Notes: Dependent variable is estimated exchange rate-adjusted changes in the stock of cross-border loans from international banks to non-banks, expressed as % of annual GDP. Coefficient on FX regulations are reported as the sum of the quarterly coefficient estimates over 4 quarters, with a *p*-value instead of standard error. Estimates are panel regressions with country and time fixed effects. Sample period is 1996Q1-2014Q4. Robust standard errors clustered at country level. See notes to Table 1 in paper for more details. Constant is included but not reported. (*** p<0.01, ** p<0.05, * p<0.1)

Hypothesis #2:
Impact on Corporate Debt Issuance

	FX Inflows	FX Share	Non-FX Inflows
FX regulation (t to t-3)	**0.0549****	**0.513****	**0.00941**
p-value	***0.0370***	***0.0269***	***0.779***
Non-FX regulation (t to t-3)	0.000220	0.0707	-0.00265
p-value	*0.991*	*0.448*	*0.584*
Real GDP Growth (t-1)	0.0020	-0.0004	-0.0004
	(0.0013)	(0.0085)	(0.0005)
Volatility of exchange rate (FW, t-1)	0.0134	0.0521	-0.0082**
	(0.0107)	(0.0463)	(0.0039)
IR differential (Changes, FW, t-1)	-0.0031*	-0.0171	0.0005
	(0.0016)	(0.0170)	(0.0006)
Sovereign Ratings (t-1)	0.0107	0.0058	-0.0012
	(0.0066)	(0.0148)	(0.0015)
Financial Openness (Changes, t-4)	0.0215	0.3201	-0.0176
	(0.0483)	(0.2246)	(0.0112)
Time Fixed Effects	Yes	Yes	Yes
Observations	3,147	2,728	2,613
Adj. R-squared	0.1	0.039	0.202
Countries	44	44	36

Notes: Dependent variable is net issuance of debt securities issued by domestic corporates, expressed as % of annual GDP. Coefficient on FX regulations are reported as the sum of the quarterly coefficient estimates over 4 quarters, with a *p*-value instead of standard error. Estimates are panel regressions with country and time fixed effects. Sample period is 1996Q1-2014Q4. Robust standard errors clustered at country level. See notes to Table 1 in paper for more details. Constant is included but not reported. (*** p<0.01, ** p<0.05, * p<0.1)

Cross-check:
Impact on Bank Intl Debt Issuance

	FX Inflows	FX Share	Non-FX Inflows
FX regulation (t to t-3)	**-0.110***	**-0.255**	**-0.00833**
p-value	***0.0865***	***0.118***	***0.885***
Non-FX regulation (t to t-3)	0.0301	0.0782	0.0327
p-value	*0.317*	*0.395*	*0.275*
Real GDP Growth (t-1)	0.0011	0.0160**	-0.0015
	(0.0031)	(0.0070)	(0.0024)
Volatility of exchange rate (FW, t-1)	0.0092	0.0101	0.0505
	(0.0182)	(0.0526)	(0.0353)
IR differential (Changes, FW, t-1)	0.0089	0.0144	-0.0030
	(0.0062)	(0.0126)	(0.0034)
Sovereign Ratings (t-1)	0.0462*	0.0170	0.0175***
	(0.0263)	(0.0180)	(0.0062)
Financial Openness (Changes, t-4)	0.0230	-0.2968	0.1969
	(0.0685)	(0.2011)	(0.1655)
Time Fixed Effects	Yes	Yes	Yes
Observations	3,321	2,619	2,054
Adj. R-squared	0.210	0.016	0.109
Countries	47	45	28

Notes: Dependent variable is net issuance of debt securities issued by banks, expressed as % of annual GDP. Coefficient on FX regulations are reported as the sum of the quarterly coefficient estimates over 4 quarters, with a p-value instead of standard error. Estimates are panel regressions with country and time fixed effects. Sample period is 1996Q1-2014Q4. Robust standard errors clustered at country level. See notes to Table 1 in paper for more details. Constant is included but not reported. (*** p<0.01, ** p<0.05, * p<0.1)

Magnitudes

- **Direct effect of FX regulations:** significant and large reduction in bank cross-border FX borrowing
  - ↓0.5% - 0.7% of GDP over next year
  - Context:
    - ~1/3 of median bank FX inflows in sample
    - ~ 50% reduction in FX loans to banks in Brazil & Indonesia
- **Leakage from FX regulations**: significant and moderate increase in corporate FX debt issuance
  - ↑0.05% - 0.06% of GDP over next year
  - Context:
    - ~10% of median corporate FX debt issuance in sample
    - ~ 15%-20% increase in FX corporate debt issuance in Brazil & Indonesia
- **Net effect: Aggregate FX borrowing in economy falls** after tighter FX regulations on banks
  - But 10%-16% of aggregate FX exposure shifts from banks to other sectors

Other Noteworthy Results

- **Effects of different types of FX regulations**
  - Both asset- and liability-based regulations significantly reduce cross-border bank borrowing
  - Liability-side regulations seem to correspond to greater leakages
    - Corporate FX debt issuance 3x larger than estimated effect for asset-side regulations
- **No significant effects of FX regulations on other cross-border capital flows (as expected)**, suggests results not capturing omitted variables
  - No increase in bank debt issuance (in FX or local currency)
  - No impact on bank borrowing in non-FX
  - No impact on corporate debt issuance in non-FX
- **Series of sensitivity tests**

Key Hypotheses

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Estimation

$$\Delta eprice_{i,t} = \alpha + \alpha_i + \beta\, \Delta exrate_{i,t} + \delta\, cfxm_{i,t} + \mu\, \Delta exrate_{i,t} \times cfxm_{i,t} + controls_{i,t} + \varepsilon_{i,t},$$

- $\Delta eprice_{i,t}$: stock market index return (for financials or broader economy) for country *i* in quarter *t*
- $\Delta exratei,t$: growth rate of a financially-weighted exchange rate (+ is appreciation)
- $cfxm_{i,t}$: FX regulation cumulated over 4 quarters

Key test: Do FX regulations reduce the sensitivity of the equity indices to exchange rate movements? (is μ <0?)

$$\frac{\Delta eprice_{i,t}}{\Delta exrate_{i,t}} = \beta + \mu\, cfxm_{i,t}$$

Hypotheses #3&4:
Impact on Sensitivity to ER Movements

	Financial Index	*Broad Index*	*Corporate Proxy*
Cum. FX Regulation (t to t-3)	-1.504	-0.629	0.205
	(1.298)	(1.467)	(0.981)
Ex. Rate Appreciation (t)	1.459***	1.184***	0.179*
	(0.224)	(0.162)	(0.101)
FX Regulation X Ex. Rate Apprec. (t)	**-0.781*** **	-0.432*	0.023
	(0.276)	(0.240)	(0.171)
Industry Production Growth (t)	0.086*	0.058	0.006
	(0.045)	(0.044)	(0.028)
Inflation (t)	-0.144	-0.311	-0.267
	(0.420)	(0.308)	(0.198)
Short-Term Interest Rate (t)	-0.278*	-0.419**	-0.218*
	(0.144)	(0.187)	(0.111)
Stock Market Turnover Ratio (t)	0.016	0.048***	0.036***
	(0.021)	(0.017)	(0.010)
Rule of Law (t)	-4.225	-1.657	1.154
	(3.229)	(3.375)	(2.433)
Global Volatility (t)	-10.126***	-9.859***	-3.374***
	(0.899)	(0.780)	(0.405)
Country Fixed Effects	Yes	Yes	Yes
Observations	1,093	1,093	1,093
R-squared	0.338	0.392	0.162
Number of Countries	23	23	23

Dependent variable is equity return for financial market index, broad market index, or an estimate of a corporate market index. Clustered standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Constant included but not reported.

Extensions & Sensitivity

- **Larger reduction in sensitivity to currency movements from FX regulations** for:
  - Emerging markets
  - Larger currency movements
    - (<10th and > 90th percentile)
- Series of sensitivity tests

Summary

- **Empirical analysis confirms 4 model predictions for impact of macroprudential FX regulations:**
  - (1) banks borrow less in foreign currency
  - (2) firms shift away from bank borrowing & increase FX debt issuance
  - (3) banks stock returns are less sensitive to currency movements
  - (4) less reduction in sensitivity of corporate equity returns
- **Can achieve broader goal of building bank resilience to ER movements**
  - But leakages may limit benefits to broader economy

Broader Implications

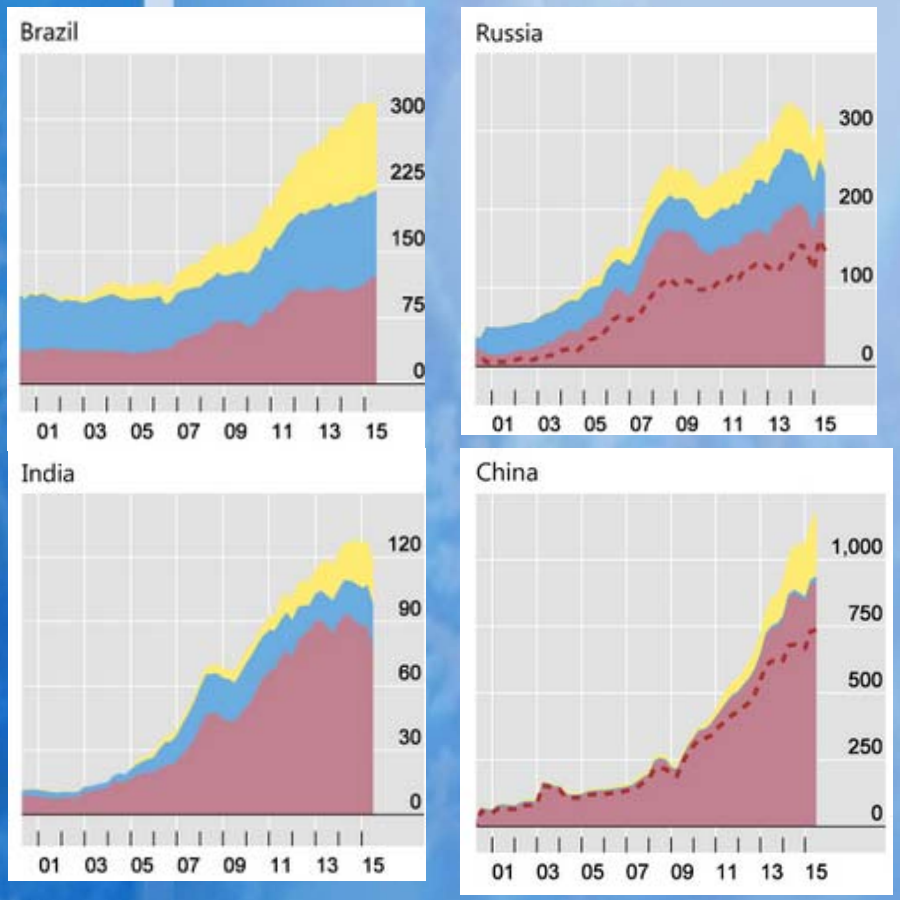
- **Debate on macroprudential regulations vs. capital controls**
- **Highlights importance of regulatory perimeter for regulations**
- **Evaluation of macroprudential regulations needs to consider costs and benefits of "shifting snowbank" of risks across sectors**
  - Does a reduction in aggregate FX exposure in banks and broader economy imply reduction in FX risks overall?
  - What are risks of increased exposure in unregulated sectors?

A Muddy Snowbank

XTRA

Example: The BRICs

USD credit to non-bank borrowers (in bn)



Key Features

- Historically, FX bank lending dominates FX debt issuance
- Local FX lending plays an important role (Russia, China)
- More recently, FX bond issuance starts to increase

Source: McCauley, McGuire and Sushko (2015)