Intervening against the Fed

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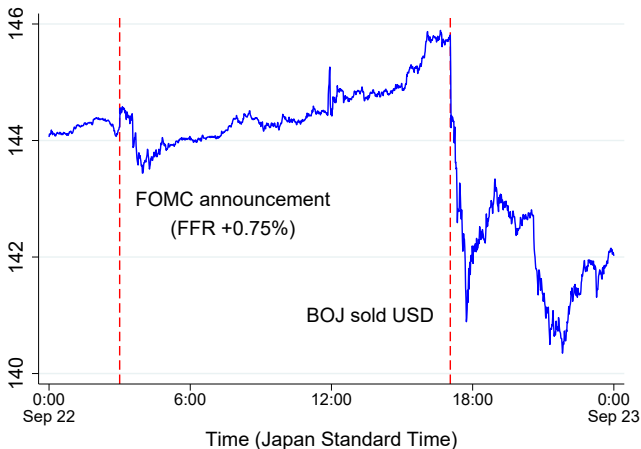
May 19, 2023

2nd Annual International Roles of the U.S. Dollar Conference
Federal Reserve Bank of New York

UNIVERSITY OF CAMBRIDGE

Figure 1: Spot Exchange Rate: 1USD = JPY

FOMC announcement
(FFR +0.75%)

BOJ sold USD

Time (Japan Standard Time)

Note: Higher value implies dollar appreciation / yen depreciation.

Motivation

Question:

- Can FXI mitigate the effect of US monetary shocks?

Method:

- Event study using US monetary surprise (Nakamura and Steinsson, 2018)
- Identify FXI via deviation from estimated FXI rule
- Daily FXI, exchange rate, firm-level stock price and currency denomination of balance sheet

Result: When the Fed hikes unexpectedly,

- **No FXI** $\Rightarrow$ Local currency **depreciates** + stock price of firms with dollar debt **decreases**
- **FXI** $\Rightarrow$ Exchange rate and stock price are **stable**

Literature

- Foreign Exchange Intervention
    - Theory: Gabaix and Maggiori (2015), Cavallino (2019), Amador et al. (2020), Fanelli and Straub (2021), Hassan et al. (2022)
    - Empirics: Fatum and Hutchison (2010), Kuesteiner et al. (2018), Adler et al. (2019), Fratzscher et al. (2019)

- High-frequency identification of monetary policy shocks
    - Gurkanyak et al. (2005), Gorodnichenko and Weber (2016), Nakamura and Steinsson (2018a;b), Jarociński and Karadi (2020), Bu et al. (2021)

- Dominant currency
    - Trade: Corsetti et al. (2020), Gopinath et al. (2020), Mukhin (2021)
    - Finance: Akinci and Queralto (2019), Gopinath and Stein (2021)

- Firm Heterogeneity and international trade / finance
    - Amiti et al. (2014), Rodnyansky (2019), Maggiori et al. (2019), Casas et al. (2022), Salomao and Varela (2022)

Data Source

- Period: 2000-2019, 13 countries, 4,060 firms
  - Argentina, Australia, Brazil, Chile, Colombia, Costa Rica, Georgia, Hong Kong, Japan, Mexico, Peru, Switzerland, and Turkey
    - Criteria: daily FXI data is available + intervened against US dollar

- FX intervention: central bank website, FRED, individual contacts
- US monetary shock: Nakamura and Steinsson (2018)
- Exchange rate and stock returns: Datastream
- Balance sheet (currency denomination of debt): Capital IQ
- Fundamentals: Worldscope, OECD Input-Output Table

▸ Summary statistics ▸ FXI Frequency ▸ Sample firms ▸ Firm Selection Criteria ▸ Capital IQ Data

Estimation of FXI Policy Rule

$$\widetilde{FXI}_{c,t} = \alpha + \sum_c \beta_c (FFR_t \times \gamma_c) + \delta Z_{c,t} + \gamma_c + \epsilon_{c,t}. \tag{1}$$

- $\widetilde{FXI}_{c,t}$: **Counter-intervention** dummy
    - 1 if FFR $\Uparrow$ on date t, CB sells but does not buy USD b/w t and $t+5$
    - -1 if FFR $\Downarrow$ on date t, CB buys but does not sell USD b/w t and $t+5$

- FFR_t: US monetary shock on date t ($FFR_t \Uparrow$ = US tightening)

- $Z_{c,t}$: Controls
    - Past trend and volatility of exchange rate, past intervention, macro variables (policy rate, GDP, CPI inflation, unemployment rate, trade balance over GDP ratio), macro variables $\times$ FFR shock

- γ_c: Country FE

Estimation of FXI Policy Rule

Figure 2: Variance Decomposition for Counter-Intervention
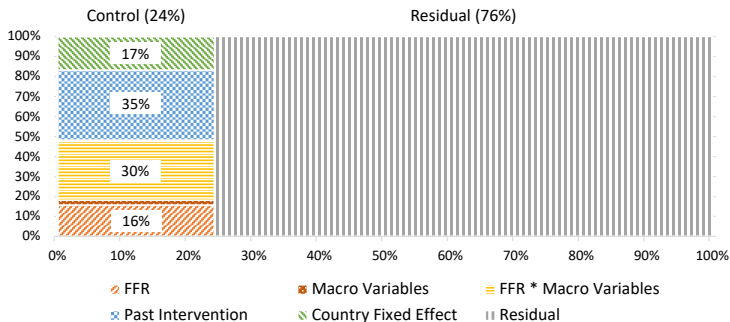
- 76% of variation in counter-intervention is cannot be explained.
- Residual = **Unexpected intervention**

Effect of FXI on Exchange Rate

$$\log(e_{c,t+1}) - \log(e_{c,t-1}) = \alpha + \beta FFR_t + \delta Z_{c,t} + \gamma_c + \epsilon_{c,t}. \qquad (2)$$

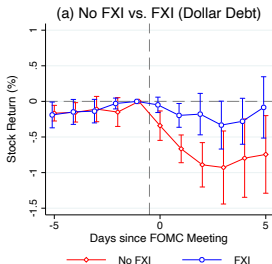- e: Spot exchange rate ($e \Uparrow$: USD appreciation / local depreciation)

- FFR_t: US monetary shock on date t ($FFR_t \Uparrow$ = US tightening)

- $Z_{c,t}$: Controls
  - Past trend and volatility of exchange rate, past intervention, macro variables (policy rate, GDP, CPI inflation, unemployment rate, trade balance over GDP ratio)

- γ_c: Country FE

- SE is clustered at country and date levels

- Estimate (2) in countries with and without counter-intervention

Result: Exchange Rate

	Exchange rate depreciation		
	(1)	(2)	(3)
FFR shock	0.225***	0.00446	0.201**
	(0.0690)	(0.0213)	(0.0724)
Intervention			0.266
			(0.155)
FFR shock × Intervention			-0.202**
			(0.0724)
Observations	418	417	836
R-squared	0.108	0.0833	0.0840
Intervention	No	Yes	Both
Country FE	Yes	Yes	Yes
Country and Date Clusters	Yes	Yes	Yes

When the Fed funds rate increases,

- **No FXI** $\Rightarrow$ local depreciation / USD appreciation
- **FXI** $\Rightarrow$ little effect

(a) Intervention vs. No Intervention

(b) Effect of Intervention
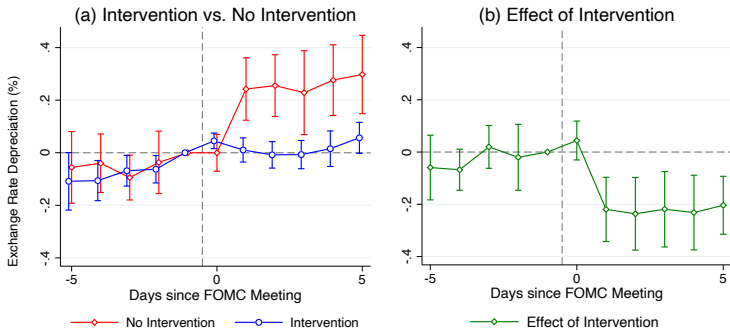
- FXI has persistent effect on exchange rate over time.

Effect of FXI on Stock Price

$$\log(p_{i,t+1}) - \log(p_{i,t-1}) = \alpha + \beta FFR_t + \delta_1 Z_{i,t} + \delta_2 Z_{ind,t} + \gamma_i + \epsilon_{i,t}. \tag{3}$$

- p: stock price

- $Z_{i,t}$: firm-level control (total asset, export intensity, liquidity over asset ratio, firm age + interaction with FFR shock)

- $Z_{ind,t}$: industry-level control (import content of production)

- γ_i: firm FE

- Estimate (3) for
  1. Firms with and without dollar debt
  2. Countries with and without counter-intervention

Result: Stock Price

	Change in stock price $(\log(p_{i,t+1}) - \log(p_{i,t-1}))$				
	(1)	(2)	(3)	(4)	(5)
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.666***	-0.196*	-0.0937**	-0.151**	
	(0.119)	(0.102)	(0.0450)	(0.0575)	
FFR shock × Dollar Debt					-0.263***
					(0.0697)
FFR shock × Intervention × Dollar Debt					0.242***
					(0.0672)
Observations	1926	1258	103155	9915	116754
R-squared	0.0930	0.115	0.0317	0.209	0.0865
Firm FE	Yes	Yes	Yes	Yes	Yes
Country × Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

When the Fed funds rate increases,

- Firms with dollar debt:
  - **No FXI** $\Rightarrow$ large decline in stock price
  - **FXI** $\Rightarrow$ small decline in stock price
- Firms without dollar debt: **FXI has little effect**

(a) No FXI vs. FXI (Dollar Debt)   (b) Effect of FXI (Dollar Debt)

(c) No FXI vs. FXI (No Dollar Debt)   (d) Effect of FXI (No Dollar Debt)
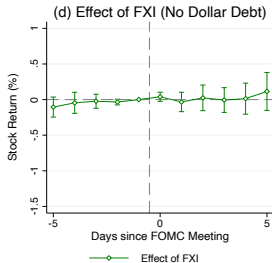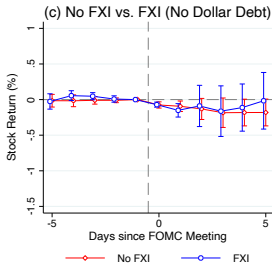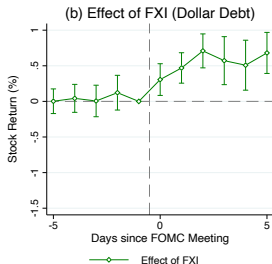
- FXI has persistent effect on stock price for firms with dollar debt.

▸ Triple interaction

Robustness Checks

1. Debt maturity ▸ Table
2. Intensive and extensive margins of dollar debt ▸ Table
3. Control for international sales and asset ▸ Table
4. Exchange rate regimes ▸ Table
5. Size of intervention ▸ Table
6. Control for daily policy rate ▸ Table
7. Alternative definition for unexpected counter-intervention ▸ Table
8. Currency denomination of stock price ▸ Table

Conclusion

- Identification of FXI by using high-frequency US monetary shock and estimating deviation from FXI policy rule

- Result: FXI that counteracts against Fed stabilizes exchange rate and stock price of firms, especially those with dollar debt.

- FXI can successfully insulate countries from global financial cycle.

Appendix

Table 1: Summary Statistics: FFR shock, exchange rate, and stock price

	Mean	Med	S.D.	p5	p95	Obs
(1) FFR shock (basis point)	0.015	-0.48	1.81	-3.1	3.75	90
(2) Exchange rate (% change, $\log(e_{c,t+1}) - \log(e_{c,t-1})$)	0.04	0	0.72	-1.37	1.29	875
(3) Stock price (% change, $\log(p_{i,t+1}) - \log(p_{i,t-1})$)	0.02	0	3.48	-5.61	5.71	124,559

Note: t is the FOMC announcement date. $e_{c,t+1}$ is the exchange rate in country c at date $t+1$. Higher $e_{c,t+1}$ implies the appreciation of US dollar or depreciation of local currency. $p_{i,t+1}$ is the stock price of firm i at date $t+1$. The stock price is in terms of local currency. Observations are the number of FOMC announcement dates (row 1), country times FOMC announcement dates (row 2), and firm times FOMC announcement dates (row 3).

▸ Back to data source

Table 2: Interventions around FOMC event dates

Country	Frequency			Ave. Net Purchase of USD		Periods
	Buy USD	Sell USD	Counter	Millions USD	% GDP ($\times 10^{-4}$)	
	(1)	(2)	(3)	(4)	(5)	(6)
Argentina	59	45	15	11	2.9	2003-2019
Australia	0	2	2	-0.7	-0.094	2000-2019
Brazil	11	1	8	19	1.2	2009-2019
Chile	6	0	4	0.01	0.0062	2008-2019
Colombia	34	2	18	5.6	2.3	2000-2019
Costa Rica	34	32	3	0.61	2.1	2006-2019
Georgia	9	12	15	0.21	2.3	2009-2019
Hong Kong	83	58	13	26	12	2000-2019
Japan	4	0	1	0.0094	0.0019	2000-2019
Mexico	0	24	7	-17	-1.6	2000-2011
Peru	72	51	26	6.6	4.7	2000-2019
Switzerland	0	0	0	-0.45	-0.094	2000-2001
Turkey	1	1	0	2.3	0.34	2002-2019
Total	312	229	111	4.5	2.3	2000-2019

Note: there are 90 total FOMC event dates.

Counteracting intervention = FFR increases at date t and central banks sell USD at least once and never buy USD between dates t and $t + 5$.

▸ Back to data source

Table 3: Sample Firms

Country	Total	Dollar Debt	Country	Total	Dollar Debt
Argentina	34	25	Hong Kong	480	42
Australia	1190	126	Japan	2216	4
Brazil	68	21	Mexico	48	33
Chile	3	1			
Colombia	22	9	Total	4060	261

- 261 firms (6%) have dollar debt (14% except Japan).

- Share of dollar debt / total debt = 66%, conditioning on firms with positive dollar debt.

- 501 firms (12%) are exporters (mostly in Japan).
  - Among the firms with dollar debt, four firms are exporters.
    = Firms with dollar debt are not naturally hedged.

Firm Selection Criteria

Drop firm-year observations with following criteria:[1]

- Currency composition of debt is reported.
- Total asset belongs to either top or bottom 1%.
- Direct subsidiary of another firm (to avoid double-count).
- The sum of cash and cash equivalents + tangible assets is greater than total asset.
- The difference between **the total principal due** and **the sum of principal dues of individual debt investment** is greater than 100,000 USD.

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[1]The criteria are based on Kim (2019) and Kim et al. (2020).

Capital IQ Balance Sheet Data

Figure: Excerpt of detailed financial statement for Agrometal S.A.I.

- Total debt = 5.6 (millions USD)
- Sum of individual debts = $2.2 + 0.6 + 0.1 + \cdots = 5.6$
- Dollar debt = 2.2
    - **The total debt** (from main financial statement) matches **the sum of individual debts** (from detailed statement).

▸ Back to data source

Stock Price (Triple Interaction)

Effect of FXI (Dollar Debt vs. No Dollar Debt)
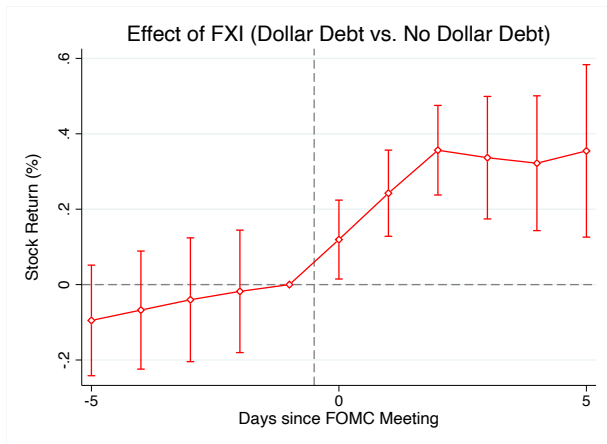
- The effect of FXI is larger for firms with dollar debt.

▸ Back

Debt Maturity

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
	(1)	(2)	(3)	(4)	(5)
Maturing Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-1.533***	-0.975***	-0.654***	-0.191*	
	(0.334)	(0.325)	(0.135)	(0.100)	
FFR shock × Maturing Dollar Debt					-0.448***
					(0.144)
FFR shock × Maturing Dollar Debt × Intervention					0.430*
					(0.257)
Observations	161	72	1752	1176	3155
R-squared	0.400	0.290	0.0966	0.120	0.204
Firm FE	Yes	Yes	Yes	Yes	Yes
Country × Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

Maturing dollar debt = dollar debt that matures within 1-year window
around (6 months before or after) FFR shock. We compare firms with
maturing and non-maturing dollar debt. ▸ Back

Intensive and Extensive Margins of Dollar Debt

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)			
	(1)	(2)	(3)	(4)
FFR shock	-0.103**	-0.157***	-0.103**	
	(0.0461)	(0.0593)	(0.0458)	
FFR shock × Dollar Debt	-0.0433***	0.000252	-0.0436***	-0.0363***
	(0.0117)	(0.00988)	(0.0115)	(0.00960)
FFR shock × Intervention			-0.0323	
			(0.0801)	
FFR shock × Dollar Debt × Intervention			0.0448***	0.0349***
			(0.0102)	(0.00660)
Observations	105114	11178	116754	116754
R-squared	0.0314	0.194	0.0332	0.0865
Dollar Debt	Both	Both	Both	Both
Intervention	No	Yes	Both	Both
Firm FE	Yes	Yes	Yes	Yes
Country × Date FE	No	No	No	No
Clusters	Firm, Date	Firm, Date	Firm, Date	Firm, Date

We use the standardized share of dollar debt over total debt as an independent variable. ▸ Back

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
	(1)	(2)	(3)	(4)	(5)
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.717***	-0.196	-0.0888**	-0.121*	
	(0.112)	(0.128)	(0.0442)	(0.0620)	
FFR shock $\times$ Dollar Debt					-0.277***
					(0.0706)
FFR shock $\times$ Intervention $\times$ Dollar Debt					0.249***
					(0.0690)
Observations	1843	974	100333	7134	110775
R-squared	0.101	0.115	0.0323	0.280	0.0895
Firm FE	Yes	Yes	Yes	Yes	Yes
Country $\times$ Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

We controlled for international sales over total sales ratio and
international asset over total asset ratio. ▶ Back

Exchange Rate Regime

	Exchange rate depreciation		
	(1)	(2)	(3)
FFR shock	0.241***	-0.0242	0.288***
	(0.0729)	(0.0489)	(0.0715)
Intervention			0.487
			(0.438)
FFR shock $\times$ Intervention			-0.286**
			(0.105)
Observations	319	242	563
R-squared	0.110	0.107	0.0889
Intervention	No	Yes	Both
Country FE	Yes	Yes	Both
Country and Date Clusters	Yes	Yes	Both

- Flexible = 5% moving band, managed floating, or more flexible
- Fixed = 2% moving band or less flexible (Ilzetzki et al., 2019)

Exchange Rate Regime

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
	(1)	(2)	(3)	(4)	(5)
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.671***	-0.0906	-0.0938**	0.00285	
	(0.121)	(0.201)	(0.0450)	(0.0933)	
FFR shock × Dollar Debt					-0.273***
					(0.0721)
FFR shock × Intervention × Dollar Debt					0.304***
					(0.0890)
Observations	1815	754	102917	5321	111311
R-squared	0.0940	0.105	0.0317	0.299	0.0839
Firm FE	Yes	Yes	Yes	Yes	Yes
Country × Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

- Flexible = 5% moving band, managed floating, or more flexible
- Fixed = 2% moving band or less flexible (Ilzetzki et al., 2019)

	Exchange rate depreciation		
	(1)	(2)	(3)
FFR shock	0.220***	-0.0145	0.197**
	(0.0662)	(0.0285)	(0.0674)
Intervention			0.212
			(0.161)
FFR shock $\times$ Intervention			-0.204**
			(0.0786)
Observations	395	346	742
R-squared	0.112	0.102	0.102
Intervention	No	Yes	Both
Country FE	Yes	Yes	Both
Country and Date Clusters	Yes	Yes	Both

We excluded small intervention = average net purchase of USD over GDP ratio is smaller than 25 percentile in absolute value. ▸ Back

Size of Intervention

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
	(1)	(2)	(3)	(4)	(5)
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.666***	-0.140	-0.0937**	0.00812	
	(0.119)	(0.157)	(0.0450)	(0.0760)	
FFR shock $\times$ Dollar Debt					-0.260***
					(0.0698)
FFR shock $\times$ Intervention $\times$ Dollar Debt					0.269***
					(0.0852)
Observations	1926	1018	103155	4639	111145
R-squared	0.0930	0.147	0.0317	0.214	0.0864
Firm FE	Yes	Yes	Yes	Yes	Yes
Country $\times$ Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

We excluded small intervention = average net purchase of USD over GDP ratio is smaller than 25 percentile in absolute value. ▸ Back

	Exchange rate depreciation		
	(1)	(2)	(3)
FFR shock	0.281**	-0.0935	0.274**
	(0.107)	(0.0872)	(0.119)
Intervention			0.303
			(0.205)
FFR shock $\times$ Intervention			-0.363**
			(0.155)
Observations	341	341	683
R-squared	0.0904	0.0940	0.0833
Intervention	No	Yes	Both
Country FE	Yes	Yes	Both
Country and Date Clusters	Yes	Yes	Both

We controlled for daily policy rate in BIS statistics in 10 countries:
Argentina, Australia, Brazil, Chile, Colombia, Hong Kong, Japan,
Mexico, Turkey, and Peru. ▸ Back

Mean Criteria for Unexpected Counter-Intervention

	Exchange rate depreciation		
	(1)	(2)	(3)
FFR shock	0.162***	0.0338	0.146**
	(0.0472)	(0.0268)	(0.0489)
Intervention			0.181
			(0.168)
FFR shock × Intervention			-0.117**
			(0.0439)
Observations	418	417	836
R-squared	0.0873	0.103	0.0743
Intervention	No	Yes	Both
Country FE	Yes	Yes	Both
Country and Date Clusters	Yes	Yes	Both

Intervention is unexpected if the residual from estimating FXI rule is greater than the mean in absolute value. ▸ Back

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
	(1)	(2)	(3)	(4)	(5)
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.650***	-0.147	-0.0907**	-0.0801	
	(0.126)	(0.146)	(0.0445)	(0.0672)	
FFR shock × Dollar Debt					-0.213***
					(0.0685)
FFR shock × Intervention × Dollar Debt					0.205**
					(0.0790)
Observations	2101	1081	105103	7848	116754
R-squared	0.0934	0.117	0.0343	0.205	0.0864
Firm FE	Yes	Yes	Yes	Yes	Yes
Country × Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

Intervention is unexpected if the residual from estimating FXI rule is greater than the mean in absolute value. ▶ Back

	Exchange rate depreciation		
	(1)	(2)	(3)
FFR shock	0.142***	-0.0201	0.121**
	(0.0371)	(0.0605)	(0.0410)
Intervention			-0.0465
			(0.162)
FFR shock × Intervention			-0.150*
			(0.0759)
Observations	627	208	836
R-squared	0.0691	0.242	0.0705
Intervention	No	Yes	Both
Country FE	Yes	Yes	Both
Country and Date Clusters	Yes	Yes	Both

Intervention is unexpected if the residual from estimating FXI rule is greater than 75 percentile in absolute value. ▸ Back

	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
	(1)	(2)	(3)	(4)	(5)
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.595***	0.0179	-0.0989**	-0.111	
	(0.121)	(0.155)	(0.0451)	(0.101)	
FFR shock × Dollar Debt					-0.188***
					(0.0594)
FFR shock × Intervention × Dollar Debt					0.223**
					(0.0870)
Observations	2578	609	109683	3636	116754
R-squared	0.0895	0.181	0.0339	0.148	0.0862
Firm FE	Yes	Yes	Yes	Yes	Yes
Country × Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

Intervention is unexpected if the residual from estimating FXI rule is greater than 75 percentile in absolute value. ▶ Back

Currency Denomination of Stock Price

	(1)	(2)	(3)	(4)	(5)
	Change in stock price ($\log(p_{i,t+1}) - \log(p_{i,t-1})$)				
Dollar Debt	Yes	Yes	No	No	Both
Intervention	No	Yes	No	Yes	Both
FFR shock	-0.761***	-0.217**	-0.175**	-0.156***	
	(0.120)	(0.104)	(0.0751)	(0.0552)	
FFR shock $\times$ Dollar Debt					-0.263***
					(0.0697)
FFR shock $\times$ Intervention $\times$ Dollar Debt					0.242***
					(0.0672)
Observations	1926	1258	103155	9914	116753
R-squared	0.103	0.113	0.0358	0.205	0.162
Firm FE	Yes	Yes	Yes	Yes	Yes
Country $\times$ Date FE	No	No	No	No	Yes
Firm and Date Clusters	Yes	Yes	Yes	Yes	Yes

The stock price in the dependent variable is denominated in USD rather
than local currency. The effect of FFR shock is larger since local currency
depreciates against USD. ▸ Back