Corporate Dollar Debt and Depreciations: All's well that ends well?

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This paper

- Question:
  - Explores the effect of depreciations on firms CAPEX when firms hold foreign-currency debt

- Paper in a nutshell:
  - Exploits newly-built database of stocks of FC bonds (FCB) for ~7,000 firms across 15 EMs, period 2000-2015
  - Regression analysis based on FE models
  - Alternative identification using market's tamper tantrum
  - Find significant negative effects of depreciations
  - A depreciation of 10% is associated with CAPEX to assets 0.3-0.5 percentage points lower for firms exposed to FCB
  - Effect seems stronger for one-year-ahead CAPEX

Literature

- Bleakly and Cowan (2008) cross-country study exploring balance sheet effects of depreciations
  - Focused on experience of LAC firms after crises of 1990s
  - Find no balance sheet effects
  - Rationalize the result: firms match/hedge FC exposures
- A few other country-specific studies
  - Find mixed results
  - Firms do not seem to hedge their currency risk with financial instruments
- Big limitation from lack of data on currency composition of firms balance sheets

Empirical strategy

- Model firm CAPEX as function of lagged exposure to FCB interacted with current depreciation:

$$y_{i,s,c,t} = \alpha + \beta \left(\text{FXB}_{i,s,c,t-1} \times \Delta e_{c,t} \right) + \theta \text{FXB}_{i,s,c,t-1} + \mathbf{\Gamma}' \boldsymbol{X}_{i,s,c,t-1} + \psi_* + \varepsilon_{i,s,c,t}$$

- Set of fixed effects in preferred model are country-sector-year

- Only determinants of CAPEX not absorbed by FEs are firm-level specific, which are controlled for with vector of lagged firm-level covariates

Empirical strategy

- Dependent variable: CAPEX to assets (flow/stock)
- FCB: stock of foreign-currency bonds (or dummy)
- Depreciation: bilateral RER against the USD
  - Adjusts for asset inflation, pass-through inflation
- All firm-level controls are scaled by assets
  - Ratios and dummy variables are not transformed
- All models estimated by OLS. Alternative models estimated are Tobit (CAPEX cannot be negative)

Empirical strategy

- The question is whether firms that have a larger exposure to FCB have lower CAPEX than their peers
  - Compare cross-section differences in CAPEX among firms, and hence C×S×T fixed-effects
  - No firm-level FEs
  - Firm-level covariates capture determinants of possible differences in CAPEX among firms, rather than capture firm dynamics of investment decisions

Data: Universe of firms

- Universe of listed non-financial, non-utilities, active firms, headquartered in the largest 24 EMs
  - Exclude countries with sovereign defaults
  - Exclude countries with less than 15 corporate issuers
  - Drop China (because mandate of SOEs)

- After data cleaning, sample is unbalanced panel of 6,917 firms from 15 EMs

- Data sources:
  - Corporate bonds: Thomson Reuters Eikon Premium
  - Firms balance sheets: Thomson Reuters Worldscope

Data: Final Sample

Region	Country	N. of firms
ASIA	India	2,032
ASIA	Indonesia	342
ASIA	Korea	1,592
ASIA	Malaysia	726
ASIA	Philippines	138
ASIA	Thailand	451
EMEA	Israel	256
EMEA	Poland	380
EMEA	South Africa	219
EMEA	Turkey	246
LAC	Brazil	195
LAC	Chile	128
LAC	Colombia	38
LAC	Mexico	91
LAC	Peru	83

Data: Stocks of foreign currency bonds

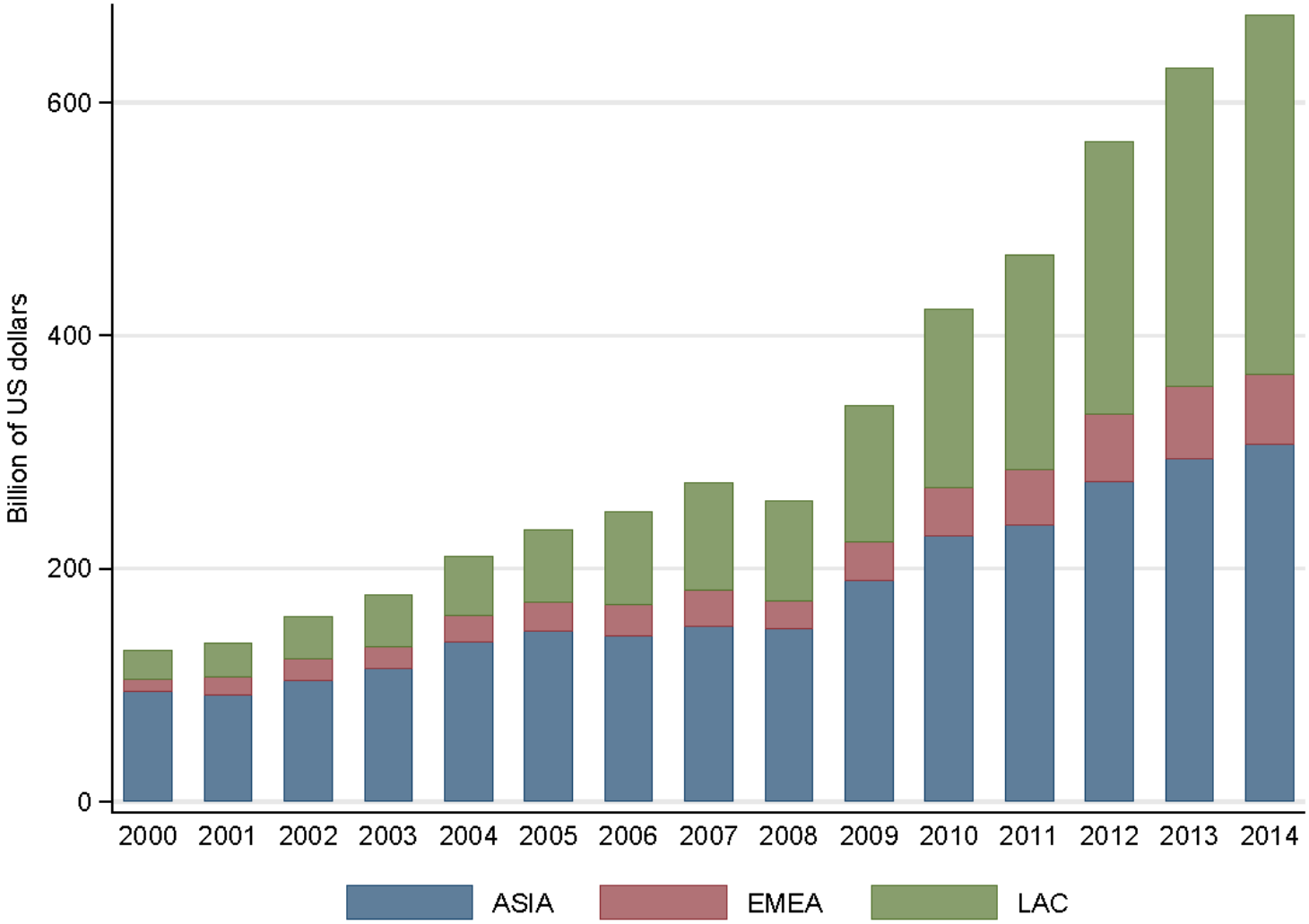
- Novel data
- Stocks are computed using all fixed-income securities issued by a firm by itself or offshore
  - Measuring stocks of bonds on a nationality basis is very important (Shin (2014); Turner (2014))
  - In Brazil issuance may be 30-40% larger when accounting for offshore issuance
- Total of 1,809 issuers in final sample (nationality)
  - Double-check association (conservative approach)
- A total of 29,078 securities

Data: Stocks of foreign currency bonds

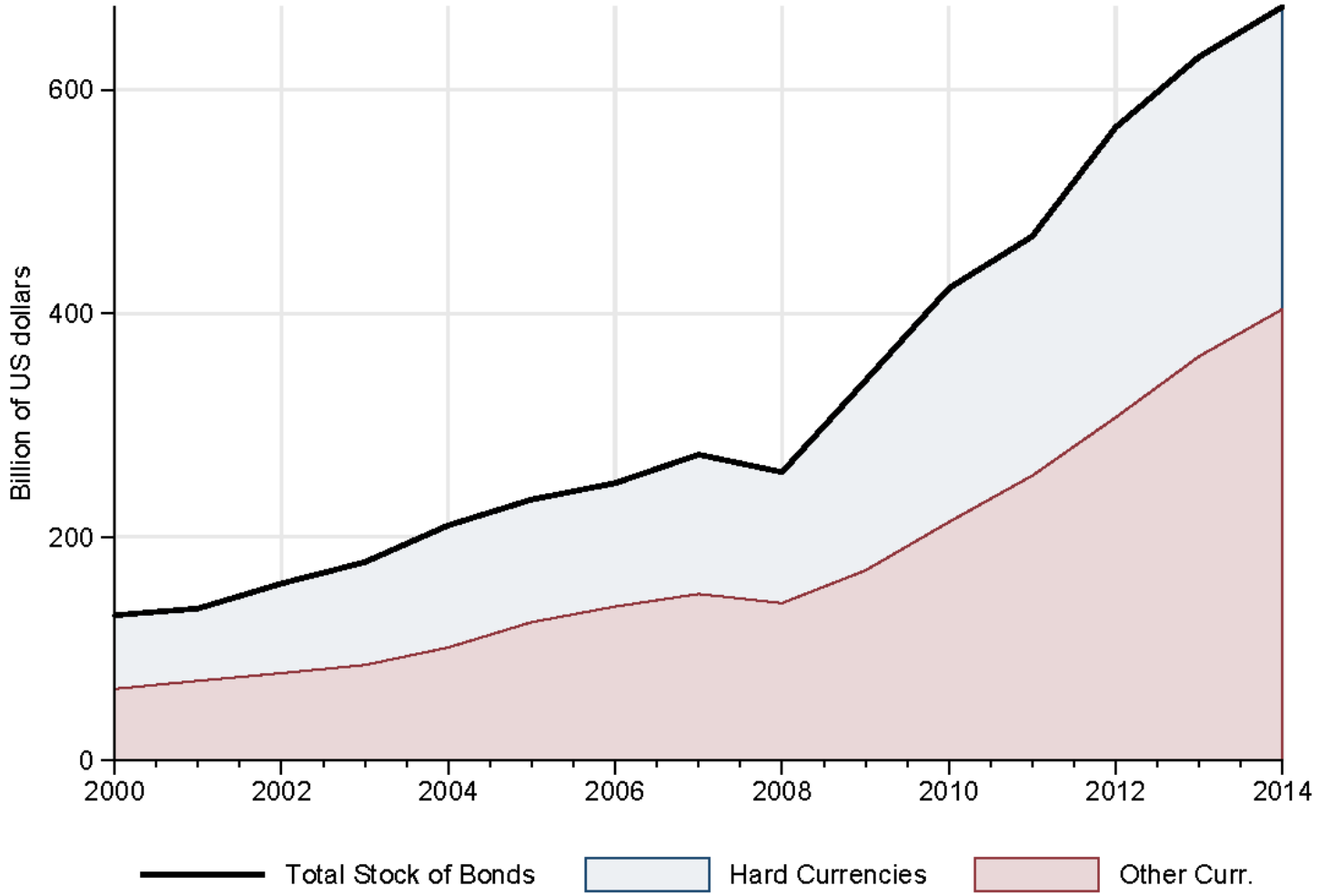
- A total of 29,078 securities
  - Bonds, notes, and commercial paper make up 86%
  - 89% of the securities were issued after year 1999
  - 12% of securities have maturities of less than one year
  - Average maturity at issuance is 4 years
  - 80% of the bonds are bullet bonds

- Computing stocks from issuance data:
  - Compute outstanding value as Dec-31 by adjusting for:
    - Amortizations , early repayments, call options exercised, defaults, cancellations, conversions, liquidations, repurchases
  - Convert gross proceeds to currency in balance sheet using FX Dec-31
  - Classify bonds into currencies: USD, EUR, GBP, JPY, CHF

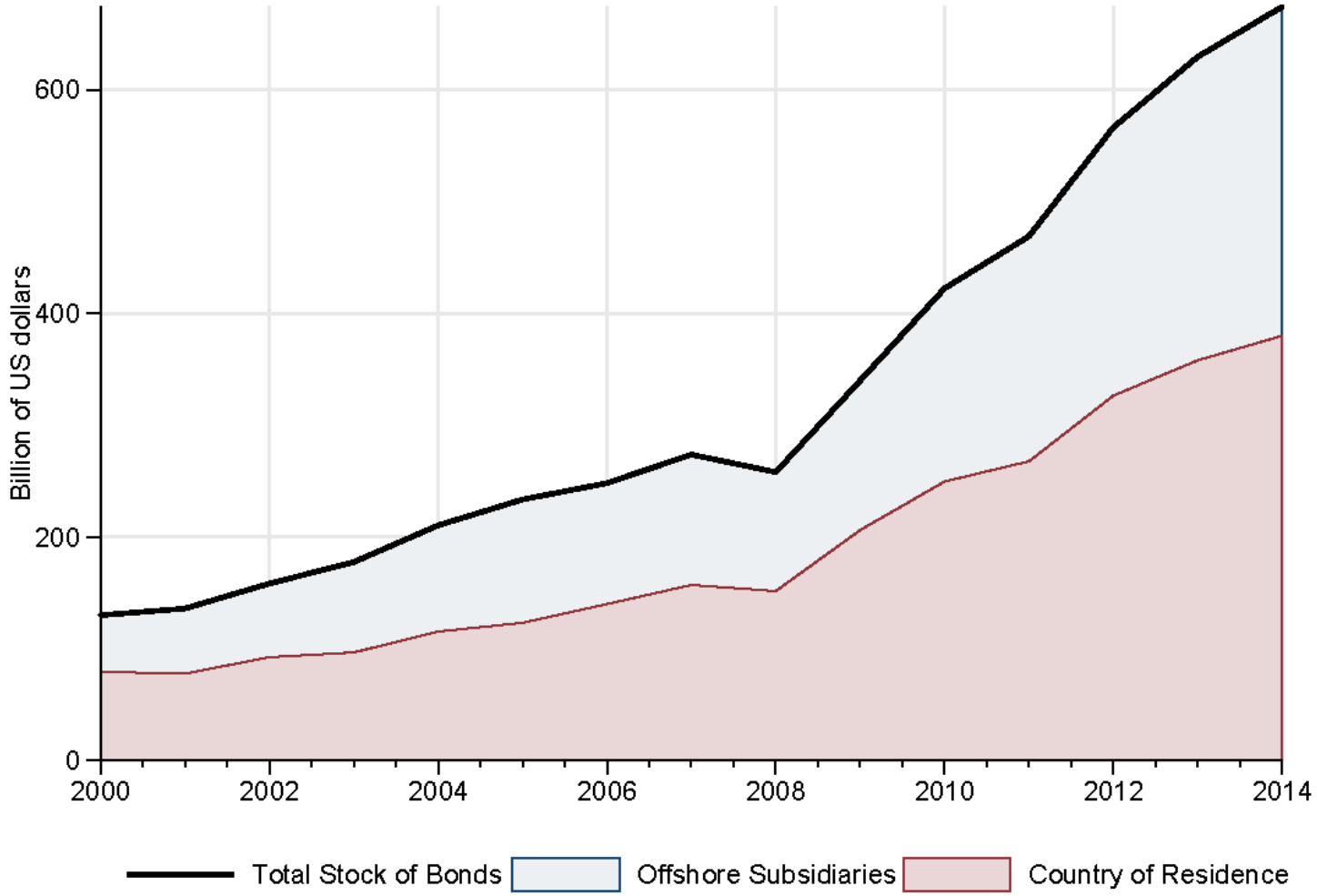
Data: Stocks of foreign currency bonds



Data: Stocks of foreign currency bonds



Data: Stocks of foreign currency bonds



Data: Firm-level controls

- Two sets of firm-level covariates:
  - Strength and performance:
    - Leverage, debt to equity, debt maturity
    - Earnings, profitability
    - Interest expense
    - Cash holdings
    - Size
    - Tangible assets
  - Operational hedges:
    - Foreign ownership
    - Exporter status
    - Foreign listing
- Normalize to *t-1* assets (flow: average *t* and *t-1*)
- Winsorize at 2% and 98%

Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FXB scaled by assets				I[FXB=1] if FXB$\geq 25^{th}$ percentile			
$FXB_{t-1} \times \triangle e_t$	-0.249	-0.259	-0.244	-0.256	-0.044	-0.046	-0.043	-0.044
	(0.092)***	(0.092)***	(0.092)***	(0.091)***	(0.019)**	(0.019)**	(0.019)**	(0.019)**
FXB_{t-1}	0.040	0.042	0.042	0.046	0.008	0.009	0.009	0.010
	(0.014)***	(0.014)***	(0.014)***	(0.014)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
$Leverage_{t-1} \times \triangle e_t$			-0.012	-0.009			-0.012	-0.009
			(0.008)	(0.017)			(0.008)	(0.016)
$Leverage_{t-1}$			-0.006	-0.009			-0.006	-0.009
			(0.001)***	(0.001)***			(0.001)***	(0.001)***
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	72,419	72,518	72,407	72,506	71,806	71,893	71,794	71,881
Adj./Pseudo R^2	0.088	-0.049	0.089	-0.049	0.087	-0.048	0.088	-0.049
Method	OLS	Tobit	OLS	Tobit	OLS	Tobit	OLS	Tobit

Controlling for firm-level covariates

	(1)	(2)	(3)	(4)	(5)
	FXB scaled by assets				I[FXB=1,0]
$FXB_{t-1} \times \triangle e_t$	-0.174	-0.174	-0.184	-0.179	-0.027
	(0.087)**	(0.087)**	(0.089)**	(0.088)**	(0.019)
Included controls in $\mathbf{X}_{t-1}$:	Only $\mathbf{X}_{t-1}$		$\mathbf{X}_{t-1}$ and $\mathbf{X}_{t-1} \times \triangle e_t$		
Firm strength and performance	Yes	Yes	Yes	Yes	Yes
Operational hedges	No	Yes	No	Yes	Yes
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes
Obs	61,830	61,830	61,830	61,830	61,222
Adj./Pseudo R^2	0.179	0.179	0.179	0.180	0.178
Method	OLS	OLS	OLS	OLS	OLS

One-year-ahead CAPEX

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FXB scaled by assets				I[FXB=1] if FXB$\geq 25^{th}$ percentile			
$FXB_{t-1} \times \triangle e_t$	-0.326	-0.347	-0.268	-0.274	-0.061	-0.064	-0.046	-0.047
	(0.092)***	(0.093)***	(0.090)***	(0.089)***	(0.018)***	(0.018)***	(0.018)**	(0.018)***
Including $\mathbf{X}_{t-1} \times \triangle e_t$?	No	No	Yes	Yes	No	No	Yes	Yes
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	65,514	65,605	55,980	56,080	64,914	64,993	55,385	55,476
Adj./Pseudo R^2	0.084	-0.046	0.157	-0.080	0.083	-0.045	0.156	-0.079
Method	OLS	Tobit	OLS	Tobit	OLS	Tobit	OLS	Tobit

Concerns about OVB and spurious correlation

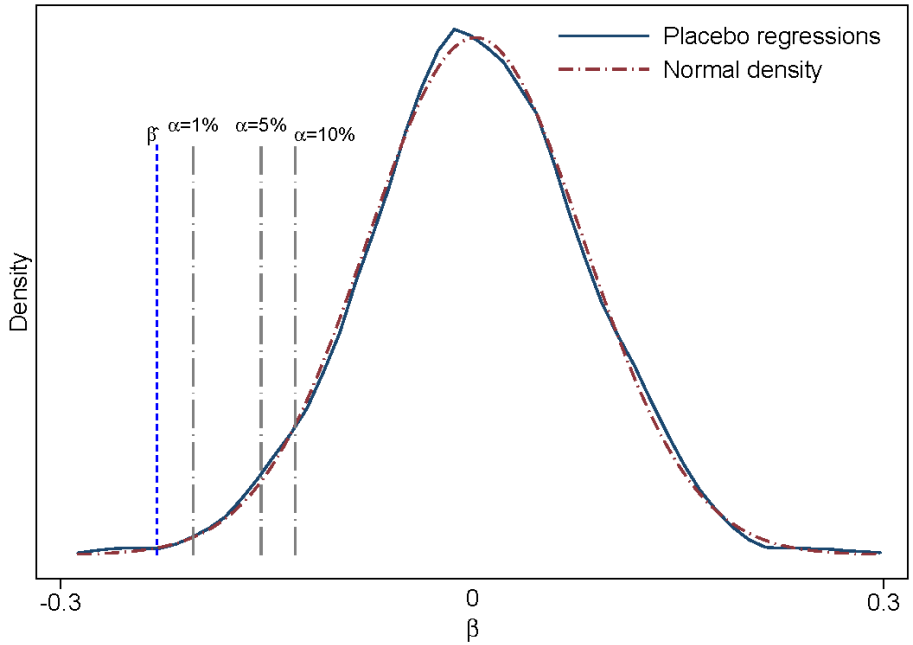
- Not an experimental design
- Given C×S×T fixed-effects, only source of variation not captured in model is firm-specific
- Concerns of OVB tackled introducing 12 covariates and their interactions with depreciation
- However, one cannot be sure of modeling the true DGP. Alternatives:
  - Using machine learning methods to model covariates and their functional form more flexibly
  - Randomization inference

Double-Step LASSO (caveat)

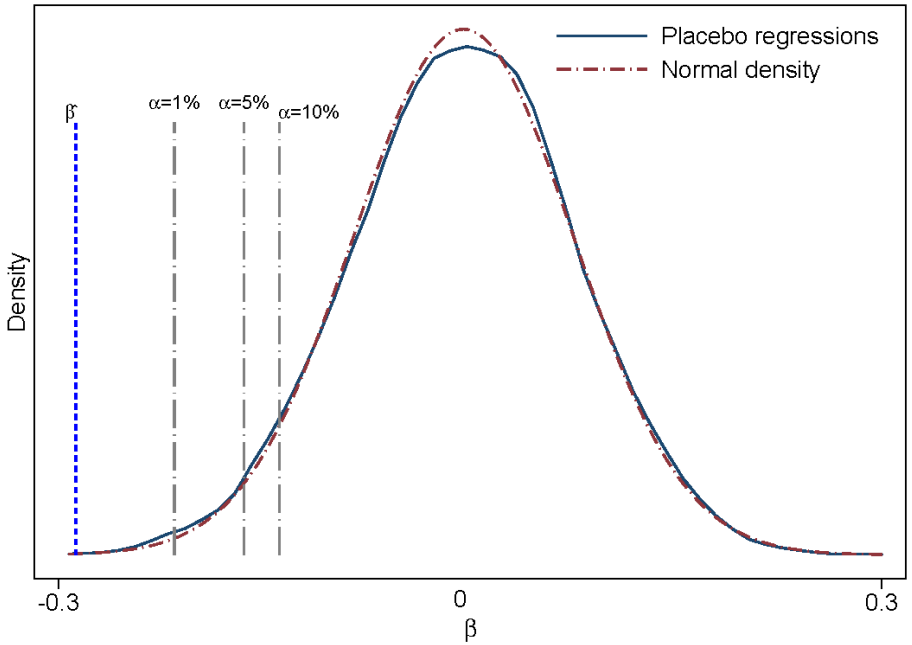
	(1)	(2)	(3)	(4)	(5)	(6)
	FXB scaled by assets			I[FXB=1] if FXB$\geq 25^{th}$ percentile		
	Model with $\mathbf{X}_{t-1}$;$\mathbf{X}_{t-1} \times \triangle e_t$	All covariates; all interactions	Double-Step Lasso	Model with $\mathbf{X}_{t-1}$;$\mathbf{X}_{t-1} \times \triangle e_t$	All covariates; all interactions	Double-Step Lasso
Dependent variable: $CAPEX_t$						
$FXB_{t-1} \times \triangle e_t$	-0.179	-0.141	-0.125	-0.027	-0.019	-0.016
	(0.088)**	(0.086)	(0.090)	(0.019)	(0.019)	(0.018)
Covariates	26	149	9	26	149	12
Obs	61,830	61,830	62,202	61,222	61,222	61,594
Adj./Pseudo R^2	0.180	0.214	0.203	0.178	0.213	0.202
Dependent variable: $CAPEX_{t+1}$						
$FXB_{t-1} \times \triangle e_t$	-0.268	-0.233	-0.219	-0.046	-0.028	-0.034
	(0.090)***	(0.095)**	(0.102)**	(0.018)**	(0.018)	(0.018)*
Covariates	26	149	8	26	149	11
Obs	55,980	55,980	56,619	55,385	55,385	56,024
Adj./Pseudo R^2	0.157	0.189	0.171	0.156	0.187	0.169

Randomization inference (caveat)

CAPEX at *t*



CAPEX at *t+1*

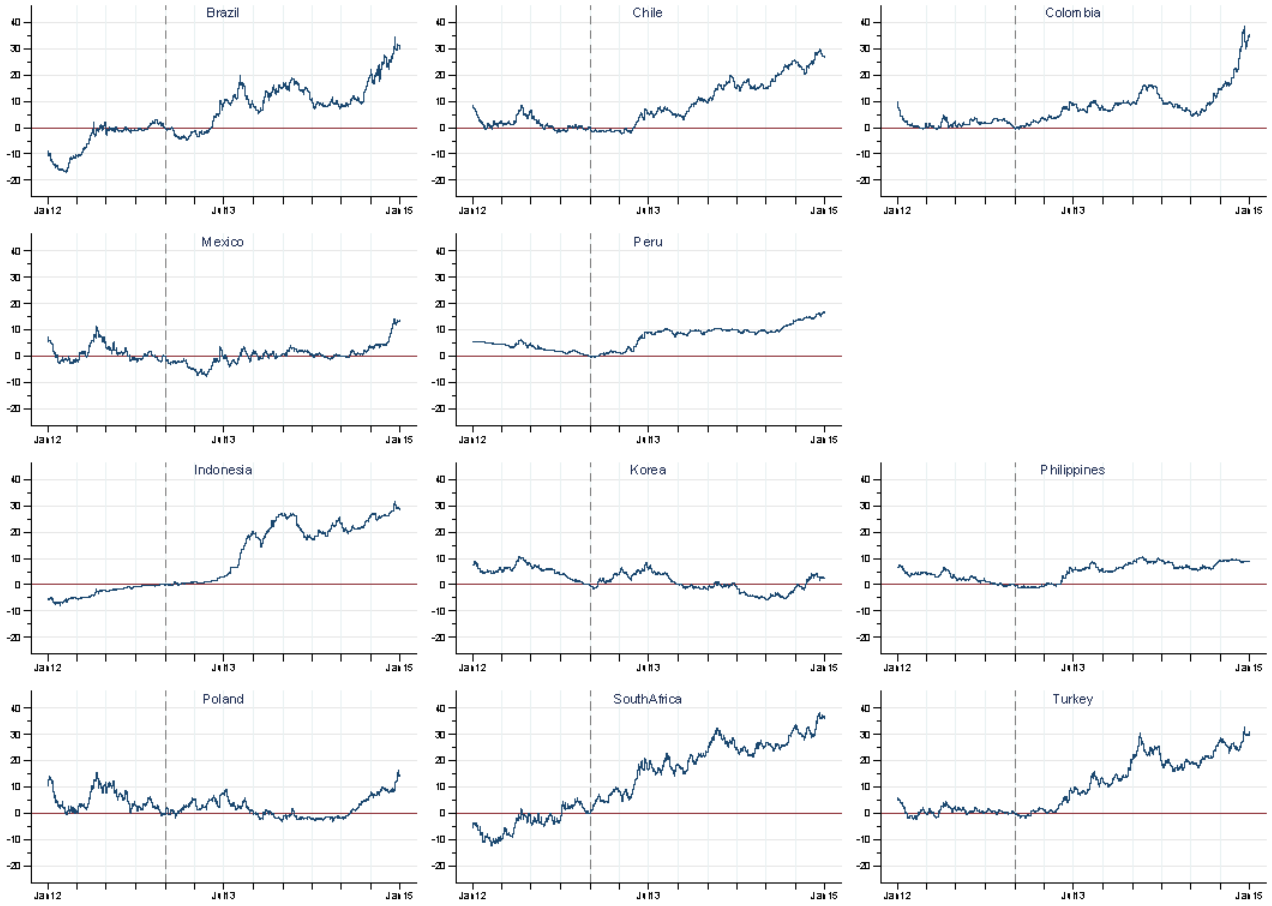


Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Include CAPEX_{t-1}		Normalize by assets_{t-1}		Adjust by asset disposals	NER	
Dependent variable: CAPEX_t							
$\text{FXB}_{t-1} \times \triangle e_t$	-0.093	-0.097	-0.412	-0.426	-0.228	-0.148	-0.154
	(0.056)*	(0.056)*	(0.201)**	(0.203)**	(0.096)**	(0.081)*	(0.080)*
Obs	64,676	64,770	72,434	72,533	57,511	72,419	72,518
Adj./Pseudo R^2	0.335	-0.176	0.097	-0.072	0.089	0.088	-0.049
Dependent variable: CAPEX_{t+1}							
$\text{FXB}_{t-1} \times \triangle e_t$	-0.215	-0.234	-0.643	-0.675	-0.351	-0.245	-0.260
	(0.065)***	(0.067)***	(0.244)***	(0.254)***	(0.099)***	(0.082)***	(0.082)***
Obs	64,675	64,769	65,526	65,617	52,721	65,514	65,605
Adj./Pseudo R^2	0.335	-0.176	0.094	-0.065	0.084	0.084	-0.046
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Method	OLS	Tobit	OLS	Tobit	OLS	OLS	Tobit

Alternative identification: DiD

- Use market's tamper tantrum of 2013 as a natural experiment

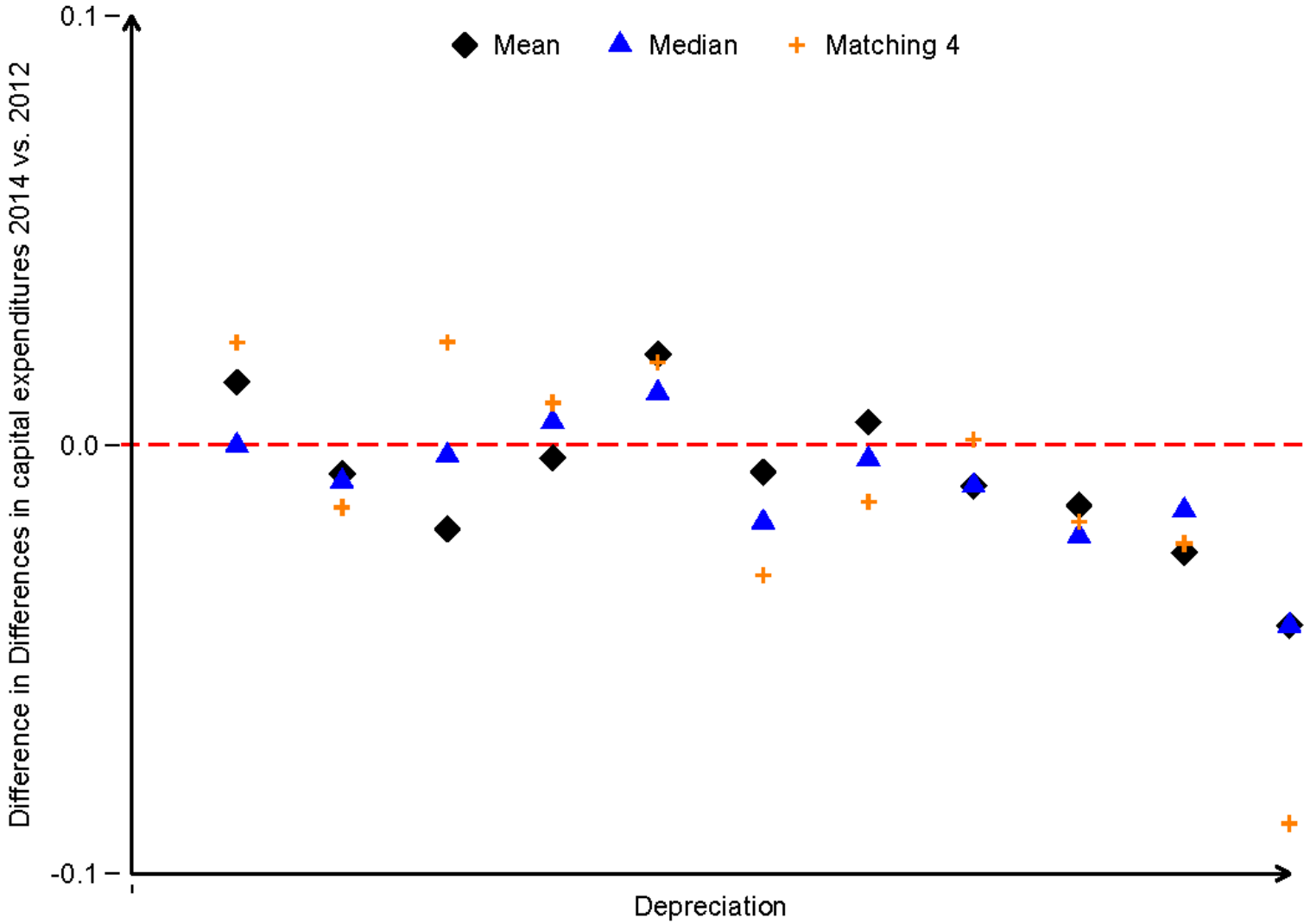


DiD market's taper tantrum of 2013

- Use market's tamper tantrum of 2013 as a natural experiment

- Compare difference in CAPEX in 2014 vs. 2012 of firms with FXB exposures as-of-end of 2012 with those firms that had no FXB exposure

DiD market's taper tantrum of 2013



DiD market's taper tantrum of 2013

- Estimate simple DiD:

$$y_{i,s,c,t} = \alpha + \psi_i + \gamma T_t + \delta \left(T_t \times \text{FXB}_i^{12} \right) + \xi_{i,s,c,t}$$

- Interact with intensity of depreciation 2014-2012:

$$y_{i,s,c,t} = \alpha + \psi_i + \gamma T_t + \tilde{\delta} \left(T_t \times \text{FXB}_i^{12} \right) + \phi \left(T_t \times \Delta e_c^{12-14} \right) + \varphi \Delta e_c^{12-14} + \lambda \left(T_t \times \text{FXB}_i^{12} \times \Delta e_c^{12-14} \right) + \varepsilon_{i,s,c,t}$$

- Plug country and sector dummies $\times T_t$ (i.e., allow differences in post period by country and sector)

- Control for firm-level covariates (2012 levels)

DiD market's taper tantrum of 2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	I[FXB=1] if FXB>0						I[FXB=1] if FXB$\geq 25^{th}$ percentile		
$T \times$ FXB	-0.005	-0.004	-0.008						
	(0.002)**	(0.000)***	(0.003)***						
$T \times$ FXB $\times \Delta e$				-0.165	-0.103	-0.092	-0.240	-0.202	-0.160
				(0.046)***	(0.061)*	(0.038)**	(0.049)***	(0.058)***	(0.053)***
Fixed effects interacted with T?									
Country-Sector FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Sector FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Country FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Including $\boldsymbol{X}_i^{12}$?	No	No	Yes	No	No	Yes	No	No	Yes
Obs	2,699	2,699	2,674	2,699	2,699	2,674	2,695	2,695	2,670
Adj. R^2	0.001	0.036	0.069	0.004	0.036	0.069	0.004	0.037	0.069

Placebo regression with 2012-2010 comparison yield non-significant coefficients

Discussion about earnings and hedging

- Bleakley and Cowan (2008) rationalized their result of no balance sheet effect by noting firms hedge their foreign currency exposures. However:
  - Regressions on *t* ant *t+1* earnings do not back this idea
  - Micro data for CHL, COL, BRA shows that a large proportion of non-exporters hold FC debt
  - Most firms do not use financial hedges

- Bringing hypothesis to the data using a triple DiD approach:
  - If firms effectively match/hedge FC liabilities, then exporters with FCB should increase their CAPEX facing a depreciation compared to non-FCB exporters

3 DiD: Exporters and FCB hedges

$$
\begin{aligned}
y_{i,s,c,t} =& \alpha + \delta_0 \text{FXB}_{i,s,c,t-1} + \delta_1 \text{EXP}_{i,s,c,t-1} + \delta_2 \left(\text{FXB}_{i,s,c,t-1} \times \text{EXP}_{i,s,c,t-1}\right) \\
&+ \delta_3 \left(\text{FXB}_{i,s,c,t-1} \times \Delta e_{c,t}\right) + \delta_4 \left(\text{EXP}_{i,s,c,t-1} \times \Delta e_{c,t}\right) \\
&+ \delta_5 \left(\text{FXB}_{i,s,c,t-1} \times \Delta e_{c,t} \times \text{EXP}_{i,s,c,t-1}\right) \\
&+ \psi_c + \psi_s + \psi_t + \psi_{c,t} + \psi_{s,t} + \psi_{c,s} + \zeta_{i,s,c,t}
\end{aligned}
$$

3 DiD: Exporters and FCB hedges

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$CAPEX_t$				$CAPEX_{t+1}$			
	FXB scaled by assets		I[FXB=1,0]		FXB scaled by assets		I[FXB=1,0]	
	Δe	I[Δe=1,0]	Δe	I[Δe=1,0]	Δe	I[Δe=1,0]	Δe	I[Δe=1,0]
$FXB_{t-1} \times \Delta e_t$	-0.084	-0.045	-0.028	-0.011	-0.212	-0.074	-0.042	-0.013
	(0.104)	(0.033)	(0.011)**	(0.004)**	(0.066)***	(0.027)**	(0.014)***	(0.006)*
$EXP_{t-1} \times \Delta e_t$	0.008	0.007	0.006	0.006	0.004	0.005	0.003	0.005
	(0.010)	(0.003)**	(0.011)	(0.003)*	(0.010)	(0.003)	(0.010)	(0.003)
$FXB_{t-1} \times \Delta e_t \times EXP_{t-1}$	-0.236	0.001	-0.017	0.001	-0.164	0.047	-0.026	0.007
	(0.129)*	(0.049)	(0.017)	(0.008)	(0.145)	(0.033)	(0.020)	(0.006)
Country-Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	72,518	72,518	71,893	71,893	65,605	65,605	64,993	64,993
Adj. R^2	0.090	0.090	0.089	0.089	0.087	0.087	0.086	0.086

Usage of Financial Derivatives and Foreign-Currency Debt in BRA, CHL, COL

	(1)	(2)	(3)	(4)	(5)
	Brazil	Chile	Colombia all firms	Colombia med. & large	Colombia listed
Panel A. Statistics for full sample					
Number of firms	100	217	39,873	563	60
Percentage of firms with FX debt	85	77.0	17.5	52.0	45
FX debt to total liabilities	16.3	18.3	3.3	11.0	12.5
Prob(derivatives=1 | FXB=1)	100	70.1	18.8	37.2	52.9
Prob(net forward long =1 | FX debt=1)	43.8	n.a.	22.7	30.7	43.1
Prob(exporter=1 | FXD=1)	100	43.1	49.0	72.9	72.5
Panel B. Statistics for firms with stocks of foreign-currency bonds (FXB)					
Number of firms with FXB	52	17	9	9	1
FX bonds to total FX debt	28.0	11.8	0.09	1.5	0.2
Prob(FX loans=1 | FXB=1)	83.0	71.7	78.0	82.1	100
FX debt to total liabilities if FXB =1 (%)	26.7	38.6	51.8	51.0	43.0
Years in sample	2003-2014	2009-2014	2005-2013	2005-2013	2005-2013

Concluding remarks

- Cross-country study of non-crises times in 15 EMs indicate that currency depreciations have deleterious effects on firm investment when firms are exposed to foreign-currency debt

Thanks!

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