Exchange Rate Fluctuations and Firm Leverage

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Big Picture

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   - Local currency depreciation (appreciation) $\Rightarrow$ Exports $\uparrow$ ($\downarrow$), Imports $\downarrow$ ($\uparrow$)
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   - Important role for imported intermediate inputs
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2. Policy makers argue that flexible exchange rates hurt their economies through currency mismatches on balance sheets linked to credit boom-busts
   - Under financial frictions, balance sheet currency mismatches can lead to fluctuations in investment and output
     ⇒Krugman (1999), Cespedes et al. (2004)
   - Large empirical evidence on **contractionary depreciations** via balance sheet channel
     ⇒e.g., Aguiar (2005), Kalemli-Ozcan et al. (2016)

The Channel: Leverage

Recent focus on **expansionary appreciations** through similar mechanism in the context of GFC with global banks

⇒Bruno and Shin (2015), Gabaix and Maggiori (2015), Miranda-Agrippino and Rey (2019), Jiang et al.

The channel: Endogenous leverage under un-hedged FX debt

- Local currency depreciates:
  ⇒ Firms with FX debt face (-) networth shock, cannot borrow
  ⇒ Banks with FX debt face (-) networth shock, cannot lend
- Local currency appreciates:
  ⇒ Firms with FX debt face (+) networth shock, over-borrow
  ⇒ Banks with FX debt face (+) networth shock, over-lend

Our Contribution

Do firms increase leverage with appreciations and de-lever with depreciations?

Important to know since policy implications will differ:

- If banks are hedged then the channel cannot work via credit supply
  ⇒di Giovanni et al. (2019)

- If the channel works via firm credit demand then firm heterogeneity is important
  ⇒ Exporters will be hedged, non-tradeable sector firms mostly not, importers: depends

Firm Data: ORBIS, 10 Asian EMEs, 2002–2015

- ORBIS firm-level database provided by Moody's-BvD, harmonized worldwide.
- Balance sheets and income statements with 4-digit NACE industry classification.
- Collected from official business registers, annual reports, and newswires.
- Private and public firms (advantage over Compustat/Worldscope).
- Country coverage might differ by country:
  $\Rightarrow$ We cover 50+ percent of aggregate output and corporate sector debt.

FX Debt Data Issues: Micro vs. Macro

MICRO: Firm and bank level FX exposures (debts, assets, hedges):

- Administrative data (credit registers), not feasible to put together for many countries
- IADB project: For Latin American countries only, listed firms only

MACRO: Country-level data from BIS GLI:

- Sector decomposition: Non-financial (HH, firms, government) and financial
- Only for 42 countries $\Rightarrow$ Our sample of 10 EMEs account for 53% of FX debt on average during 2002–2015.
- Since 2015, more countries and granular sector division

All other country-level FX debt data are "estimates" of currency composition of IIP, not actual exposures.

Advantages of Our Data

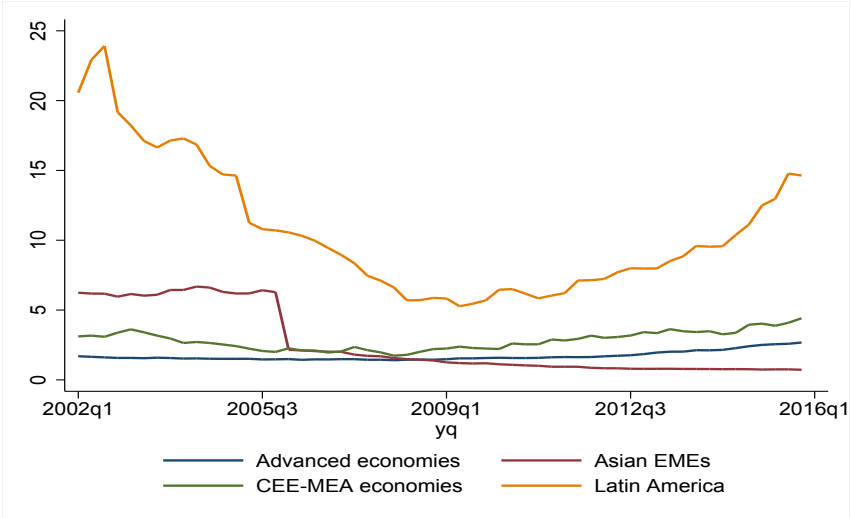
- Actual FX debt
- No underestimation problem for the corporate sector FX Debt
  - Lender: domestic and external
  - Asset class: bonds and loans

FX Loans: Larger Portion of FX Debt

Important underestimation of FX debt of corporate sector by focusing only on bonds in the aggregate data (small firms cannot issue in the international markets)

	China	Hong Kong SAR	Indonesia	India	Korea	Malaysia	Philippines	Singapore	Thailand	Taipei
2002	93%	85%	96%	83%	29%	21%	36%	89%	71%	70%
2003	94%	86%	97%	84%	20%	18%	30%	83%	72%	60%
2004	93%	85%	92%	76%	21%	33%	30%	83%	70%	58%
2005	94%	87%	79%	68%	57%	41%	35%	84%	73%	56%
2006	95%	89%	74%	61%	62%	43%	29%	82%	74%	63%
2007	96%	90%	67%	60%	64%	46%	31%	85%	77%	69%
2008	97%	92%	59%	67%	73%	46%	28%	88%	74%	80%
2009	98%	93%	47%	65%	67%	55%	25%	86%	78%	86%
2010	98%	95%	61%	73%	66%	52%	33%	87%	85%	87%
2011	98%	95%	65%	80%	67%	57%	33%	90%	86%	86%
2012	99%	93%	62%	88%	60%	43%	35%	90%	88%	86%
2013	98%	93%	62%	86%	58%	49%	35%	93%	89%	86%
2014	99%	92%	63%	82%	57%	52%	35%	93%	86%	87%
2015	98%	93%	59%	83%	55%	56%	35%	93%	87%	86%

Corporate Sector FX Bond Share in Total Debt by Region



Empirical Framework

Do firms increase (decrease) their leverage with local currency appreciations (depreciations) when the FX exposure of the corporate sector is high?

$$\text{Leverage}_{i,j,c,t} = \beta \cdot \text{FXdebt}_{c,t-1} \times \text{DummyXR}^{k}_{c,t} + \lambda \cdot \text{FXdebt}_{c,t-1} + \rho \cdot \text{DummyXR}^{k}_{c,t} + \theta \cdot X_{i,c,t-1} + \alpha_i + \gamma_c + \phi_{j,t} + \varepsilon_{i,j,c,t} \quad (1)$$

Benchmark Results

Dependent variable: Financial debt/assets$_{i,j,c,t}$

Change in XR (k)	(1) $k \geq +0\%$	(2) $k \geq +5\%$	(3) $k \geq +10\%$	(4) $k \leq -0\%$	(5) $k \leq -5\%$	(6) $k \leq -10\%$
FXdebt$_{c,t-1}\times$ DummyXR$^{k}_{c,t}$	-0.0484***	-0.0805***	-0.5312***	0.0492***	0.0816***	-0.2620***
	(-6.5)	(-9.3)	(-19.0)	(6.6)	(10.8)	(-10.8)
FXdebt$_{c,t-1}$	2.3841***	2.3751***	2.4440***	2.3328***	2.3279***	2.4123***
	(76.4)	(75.3)	(78.4)	(69.6)	(68.5)	(71.5)
DummyXR$^{k}_{c,t}$	0.0189***	0.0324***	0.0699***	-0.0184***	-0.0108***	0.0132***
	(23.0)	(35.1)	(43.0)	(-22.5)	(-19.9)	(7.6)
Profitability$_{i,j,c,t-1}$	-0.0441***	-0.0442***	-0.0441***	-0.0441***	-0.0441***	-0.0442***
	(-23.6)	(-23.7)	(-23.6)	(-23.6)	(-23.6)	(-23.6)
Collateral$_{i,j,c,t-1}$	0.0650***	0.0652***	0.0661***	0.0650***	0.0644***	0.0653***
	(34.7)	(34.9)	(35.3)	(34.7)	(34.4)	(34.8)
Size$_{i,j,c,t-1}$	0.0204***	0.0202***	0.0200***	0.0204***	0.0204***	0.0209***
	(28.4)	(28.2)	(27.9)	(28.4)	(28.4)	(29.3)
Sales growth$_{i,j,c,t-1}$	-0.0009***	-0.0009***	-0.0009***	-0.0009***	-0.0010***	-0.0009***
	(-3.1)	(-3.2)	(-3.2)	(-3.1)	(-3.4)	(-3.0)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,373,080	1,373,080	1,373,080	1,373,080	1,373,080	1,373,080
R^2	0.78	0.78	0.78	0.78	0.78	0.78

Excluding Government FX Bonds

Dependent variable: Financial debt/assets$_{i,j,c,t}$

Change in XR (k)	(1) $k \geq +0\%$	(2) $k \geq +5\%$	(3) $k \geq +10\%$	(4) $k \leq -0\%$	(5) $k \leq -5\%$	(6) $k \leq -10\%$
FXdebt$_{c,t-1}\times$ DummyXR$^{k}_{c,t}$	-0.2061***	-0.3583***	-1.1352***	0.2061***	0.4327***	0.0908***
	(-14.2)	(-21.7)	(-19.1)	(14.2)	(27.7)	(2.8)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,373,080	1,373,080	1,373,080	1,373,080	1,373,080	1,373,080
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Larger Effects with FX Loans

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Change in XR (k)	(1) $k \geq +0\%$	(2) $k \geq +5\%$	(3) $k \geq +10\%$	(4) $k \leq -0\%$	(5) $k \leq -5\%$	(6) $k \leq -10\%$
FXloan$_{c,t-1}\times$ DummyXR$^{k}_{c,t}$	-0.1681***	-0.5514***	-1.5236***	0.1701***	0.5065***	0.2665***
	(-9.8)	(-26.8)	(-23.7)	(9.9)	(24.9)	(7.4)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,373,080	1,373,080	1,373,080	1,373,080	1,373,080	1,373,080
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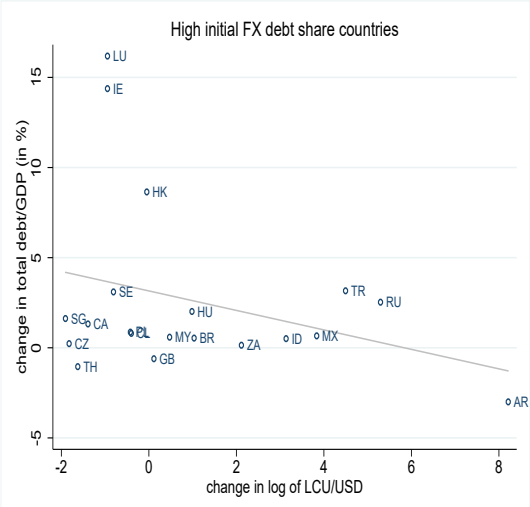
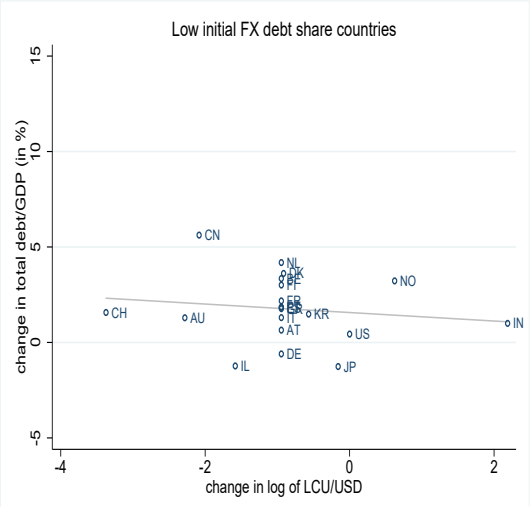
Economic Significance: Depreciations are more important

- A depreciation of 10 percent or more decreases firm leverage by 0.1517
  $\Rightarrow$ 90 percent decline in leverage over its mean.
- An appreciation of 10 percent or more increases firm leverage by 0.0265
  $\Rightarrow$ 20 percent increase in leverage over its mean.

Exchange Rate Fluctuations Correlate with Country-Level Leverage only in High FX Debt Countries





Threats to Identification and Robustness

Any unobserved time varying heterogeneity at firm and country levels might effect our results.

- Define firm-level FX dummy assuming each firm holds a constant share of its total debt in FX (given by corporate sector level)
  $\Rightarrow$ **Allows use of country-year fixed effects**
- Placebo test with small depreciations/appreciations
- Role of debt maturity $\Rightarrow$ Does not matter for appreciations; LT debt more important for depreciations
- Firms in tradeable and non tradeable sectors $\Rightarrow$ Results are stronger for firms in non-tradeable sector, especially for depreciations

Conclusion

- We show that when home currency appreciates (depreciates), firms operating in countries whose corporate sectors hold more of the debt in foreign currency, increase (decrease) their leverage relatively more.
- The effect of a depreciation is quantitatively larger than that of an appreciation, especially for depreciations larger than 10 percent.
- Our results are due to loans in foreign currency, rather than bonds, highlighting the important role of local FX lending.

Policy Implications

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  - Diamond, Hu and Rajan (2018) shows that changes in the source country monetary policy can lead to boom-bust cycles in emerging markets though currency appreciations and depreciations.
  - Kalemli-Ozcan (2019) shows that using monetary policy to limit exchange rate fluctuations in response to changes in center country monetary policy can be counter-productive.

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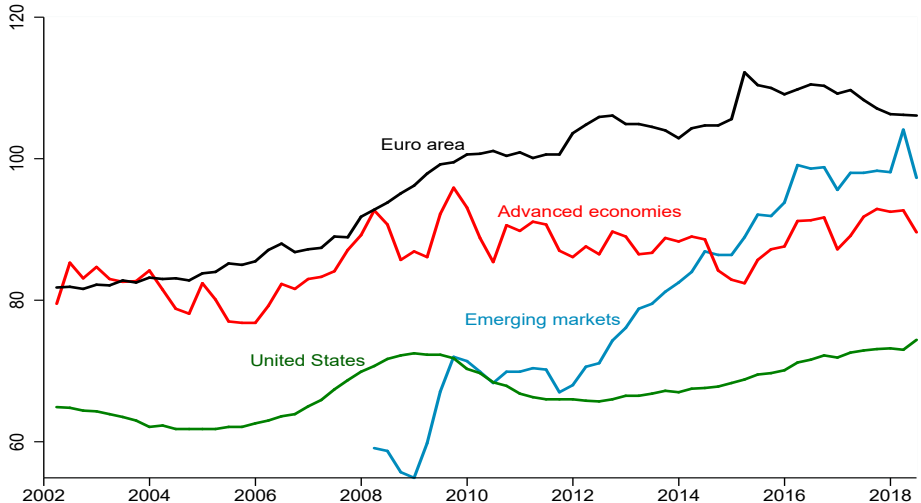
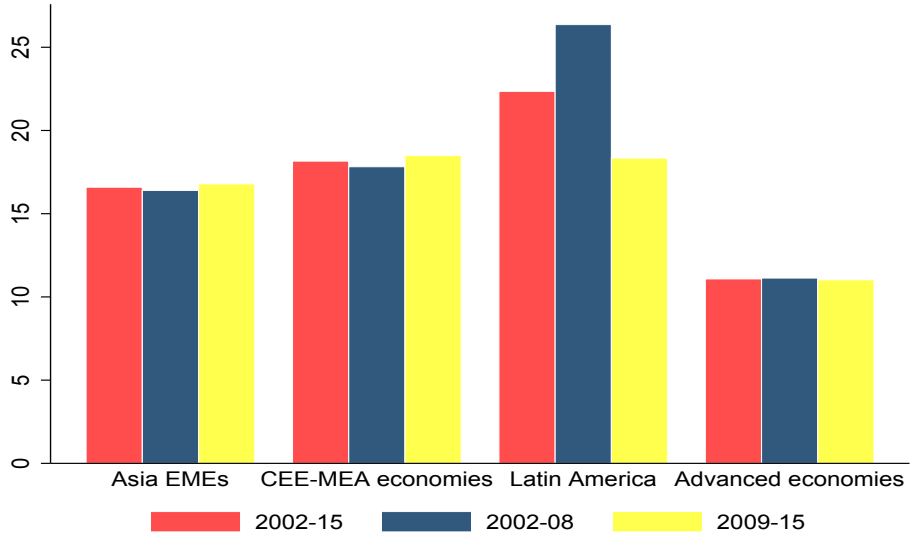
- Taken together with our paper, these results highlight the importance of macroprudential policies to prevent the accumulation of un-hedged FX debt in the first place.

APPENDIX

Corporate Debt to GDP



FX Debt in Total Debt



Share of USD in FX Debt

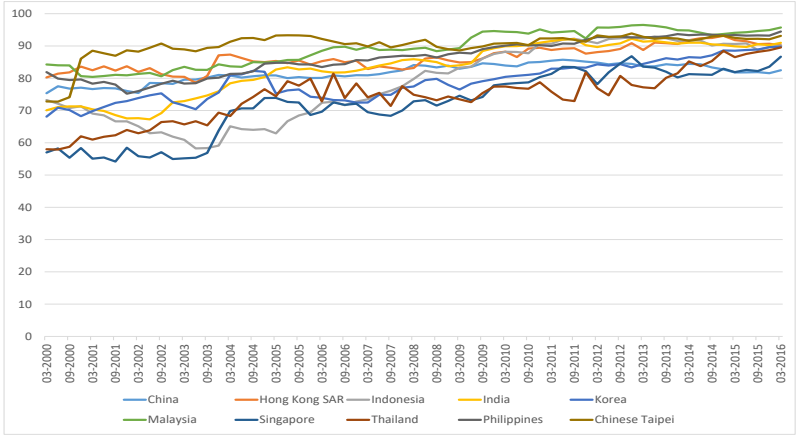


TABLE: FX Debt/Total Non-Financial Sector Debt, 2002 vs 2015

	2002Q1	2015Q4		2002Q1	2015Q4
China	3.87	2.09	Hong Kong SAR	31.55	47.35
Indonesia	11.13	26.45	India	1.97	4.45
Korea	4.76	3.68	Malaysia	10.06	3.06
Philippines	35.18	22.08	Singapore	28.33	28.32
Thailand	12.76	7.93	Chinese Taipei	4.69	4.48

Firm-level FX Debt Approximation

$$\text{Leverage}_{i,j,c,t} = \beta \cdot \text{FXdebt}_i \times \text{DummyXR}^k_{c,t} + \theta_1 \cdot X_{i,c,t-1} + \theta_2 \cdot X_{i,c,t-1} \times \text{DummyXR}^k_{c,t} + \alpha_i + \gamma_{c,t} + \phi_{j,t} + \varepsilon_{i,j,c,t} \quad (2)$$

Dependent variable: Financial debt/assets$_{i,j,c,t}$

Change in XR (k)	(1) $k \geq +10\%$	(2) $k \leq -10\%$
FX debt$_i \times$ DummyXR$^k_{c,t}$	-0.0058***	0.0550***
	(-3.7)	(26.8)
Firm FE	Yes	Yes
Country-Year FE	Yes	Yes
Industry-Year FE	Yes	Yes
Observations	1,372,970	1,372,970
R^2	0.79	0.79

Placebo

Dependent variable: Financial debt/assets$_{i,j,c,t}$

Change in XR (k)	(1) $1\% \geq k \geq +0\%$	(2) $1\% \geq k \geq +0\%$	(3) $-1\% \leq k \leq -0\%$	(4) $-1\% \leq k \leq -0\%$
FX debt$_i \times$ DummyXR$^k_{c,t}$	-0.0629	-0.0421	-0.0049*	-0.0049*
	(-1.1)	(-0.9)	(-8.9)	(-6.5)
Controls	Yes	Yes	Yes	Yes
Controls$\times$ DummyXR$^k_{c,t}$	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
Observations	144,372	144,372	249,693	249,693
R^2	0.84	0.84	0.85	0.85

Non-Tradeable Sector Firms

Dependent variable: Financial debt/assets$_{i,j,c,t}$

Change in XR (k)	(1) Tradeable $k \geq +10\%$	(2) Non-tradeable $k \geq +10\%$	(3) Tradeable $k \leq -10\%$	(4) Non-tradeable $k \leq -10\%$
FX debt$_i \times$ DummyXR$^k_{c,t}$	-0.0037	-0.0048**	0.0341***	0.0643***
	(-1.5)	(-2.3)	(10.8)	(22.4)
Firm FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
Observations	768,318	547,414	768,318	547,414
R^2	0.82	0.75	0.82	0.76