

Currency Hedging in Emerging Markets

Managing cash-flow exposure

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The opinions and assessments expressed in this presentation do not necessarily reflect those of the Central Bank of Chile or its Board Members.

Currency Hedging in Emerging Markets: Motivation

- Use of foreign currency is prevalent in EME → currency mismatches
 - trade, capital markets, funding for banks and non-financial firms; original sin, fear of floating

(Eichengreen and Hausmann, 1999; Calvo and Reinhart, 2002; Céspedes et al., 2004; Goldberg and Tille, 2009; Rey, 2013; Bruno and Shin, 2015; Gopinath, 2015; Itzetzi et al., 2019; etc.)

- Although FX-derivative markets are among the largest markets in the world, 70% of daily global turnover FX market is in FX-derivatives; 30% spot
 - Non-existent in EMEs two decades ago
 - Last decade has seen impressive growth in size and scope
(\$1.6 trillion per day in April 2019, whereas spot trading was less than \$0.5 trillion; growth rates 60% (2016-2019), BIS,2019)
- Growth in EMEs has received less attention
 - ER volatility and associated vulnerabilities could matter the most
 - Data limitation

Currency Hedging: Questions

1. Do firms exploit natural hedging?
2. Which firms use FX-derivatives?
3. Is hedging complete?
4. Does the development of the FX derivatives market, and financial markets in general, affect firms' FX hedging decisions? How?

Currency Hedging in Emerging Markets: Approach

- Rich detailed firm-level data (2005-2018) for Chile linking:
 1. Foreign currency (FX) derivatives (daily, contract level)
 2. Foreign currency debt; information also for local debt
 3. Custom's data on international trade and trade credits
 4. Employment/sales data from IRS
 5. Tax IDs
 - Comprehensive: firms' joint decision on trade, financing and hedging
 - Representative: sample accounts for 85% of total employment
- Policy reform to study the role of financial intermediaries in affecting the dynamics of the forward exchange rate markets: changes in pension fund regulation.

Currency Hedging in Emerging Markets: Summary of Findings

- Stylized facts:
 1. Natural hedging of currency risk is limited
 2. Financial hedging is more likely to be used by larger firms and hedge larger amounts
 3. Firms in international trade are more likely to use FX derivatives to hedge their gross (rather than net) cash currency risk
 4. Firms are more likely to pay larger premiums for longer maturity contracts
- Policy reform: negative supply shock—reducing the liquidity of FX derivatives to firms—lowers firms use of FX derivatives and increases the forward premium and amounts hedged.

Currency Hedging in Emerging Markets

1. Do firms exploit natural hedging?

- No
- Natural hedging is limited. Firms tend to hedge cash in/out-flows separately

2. Which firms use FX-derivatives?

- Yes
- Larger firms (employment, sales); with operations in FX (in particular int. trade)

3. Is hedging complete?

- No
- Firms hedge larger amounts and pay extra for longer maturities

4. Does the development of the FX derivatives market, and financial markets in general, affect firms' FX hedging decisions? How?

- Yes.
- Market liquidity firms' hedging decisions

Related Literature: Use of FX Derivatives

- Papers have exploited net positions of listed/MNCs firms or survey data; proxies.
 - Operational hedging (geographic dispersion, # of countries/regions of operation)→ not a good substitute for financial hedging; US MNC financial statements (1996-98), Allayannis et al. (2001)
 - Firms with ex-ante foreign currency exposure → use of different types of derivatives (economies of scale in firm's risk management programs); 372 Fortune-500 firms, Geczy et al. (1997)
 - Use of FX derivatives to be more prevalent in firms with exchange rate exposure; (Korea, Bae et al. (2018); Euro area, Lyonnet, et al. (2016); Germany, Kuzmina and Kuznetsova (2018); Brazil, Rossi-Junior (2012); Colombia, Alfonso-Corredor (2018); Chile, Miguel (2016); Mexico, Stein et al. (2021)
- Transaction-level data + broad coverage: firms that use FX derivatives are **larger, and hedging is partial**: fixed costs (but not restricted to risk management); (Melitz (2003); Alfaro and Chen (2018); Salōmao and Valera (2020)
- Even firms with international trade and debt exposure **do not fully exploit natural hedges and partially hedge gross positions.**

Related Literature, Cont.

- Timing of operational and financial milestones (signing of contract, delivery/sales of products or services, payments) in the day-to-day operation of a firm: key to understanding its foreign currency risk exposure.
 - Foreign currency cash-flows + domestic currency obligations (taxes, wages, others)
 - Natural hedging may still render firms vulnerable to currency fluctuations associated to working capital obligations.
- Value of Hedging–Different types of capital market imperfections: financial frictions, information asymmetries, transaction costs, tax schedules (Smith and Stulz, 1985; Froot et al., 1993)
- **Role of financial intermediaries in shaping exchange rate markets**
Correia et al. (2010); Liao and Zhang (2020)
 - Pensions Funds: Supply shock to the short side of FX-derivatives market, affected firms hedging decisions increasing exchange rate exposure temporarily.

Plan of the presentation

- 1.- Background + Data
- 2.- Four stylized facts
- 3.- Market liquidity $\leftarrow$ regulatory change to Pension Funds (AFPs) hedging requirements

Background + Data

Merge of Detailed Administrative Data, Chile (2005-18)

1. **FX-derivatives:** Daily, census, transaction-level (data since 1997); this paper > 7 days; after 2005

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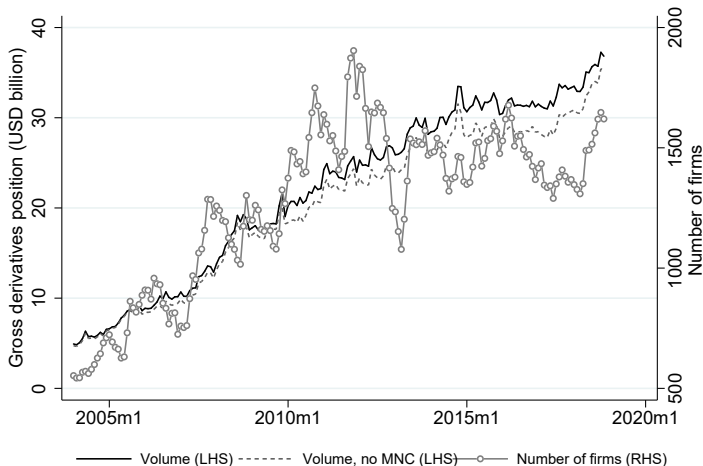
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4. **Firm data:** Yearly, census, firm-level. Includes: sales, sector, age and workers
 - Merge using tax ID (create firms); end of month.
 - Sample accounts for 85% of total (dependent) employment in the economy; FX-derivatives firms, 26%.
 - Any given year: close to 30,000 firms (105,000 in total), from which 1,300 (7,300 in total) use FX-derivatives between 2005-2018.

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 - Any given year: close to 30,000 firms (105,000 in total), from which 1,300 (7,300 in total) use FX-derivatives between 2005-2018.
- Chile: data quality + stable macro balances (no domestic fueled crisis)
- OTC, FX derivatives > R derivatives, (BIS, 2019).

FX derivatives market and Chile

Fig: Number of firms and gross FX Derivatives positions



Gross FX-Derivatives position is the sum of long and short positions.
Volume and number of firms consider only those in the non-financial corporate sector

Data: 1. Fx derivatives snapshot

- Total contracts close to 1.9 million; close to 725K are with one non-financial firm counter-party, (excludes < 7 days, 1.4% of sample).

B. By type of operation, Non-Financial firms only

Type	Non-Financial Firms: purchases					Non-Financial Firms: sales				
	Obs.	Share	Notional	Maturity	Non-	Obs.	Share	Notional	Maturity	Non-
	(#)	(%)	Median (\$ 000)	Median (days)	delivery (%)	(#)	(%)	Median (\$ 000)	Median (days)	delivery (%)
	(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(10)	(11)
Forwards	452,145	89.4	1324.2	80.9	57.5	187,591	85.8	1270.8	113.6	83.6
Futures	299	0.1	1935.5	92.2	90.3	57	0.0	645.0	50.9	42.1
Call options	6,470	1.3	617.7	145.4	93.8	14,944	6.8	758.8	172.6	90.1
Put options	7,086	1.4	736.7	153.4	92.5	6,138	2.8	985.1	200.2	94.9
Swaps	141	0.0	7670.8	1839.6	61.7	93	0.0	4819.1	1464.8	49.5
FX swaps	11,810	2.3	4024.3	74.4	26.6	3,840	1.8	3524.6	88.1	69.0
CC Swaps	27,725	5.5	1120.0	635.9	2.7	6,074	2.8	3605.2	907.6	18.0
Total	505,676	100.0	1,360.9	113.5	54.7	218,737	100.0	1333.5	142.2	82.3

Samples: 2005-2018

- Non-financial firms (close to 105,000)
- Without and with MNCs, (90% domestic firms)
- Without and with copper (244 firms, 4,561 contracts)
- Subsets of only X, only M, trade (X & M), only debt, debt & trade.
- Without and with swaps
- Dollar hedging ($> 85\%$ of sample; robustness all currencies)

Four Stylized Facts

Fact 1. *Firms' use of natural hedging is limited*

- Many firms have operational/ financial exposure to foreign currency (FC)
- If FC cash-flows go in opposing directions → Firms could *naturally hedge*. Do they? What is the correlation between the value of receivable and payables in FC?

Outstanding balances

$$X_{i,m}^{TC} = \alpha_0 + \alpha_1 (M_{i,m}^{TC} + FCD_{i,m}) + \eta_i + \eta_{j,y} + \varepsilon_{i,m}$$

For firm i , month m , industry j

- $X_{i,m}^{TC}$, Trade credit from exports (log)
- $M_{i,m}^{TC}$, Trade credit from imports (log)
- $FCD_{i,m}$, foreign currency debt (log)
- firm FE; industry $\times$ year FE; errors clustered at the firm-level

→ $\alpha = 1$, naturally hedged

Fact 1. Firms' use of natural hedging is limited

Dependent variable: (log) Exports trade credit $\times TC$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
M^{TC}	0.024** (0.008)	0.023*** (0.006)					
$M^{TC} + FCD$			0.028*** (0.006)				
$M^{TC} \times 1(\text{Trade only})$				0.009 (0.008)	0.016* (0.007)	0.018** (0.006)	0.036* (0.014)
$M^{TC} \times 1(\text{Trade and FX})$				0.022* (0.008)	0.026*** (0.008)	0.025*** (0.007)	0.046** (0.015)
$M^{TC} \times 1(\text{Trade and FCD})$				0.052** (0.018)	0.055** (0.019)	0.051** (0.019)	0.076* (0.031)
$M^{TC} \times 1(\text{Trade and FX and FCD})$				0.053* (0.027)	0.072** (0.025)	0.053** (0.018)	0.068*** (0.020)
Observations	1367449	1354886	1354886	1372486	1367449	1354886	173820
R Squared	0.0049	0.029	0.048	0.0034	0.0083	0.034	0.023
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Include MNC	-	-	-	Yes	-	-	-
Include Mining	Yes	-	-	Yes	Yes	-	-
$X > 0$ & $M > 0$	-	-	-	-	-	-	Yes

All variables in logs

Fact 1. *Firms' use of natural hedging is limited*

- Look directly at cash flows (from trade credits) maturing in the same period t ,

$$X_{i,m}^{CF} = \alpha_0 + \alpha_1(M_{i,m}^{CF} + FCD_{i,m}) + \eta_i + \eta_{j,y} + \varepsilon_{i,m}$$

For firm i , month m

- $X_{i,m}^{CF}$, cash-flow maturing-in- t from export trade credit
- $M_{i,m}^{CF}$, cash-flow maturing-in- t from import trade credit

Fact 1. Firms' use of natural hedging is limited: Flows Maturing in the Same Period

	Dependent variable: (log) Exports trade credit $\times CF$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
M^{CF}	0.026*** (0.008)	0.022*** (0.005)					
$M^{CF} + FCD$			0.020*** (0.005)				
$M^{CF} \times 1(\text{Trade only})$				0.014 (0.008)	0.018** (0.007)	0.017** (0.005)	0.045*** (0.013)
$M^{CF} \times 1(\text{Trade and FX})$				0.031** (0.010)	0.037*** (0.009)	0.029*** (0.006)	0.063*** (0.012)
$M^{CF} \times 1(\text{Trade and FCD})$				0.019 (0.017)	0.048** (0.016)	0.039* (0.016)	0.069*** (0.020)
$M^{CF} \times 1(\text{Trade and FX and FCD})$				0.034*** (0.010)	0.034*** (0.010)	0.026** (0.008)	0.049*** (0.015)
Observations	1484735	1472050	1472050	1489806	1484735	1472050	181476
R Squared	0.0099	0.034	0.034	0.013	0.011	0.036	0.049
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Include MNC	-	-	-	Yes	-	-	-
Include Mining	Yes	-	-	Yes	Yes	-	-
$X > 0 \ \& \ M > 0$	-	-	-	-	-	-	Yes

All variables in logs

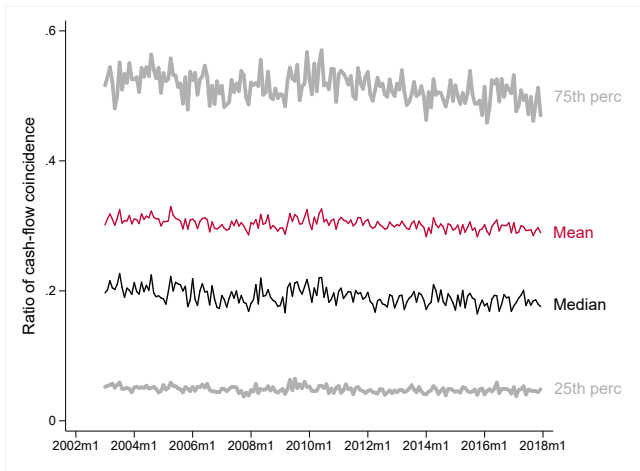
→ Little support for hypothesis of natural hedging; firms retain currency risk

Fact 1. *Firms' use of natural hedging is limited: Maturity and Timing of Flows*

- Weak correlation between exports and imports trade credit balances at the firm level

	Maturity in days							Num. Obs.
	Mean	St. Dev.	Min	p10	Median	p90	Max	
Imports trade credit	91	58	0	30	88	180	540	1,435,768
Exports trade credit	137	94	0	21	115	267	540	433,354
Foreign currency debt	1375	1291	30	90	1099	2880	10830	10,103

Coincidence of Cash Flows (Trade Credits)



Note.— All series show moments of within-period distributions of the coincidence measure. Thick gray lines show the 25th and 75th percentiles, solid black line depicts the median, and the dashed black line the mean across observations within a month.

Fact 2. *Firms using FX derivatives are “selected”: Larger Firms Hedge*

	2006			2016		
	(1) Yes	(2) No	(3) Log-difference	(4) Yes	(5) No	(6) Log-difference
A. Size: All firms						
Employment (workers)	374.87	112.53	1.61***	452.64	106.96	1.84***
Sales (M\$)	17.22	5.28	1.33***	20.85	5.63	1.50***
B. Size: No trading firms						
Employment (workers)	281.00	67.13	1.83***	339.63	98.36	0.65***
Sales (M\$)	11.61	3.23	1.16***	13.37	4.57	0.86***
C. Size: Firms in international trade						
Employment (workers)	396.05	114.57	1.61***	480.93	108.53	1.84***
Sales (M\$)	18.48	5.38	1.33***	22.72	5.82	1.50***
Exports (M\$)	7.75	1.65	0.32***	2.08	1.38	0.18***
Imports (M\$)	4.94	0.47	0.65***	4.25	0.37	0.76***
Exports TC (M\$)	7.66	1.60	0.31***	1.99	1.29	0.17***
Imports TC(M\$)	4.80	0.44	0.63***	3.85	0.31	0.71***
D. Size: Firms in Debt Market						
Employment (workers)	833.11	197.28	2.72***	1167.60	341.66	2.65***
Sales (M\$)	27.34	6.30	2.04***	36.47	14.14	1.72***
Foreign Debt (M\$)	105.94	15.08	1.98***	549.24	101.39	2.54***

- Echoes literature differences between purely domestic and firms in international activity: trade, MNCs, foreign borrowing; (fixed cost)

Fact 2. *FX derivatives are more likely used to hedge larger amounts.*

Firms hedge larger amounts

- Which operations do firms hedge? → not straightforward
- Match an FX contract i with an import/export j
- Coarsened Exact Matching algorithm [Iacus et al. \(2012\)](#)
 - Exact match on firm ID, maturity date + coarsened match on notional amount
 - Look at matched/unmatched trade operations (only trade)
- Consider for A_c, i, m the contract- c amount for firm- i in month- m ,

$$A_{c,i,m} = \alpha_1 \mathbf{1}(\text{Hedged})_c + \eta_i + \eta_m + \epsilon_{c,i,m}$$

Fact 2. *Firms in trade tend to use FX derivatives contracts to hedge larger amounts*

A. Exports (amount of exports trade credit contracts, in logs)			
	2006	2016	2005-2018
	(1)	(2)	(3)
1(Hedged)	0.762*** (0.126)	0.517*** (0.144)	0.630*** (0.110)
Observations	14,948	16,576	213,364
R-squared	0.40	0.37	0.32
Firm FE	Yes	Yes	Yes
Month FE	-	-	Yes

B. Imports (amount of imports trade credit contracts, in logs)			
	2006	2016	2005-2018
	(1)	(2)	(3)
1(Hedged)	0.558*** (0.065)	0.551*** (0.101)	0.597*** (0.045)
Observations	15,146	18,224	196,104
R-squared	0.36	0.35	0.31
Firm FE	Yes	Yes	Yes
Month FE	-	-	Yes

Fact 2. *Firms in trade tend to use FX derivatives contracts to hedge larger amounts*

Firms hedge larger amounts

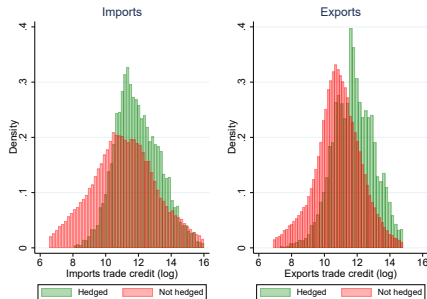


Fig: Distribution of transaction size by hedging decision

Fact 3. *Extensive margin use of FX derivatives: more likely for firms in international trade; Intensive margin: more related to gross—rather than net—exposures.*

Want to characterize the use of FX derivatives

$$FX_{i,m} = \beta_0 + \beta_1 X_{i,m}^{TC} + \beta_2 M_{i,m}^{TC} + \beta_3 FCD_{i,m} + \eta_i + \eta_{j,y} + \varepsilon_{i,m},$$

for firm i , end of the month

- $FX = 1$, firm uses FX derivatives (extensive margin)
- Or FX^{POS} =Short/Long position, in logs (intensive margin)
- X^{TC} , exports trade credit
- M^{TC} , imports trade credit
- FCD , foreign debt
- firm, industry-year FE; clustered errors at the firm level

Fact 3. *Extensive margin use of FX derivatives: more likely for firms in international trade; Intensive margin: more related to gross—rather than net—exposures*

Tab: Use of FX derivatives – extensive margin

	Dependent variable 1(firm uses FX derivatives)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
X^{TC}	0.020*** (0.005)			0.019*** (0.005)	0.022*** (0.005)	0.022*** (0.005)	0.018*** (0.004)
M^{TC}		0.049*** (0.005)		0.048*** (0.005)	0.053*** (0.006)	0.052*** (0.006)	0.057*** (0.005)
FCD			-0.014* (0.005)	-0.013* (0.006)	-0.011 (0.007)	-0.011 (0.006)	-0.006 (0.005)
$X^{TC} \times M^{TC}$					-0.009** (0.003)	-0.009* (0.003)	-0.007* (0.003)
$X^{TC} \times FCD$					0.002 (0.003)	0.002 (0.002)	-0.000 (0.002)
$M^{TC} \times FCD$					-0.006* (0.003)	-0.006* (0.003)	-0.006* (0.003)
Observations	2,091,293	2,091,293	2,091,293	2,091,293	2,091,293	2,102,357	2,112,240
R Squared	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes MNC	-	-	-	-	-	Yes	Yes
Includes Mining	-	-	-	-	-	-	Yes

Fact 3. Extensive margin use of FX derivatives: more likely for firms in international trade; Intensive margin: more related to gross—rather than net—exposures.

Tab: Sales of FX derivatives – intensive margin

Sales of FX derivatives							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
X^{TC}	0.043*** (0.009)			0.043*** (0.008)	0.042*** (0.008)	0.042*** (0.008)	0.031*** (0.009)
M^{TC}		0.013 (0.008)		0.012 (0.008)			
FCD			-0.014 (0.014)	-0.015 (0.014)	-0.014 (0.013)	-0.018 (0.012)	-0.011 (0.011)
M^{TC} by exp.					0.021* (0.009)	0.021* (0.009)	0.025* (0.010)
M^{TC} by non-exp.					0.002 (0.007)	0.002 (0.007)	0.007 (0.008)
Observations	2,081,746	2,081,746	2,081,746	2,081,746	2,081,746	2,092,810	2,112,240
R Squared	0.54	0.54	0.54	0.54	0.54	0.54	0.53
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes MNC	-	-	-	-	-	Yes	Yes
Includes Mining	-	-	-	-	-	-	Yes

Fact 3. *Extensive margin use of FX derivatives: more likely for firms in international trade; Intensive margin: more related to gross—rather than net—exposures.*

Tab: Purchases of FX derivatives – intensive margin

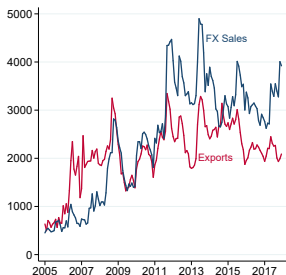
	Purchases of FX derivatives						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
X^{TC}	0.004 (0.008)			-0.000 (0.007)			
M^{TC}		0.155*** (0.015)		0.155*** (0.015)	0.155*** (0.015)	0.154*** (0.015)	0.145*** (0.016)
FCD			-0.007 (0.014)	-0.005 (0.014)	-0.005 (0.014)	-0.003 (0.013)	0.001 (0.012)
X^{TC} by importers					0.002 (0.009)	0.001 (0.009)	-0.001 (0.009)
X^{TC} by non-importers					-0.005 (0.006)	-0.004 (0.006)	-0.005 (0.006)
Observations	2,081,746	2,081,746	2,081,746	2,081,746	2,081,746	2,092,810	2,112,240
R Squared	0.64	0.65	0.64	0.65	0.65	0.65	0.65
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes MNC	-	-	-	-	-	Yes	Yes
Includes Mining	-	-	-	-	-	-	Yes

► Debt Robustness

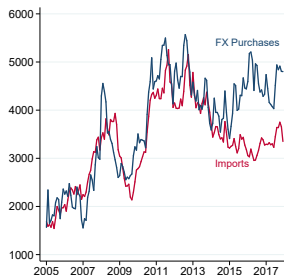
Fact 3. *Extensive margin use of FX derivatives: more likely for firms in international trade; Intensive margin: more related to gross—rather than net—exposures.*

- A large portion of firms that both import and export, hedge imports and exports separately

(a) Exports and short FX position



(b) Imports and long FX position



Notes: Sample used in this figure excludes firms which have foreign currency debt, to avoid biasing upwards the estimation of the use of FX derivatives. Correlations between series are 0.73 for exports, and 0.84 for imports. This sample also excludes multinational corporations, and mining related companies. Results without exclusion of such firms make the results stronger.

Fact 4. *FX derivatives contracts are priced differently according to maturity*

Focus on *contract* level analysis, FX contract- c , signed in day- d , which matures in N days

Forward Premium and Maturity

- Definition: (annualized daily average premium)

$$FXP_{c,d,N} = \frac{F_{c,d,N} - S_d}{S_d} \times \frac{360}{N}$$

- Consider for contract c , firm i , bank b , in day d , and maturity in days N

$$FXP_{c,i,b,d} = \beta_1 A_{c,i,b,d} + \beta_2 N_{c,i,b,d} + \beta_3 D_{c,i,b,d} + \beta_4 \mathbf{X}_{i,y} + \eta_i + \eta_{b,m} + \eta_m + \epsilon$$

- firm and month FE, clustered errors at the firm level.

Fact 4. *FX derivatives contracts are priced differently according to maturity*

Forward premium: contract level analysis

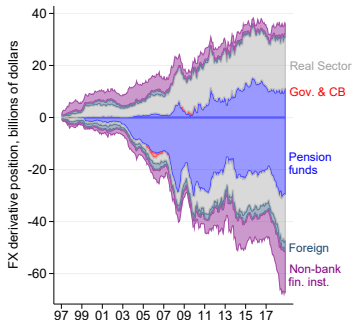
	FX Purchases			FX Sales		
	(1)	(2)	(3)	(4)	(5)	(6)
Maturity	0.425** (0.197)	0.425** (0.197)	0.330*** (0.067)	-2.117*** (0.384)	-2.120*** (0.384)	-1.154*** (0.172)
Sales	-0.157* (0.086)	-0.156* (0.087)	-0.123** (0.062)	0.075 (0.132)	0.076 (0.132)	0.207** (0.081)
Notional amount		0.014 (0.052)	-0.039* (0.023)		-0.046 (0.067)	0.016 (0.042)
Delivery instrument		0.158 (0.198)	0.146* (0.085)		-0.330 (0.336)	-0.238 (0.197)
Observations	343,621	343,621	251,497	133,424	133,424	96,904
R Squared	0.18	0.18	0.3	0.22	0.22	0.38
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
FX Purchases and FX Sales	-	-	Yes	-	-	Yes

Notes: Standard errors clustered at the firm level reported in parentheses. FXP in percentage points. Notional amount is defined as the (log) of the amount hedged in a given contract. Maturity is calculated as days from signing of the contract to its maturity ($N_{t,f,b,i}$). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

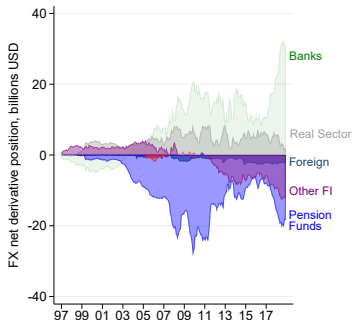
A Supply Shock

The FX derivatives market: Pension funds are large(est) players

A. Gross FX derivatives position



B. Net FX derivatives position



PFs' currency exposure abroad is subject to regulation limit → sell USD forward

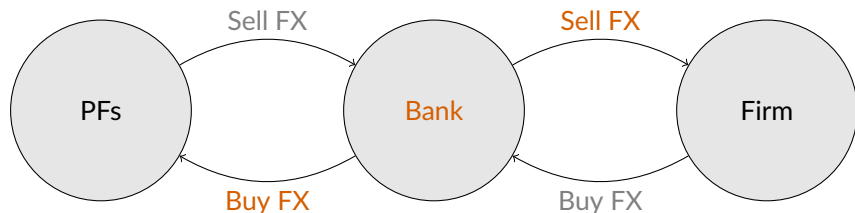
- PFs hold investments abroad
- Regulation limits the share of un-hedged portfolio in FC
 - In 2012 limits were adjusted importantly
 - Announced May 2012, approved in Jun-2012, enforced in Dec-2012

PFs' limit for share of non-hedged portfolio in FC

Effective from	A	B	Fund C	D	E
Regulation before 2012	50%	40%	35%	25%	15%
December 2012	50% of investment-grade portfolio, by currency denomination if such currency represents more than 1% of the Fund				

Supply Shock—FX derivatives market

- Regulation limits the share of PFs' un-hedged portfolio abroad (in FC)
- Banks retain no currency risk: market makers



- Change (relax) in regulation: PFs need not sell as much FX

Supply Shock—FX derivatives market

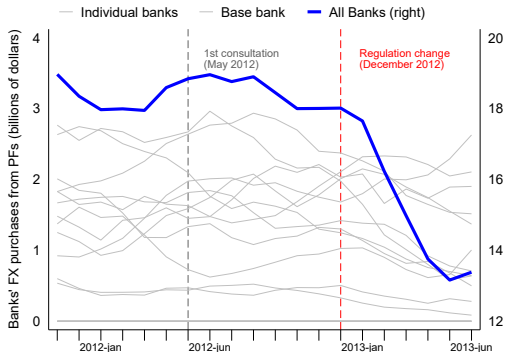


Fig: Banks' purchases of FX derivatives from Pension Funds

A Market-Level Shock: Identification Strategy

1. Average response of firms across all banks.
2. Control for changes in firms' hedging demand and capture banks' individual changes: time-varying firm and bank fixed effects
 - Supply of FX derivatives to firms.
 - Price of FX derivatives/forward premium
 - Additional check: from AFPs to Banks
3. Aggregate impact of the regulatory change on firms' hedging policies
4. Effect of the supply shock on firms' hedging decisions at the intensive and extensive margins

Average Effect Across Banks: Effect on Firms' FX Hedging

- Drastic decline in FX purchases from banks to PF following the change in regulation
- Then, banks reduced their supply of FX derivatives to firms
- By how much did firms reduce their hedging?

$$FX_{i,\tau}^{\text{Long}} = \beta_1 Post_{\tau} + \eta_i + \varepsilon_{i,\tau},$$

with

- $FX_{i,\tau}^{\text{Long}}$ = log of the average outstanding FX position by firm i in period τ ;
- $Post_{\tau} = 1$ Dec 2011-May2012; Dec 2012-May 2013;
- firm FE; clustered errors at the firm level

Firms' FX Hedging: Lower After Regulation Change

Tab: Purchases of FX derivatives before and after change in regulation

A. 6 month window. Before: Dec 2011-May 2012, After: Dec 2012-May 2013				
	Outstanding (log)		Annual Growth (%)	
	(1)	(2)	(3)	(4)
1(Post)	-0.084** (0.045)	-0.094** (0.048)	-0.550*** (0.099)	-0.545*** (0.103)
Observations	688	684	616	614
R Squared	0.111	0.15	0.59	0.40
Firm FE	Yes	Yes	Yes	Yes
Includes Mining and MNC	Yes	—	Yes	—

Supply Shock—FX Derivatives Market: Bank's Individual Supply Shocks

Digging deeper

- Exploit richness of our dataset we seek to estimate **bank-specific supply shocks**, OTC market (banks' as intermediaries)
(Amiti Weinstein (2016), Alfaro et al. (2020), others)

$$D(FX_{i,b,\tau}) = \alpha_{i,\tau} + \beta_{b,\tau} + \varepsilon_{i,b,\tau} \quad (1)$$

- with
 - $D(FX_{i,b,\tau}) = \Delta(\text{before/after})$ in firm i 's outstanding FX-purchases from bank b
 - $\alpha_{i,\tau}$ is a firm-time fixed effect,
 - $\beta_{b,\tau}$ is a bank-time fixed effect
 - clustered errors at the bank level
- Requires firms' "multibanking"; base bank.

Supply Shock—FX Derivatives Market: AFPs to Banks

- Banks that purchased more FX derivatives from pension funds before the shock: larger decrease in the sales of FX derivatives to firms post reform

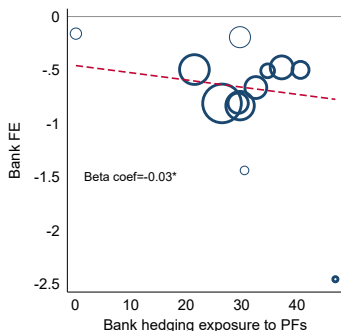


Figure: Estimated bank-specific supply shocks

Note.— Vertical axis: estimated bank fixed effects; horizontal axis; Pension Funds' share (%) in each bank's total purchases of FX derivatives before the regulation change. Circle sizes represent share of bank in total sales of FX derivatives from banks to firms. Red dashed line represents weighted linear fit. Thick lined circles are significant bank-specific-supply effects at least 10% confidence level.

Supply Shock–FX Derivatives Market: Banks' Shock

Table: Banks' sales of FX-derivatives to firms: supply side

A. FX-derivatives purchases by firms (Growth Rate)					B. Forward premium (pp.)				
	All firms		Firms in trade			All firms		Firms in trade	
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	$\beta_{b,\tau}$	Cum. share	$\beta_{b,\tau}$	Cum. share		$\beta_{b,\tau}$	Cum. share	$\beta_{b,\tau}$	Cum. share
Bank 1	-2.454** (0.634)	—	-2.478** (0.622)	—	Bank a	2.100*** (0.441)	—	2.221*** (0.314)	—
Bank 2	-1.437*** (0.300)	—	-1.209*** (0.379)	—	Bank b	2.100** (0.854)	—	1.658** (0.718)	—
Bank 3	-0.832*** (0.086)	—	-0.764*** (0.069)	—	Bank c	1.772* (0.953)	—	1.414 (0.844)	—
Bank 4	-0.812*** (0.126)	—	-0.801*** (0.131)	—	Bank d	1.701*** (0.503)	—	1.380*** (0.395)	—
Bank 5	-0.809*** (0.169)	0.65	-0.481** (0.187)	0.45	Bank e	1.261** (0.416)	0.38	0.098 (0.394)	0.43
Bank 6	-0.663*** (0.153)	—	-1.451** (0.552)	—	Bank f	1.108*** (0.345)	—	1.165** (0.395)	—
Bank 7	-0.507*** (0.128)	—	-0.455*** (0.147)	—	Bank g	0.945** (0.342)	0.76	1.342** (0.459)	0.81
Bank 8	-0.498** (0.167)	—	-0.562*** (0.137)	—	Bank h	0.539 (0.815)	—	0.448 (0.573)	—
Bank 9	-0.495*** (0.124)	—	-0.615*** (0.104)	—	Bank j	0.100 (0.633)	—	-0.698 (0.670)	—
Bank 10	-0.475*** (0.120)	0.90	-0.440*** (0.100)	0.88	Bank k	-2.448 (1.985)	—	-10.718*** (2.816)	—
Bank 11	-0.193 (0.143)	—	-0.127 (0.130)	—	Bank l	-3.007** (1.007)	—	-2.126*** (0.685)	—
Bank 12	-0.160 (0.150)	1.00	-0.118 (0.168)	1.00	Bank m	-4.491 (4.048)	1.00	-5.693 (3.259)	1.00
Obs.	806		695		Obs.	583		495	
R2	0.48		0.49		R2	0.65		0.70	

Supply Shock—FX Derivatives Market: Market-Share-Weighted Aggregate Effect

Table: Aggregate Effects of the Supply Shock

	FX-derivatives purchase (Growth Rate)	Forward Premium (pp.)
	(1)	(2)
All Firms	-0.579*** (0.069)	0.705* (0.373)
Int. Trade	-0.520*** (0.055)	0.775*** (0.227)

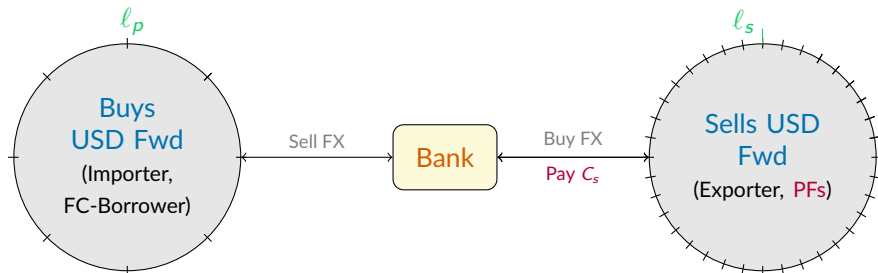
Supply Shock—FX Derivatives Market: Firms' FX Hedging

$$Y_{i,m} = \beta_1 X_{i,m}^{TC} + \beta_2 M_{i,m}^{TC} + \beta_3 FC_{i,m} + Post_{\tau} \left(\beta_4 + \beta_5 X_{i,m}^{TC} + \beta_6 M_{i,m}^{TC} + \beta_7 FCD_{i,m} \right) + \eta_f + \eta_{j,m} + \varepsilon_{i,m},$$

	Extensive margin	Intensive margin	
		Purchases	Sales
X^{TC}	0.018** (0.008)	-0.000 (0.008)	0.039*** (0.006)
M^{TC}	0.029*** (0.008)	0.018** (0.006)	0.016* (0.008)
FC Debt	0.004 (0.010)	0.028* (0.016)	-0.010 (0.023)
1(Post)*Exports	-0.047*** (0.006)	-0.003 (0.006)	-0.069*** (0.007)
1(Post)*Imports	0.001 (0.005)	-0.017** (0.007)	-0.001 (0.070)
1(Post)*FC Debt	0.002 (0.005)	-0.012 (0.008)	-0.008 (0.011)
1(Post)	-0.023*** (0.002)	-0.014 (0.079)	-0.040 (0.082)
Observations	111,458	108,320	108,320
R Squared	0.053	0.76	0.68
Num. Firms	14152	14011	14011
Firm FE	Yes	Yes	Yes

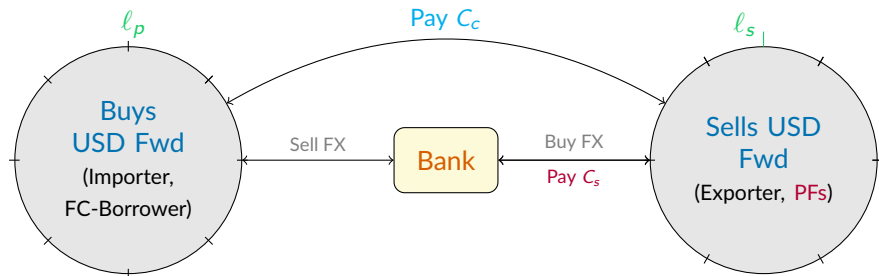
Note.— Estimation uses same sample as bank-specific supply shock equation

Sketch of Model-Market Thickness



- Importer wants to buy USD forward in t , with maturity N and amount A , indexed by ℓ_p
- Bank sells FX derivative ℓ_p and buys opposite position ℓ_s
- Bank pays a search cost C_s and easily finds a seller of ℓ_s in a thick market

Sketch of Model-Market Thickness



- Pension funds exit the market temporarily
- Bank **evaluates selling** FX derivative ℓ_p , but cannot find a seller of opposite position ℓ_s
- Bank **does not sell** ℓ_s
- Firms who normally sell USD forward, know they cannot later buy, so they too stop selling → pay coordination cost C_c , market is even thinner.

Conclusion

- We merge a unique dataset covering the census of firms and their hedging decisions
- Four stylized facts
 1. Natural hedging is limited
 2. Larger firms hedge, firms in trade hedge larger amounts
 3. Hedging is partial and more closely related to gross positions.
 4. Firms hedge larger amounts and pay extra for longer maturities
- The disagreement in timing between payables and receivables in foreign currency, and their interaction with domestic currency obligations, opens for firms the need to use financial hedges of gross transactions.
- Supply shock to the FX derivatives market → banks transmitted to firms
- Liquidity: key for mitigating systemic risk; overall financial sector (pensions', banks') play a pivotal role
 - Firms hedging activities

Currency Hedging in Emerging Markets

Managing cash-flow exposure

Laura Alfaro
(Harvard & NBER)

Mauricio Calani
(Central Bank of Chile)

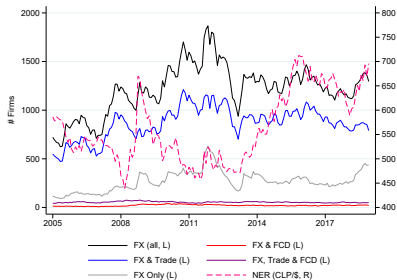
Liliana Varela
(LSE & CEPR)

2021

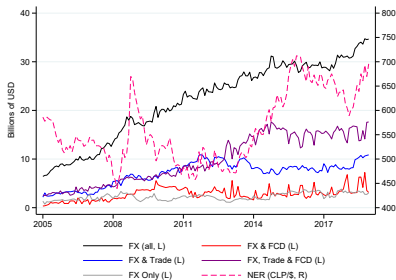
Appendix

Use of FX derivatives by type of firm

(a) Number of firms



(b) Gross derivative position

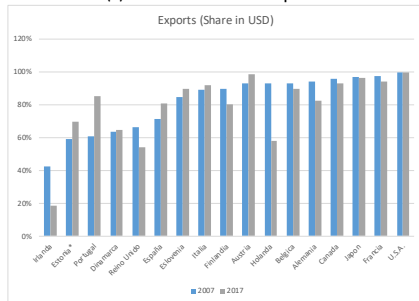


Notes: Categories of firms are mutually exclusive, except for the "(all)" category which includes all the others.

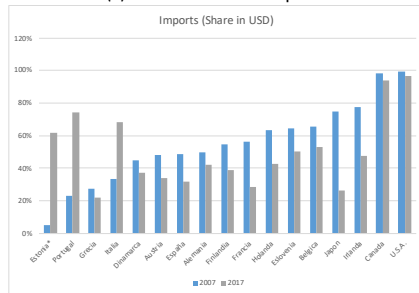
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Currency of Trade

(a) Share of USD in Exports



(b) Share of USD in Imports



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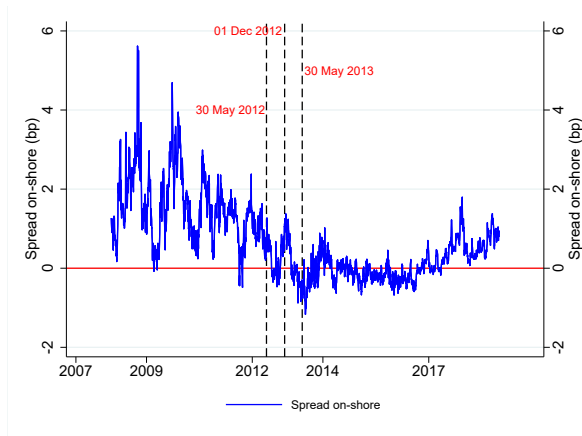
Exchange Rate and Interest Rate

Exchange Rate (CHP/USD) and Interest Rate (3 Months)



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Covered Interest Rate Parity



- $(1 + i_{t,n}^* + x_{t,n}) = (1 + i_{t,n}) * \frac{S_t}{F_{t,t+n}}$, where $i_{t,t+n}^*$ and $i_{t,t+n}$, n -year risk-free interest rates quoted at date t in U.S. dollars and Chilean pesos; S_t the spot exchange rate, and $F_{t,t+n}$ the n -year outright forward exchange rate signed in t ; $x_{t,n}$ the measure of CIP deviation

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Fact 3. *Intensive Margin: Robustness Debt*

	(1)	(2)	(3)	(4)
M^{TC}	0.145*** (0.016)	0.145*** (0.016)	0.141*** (0.017)	0.141*** (0.017)
FCD	0.001 (0.012)		0.032+ (0.020)	
X^{TC} by imp.	-0.001 (0.009)	-0.001 (0.008)	0.002 (0.009)	0.001 (0.009)
X^{TC} by non-imp.	-0.005 (0.006)	-0.005 (0.006)	-0.001 (0.007)	-0.001 (0.007)
FCD, up to 6 months		0.008 (0.012)		0.019 (0.015)
FCD, 7 to 1 year		0.017 (0.014)		0.029* (0.017)
FCD, 1 to 2 years		0.021 (0.017)		0.028 (0.020)
FCD, more than 2 years		0.003 (0.012)		0.039* (0.021)
Observations	2112240	2112240	2121848	2121848
R Squared Fe	0.65	0.65	0.69	0.69
Firm FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
Includes MNC	Yes	Yes	Yes	Yes
Includes Mining	Yes	Yes	Yes	Yes
Includes Swaps	-	-	Yes	Yes

Notes: Standard errors clustered at the firm level reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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