Currency Mismatches and the Exchange Rate Shock: Impact on the Bank lending channel

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July 19, 2023

- ▶ Exchange Rate and Emerging Economies
  - ▶ Past Experiences: Mexican peso crisis, 1997 Asian financial crisis
  - ▶ Previous Literature: *Krugman, 1999; Cespedes et al., 2004; Kim et al., 2015*
    - ▶ Currency mismatch: liabilities in foreign currency and assets in local currency
    - ▶ Borrowers: firms and households
    - ▶ Balance sheet effects

- ▶ Role of Banks in Transmitting and Amplifying Exchange Rate Shock
  - ▶ Banks often exposed to currency mismatch
  - ▶ Exchange rate shock affect banks behavior *e.g., Gabaix and Maggiori, 2015*

- ▶ Key Questions:
  - ▶ Do banks transmit and amplify exchange rate shocks through credit supply in emerging economy?
  - ▶ Are non-foreign currency borrowers also affected?

- How does the bank lending channel transmit exchange rate shocks to local currency borrowers?

- Do changes in credit supply affect firms' real activities?

Setting: Hungary during the Swiss currency shock.

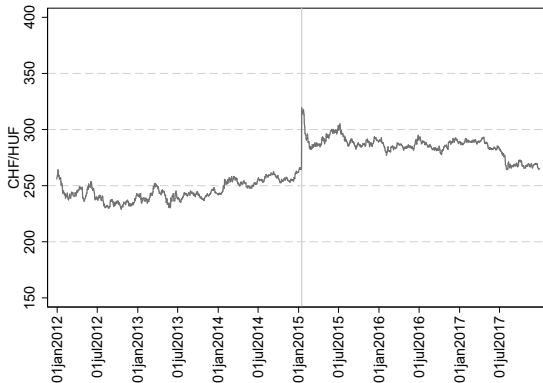

Figure: Exchange rate around the shock

1. Banks transmit exchange rate shock due to two types of currency mismatches.

   ▶ Direct mismatch: Net foreign currency asset position
      ▶ Positive correlation between pre-shock net Swiss franc asset positions and post-shock loan growth

   ▶ Indirect mismatch: Lending to unhedged borrowers
      ▶ Pre-shock lending to unhedged firms negatively affects post-shock loan growth

2. Banks' credit supply responses to exchange rate shocks are heterogeneous.
   ▶ Responses depend on individual bank balance sheet exposure to both mismatches

3. Fluctuations in bank credit supply significantly impact small firms' activities

- Data
  1. Bank Balance Sheets
  2. Hungarian Central Credit Information System
  3. Hungarian National Tax and Customs Administration database

- ▶ Swiss franc appreciation shock transmission to Hungarian economy through two on-balance sheet channels

- ▶ Channel 1: Net Swiss franc asset position
  - ▶ Banks with more CHF assets than liabilities benefit from appreciation and increases credit supply
    - ▶ Net worth positive revaluation- more free capital
    - ▶ short term interest and debt service link to asset- more liquidity
  - ▶ *de jure* **Direct mismatch**

$$\text{DMismatch}_i^j = \frac{\text{CHF assets}_i - \text{CHF liabilities}_i}{\text{Total bank assets}_i} \tag{1}$$

- ▶ Hungarian government's compulsory loan conversion program
  - ▶ Conversion of CHF household loans to HUF loans from February 2015
  - ▶ Fixed exchange rate for conversion on November 7th, 2014
  - ▶ CHF lending to households no longer counts as CHF assets before shock
  - ▶ *de facto* **Direct mismatch**

$$\text{DMismatch}_i^f = \frac{\text{CHF assets}_i - \text{CHF liabilities}_i - \textbf{CHF lending to households}_i}{\text{Total bank assets}_i}. \tag{2}$$

- ▶ Channel 2: Swiss franc-denominated corporate loans
  - ▶ Domestic currency depreciation increases debt burden (Balance-sheet effect)
  - ▶ Contractionary consequences for non-financial firms

- ▶ Borrowers' balance-sheet effect feedback on banks
  - ▶ Higher credit loss provisions and reduction in profitability
  - ▶ lower capital buffer-capital constraint
  - ▶ Worsened agency problem
  - ▶ Liquidity reduction and lending decline

- ▶ **Indirect mismatch**: Banks with higher proportion of CHF-denominated corporate loans more likely to decrease lending

$$\text{IDMismatch}_i = \frac{\text{CHF lending to unhedged firms}_i}{\text{Total bank assets}_i} \qquad (3)$$

- ▶ Credit supply variation caused by the currency mismatch could correlate with unobserved firm-specific changes in credit demand.

- ▶ In an OLS estimation, we could overestimate or underestimate the credit supply effect depend on the direction of the correlation

- ▶ Our approach in loan level analysis: **restrict sample with firms with multiple forint-denominated borrowing relationships.**

  - ▶ They were not directly exposed to the Swiss franc exchange rate risk.

  - ▶ Add fixed effects to absorb firm-specific changes in credit demand (Khwaja and Mian, 2008).

  - ▶ Equivalent to a within-firm difference-in-difference approach.

  - ▶ Multiple borrowing firms are larger on average.

- ▶ 44 financial institutions (23 banks, 21 saving cooperatives) and around 4600 multi-borrowing firms.

- ▶ we collapse the quarterly amount of credit to a pre-shock average (2014:Q1–2014:Q4) and a post-shock average (2015:Q1–2015:Q4).

- ▶ Standardized growth rate: $gm(loans_{b,j}) = \frac{loans_{b,j,2015} - loans_{b,j,2014}}{0.5(loans_{b,j,2015} + loans_{b,j,2014})}$.

- ▶ The first-difference estimation is as follows:

$$gm(loans_{b,j}) = \beta_0 + \beta_1 DMismatch_{b,2014Q4} + \beta_2 IMismatch_{b,2014Q4} + \Gamma X_{b,2014} + \rho_j + \epsilon_{b,j} \quad (4)$$

	(1)	(2)
	gm(loan)	gm(loan)
$DMismatch^f$	0.190***	0.115***
	(0.039)	(0.012)
$IMismatch$	-0.098***	-0.037***
	(0.022)	(0.007)
Bank controls	Yes	Yes
Firm FE	Yes	No
N	10,052	52,790
R^2	0.398	0.337
Firm sample	multi-borrowing	all firms

► Net Swiss franc asset position:
  ► Expansionary imapct on post-shock bank lending
  ► Banks one standard deviation apart, higher position lender increases credit by 19%

► Lending to unhedged borrowers
  ► Contractionary impact on post-shock bank lending
  ► One standard deviation increase predicts 9.8% drop in credit supply

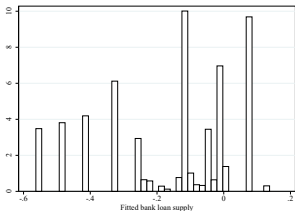► Heterogeneity in overall impact on bank-level credit supply, depends on currency mismatch exposure structure

Figure: fitted bank-level credit supply effect

**Role of net swap position – off balance sheet mismatch**

1. We primarily focuses on the impact of two on-balance sheet mismatches on bank lending, with the net Swiss franc swap position always serving as a control for potential off-balance sheet impact. table

2. Net swap position has similar impact as net CHF asset position, but magnitude is smaller.

3. Construct a simple total direct mismatch measurement, also positive significantly correlated with credit supply

$$\text{DMismatch}_i^{\text{swap}} = \text{DMismatch}_i^f + \frac{\text{net CHF swap}_i}{\text{Total bank assets}_i}$$

Alternative explanations

1. Results driven by market funding conditions (equity or bond):
   - Exclude top 10% of firms in size in each sample

2. Policy event coinciding with exchange rate shock
   - the Hungarian government requested that banks compensate household borrowers for the excess interest charged in the past. We Calculate a proxy for interest rate compensation amount at bank level, include it in baseline regression

Pre-existing trends driving differences in post-shock lending growth
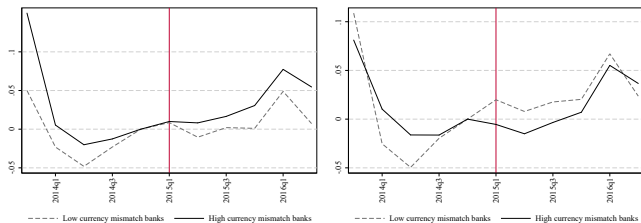
(a) Sorting by *de facto* direct mismatch   (b) Sorting by indirect mismatch

▶ Placebo test with data two years before the shock and exposure measured in 2014Q4. `table`

Alternative outcome variables

1. Extensive margin:
   ▶ Exit rate of bank-firm lending relationship. Banks with higher indirect mismatch exposure more likely to terminate a credit relationship. Higher net Swiss franc asset positions reduced the exit rate
2. Intensive margin effects:
   ▶ Consistent with baseline regression

► Fit bank-level credit supply variation using loan-level analysis results

$$\Delta supply_b = \hat{\beta}_1 DMismatch_b + \hat{\beta}_2 IDMismatch_b \qquad (5)$$

► Calculate firm-level credit supply variation using loan size-weighted average bank-level credit supply variation for each firm

$$\Delta supply_j^{AVE} = \sum_{b \in \mathbf{B}j} wbj \times \Delta supply_b \qquad (6)$$

fitted firm level credit supply

► Investigate how firm-level outcomes (y_j) are affected by Swiss franc mismatch in the bank balance sheet through regression analysis

$$y_j = \alpha_0 + \alpha_1 \Delta supply_j^{AVE} + \Gamma X_j^{AVE} + \Pi V_j + \rho^{industry} \times \rho^{region} + \hat{\rho}_j + \mu_j \qquad (7)$$

- ▶ Two main questions:
  - ▶ Can firms offset bank-specific loan supply variation by borrowing from other banks with lower pre-shock Swiss franc mismatch exposures?
  - ▶ How do changes in loan supply affect firm operations?

- ▶ A one standard deviation decrease in firm-level credit supply before the Swiss franc shock corresponds to a 18.2% decline in total bank borrowing growth for multibank firms Credit effect results

- ▶ Firms cannot fully offset credit supply variation by adjusting borrowing from less affected banks

- ▶ Bank lending channel significantly impacts real activities of small firms:
  - ▶ Positive effect on investment
  - ▶ Negative effect on liquidation likelihood

- ▶ No economically significant effect of credit supply variation on large firms' real activities

Real effect results

- ▶ Exchange rate shocks significantly impact economic volatility and both foreign and local currency borrowers

- ▶ Bank balance sheet exposure to currency mismatches dictates post-shock lending behavior

- ▶ Diverse bank responses influenced by balance sheet composition

- ▶ Policy implications:
  - ▶ Advocates macro-prudential policies to reduce exchange rate risk exposure
  - ▶ Highlights the need to account for local currency borrowers when assessing foreign exchange risk
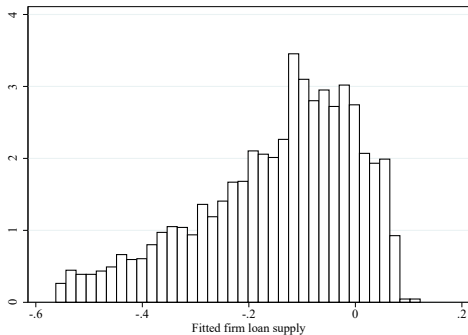
Figure: fitted firm-level credit supply effect

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	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
	gm(total loan)	gm(total loan)	gm(total loan)	gm(total loan)
$\Delta supply_j^{AVE}$	0.181***	0.129*	0.153***	0.252***
	(0.076)	(0.055)	(0.006)	(0.027)
$\Delta supply_j^{AVE} \times$ log revenue		0.004		-0.009***
		(0.006)		(0.002)
Bank controls	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Fitted FE	Yes	Yes	No	No
R-squared	0.599	0.598	0.524	0.538
Number of observations	4,510	4,459	44,356	43,246
Region × Industry	Yes	Yes	Yes	Yes

Table: firm level impact: total bank credit

back

The Bank Lending Channel at the Firm Level

	(1) OLS g(capital 2y)	(2) OLS g(capital 2y)	(3) Probit Liquidation 1y	(4) Probit Liquidation 1y
Panel A: Multi-borrowing firms				
$\Delta supply_j^{AVE}$	0.023	0.194	-0.031	-0.362
	(0.026)	(0.145)	(0.055)	(0.261)
$\Delta supply_j^{AVE} \times \log$ revenue		-0.014		0.029
		(0.011)		(0.021)
Fitted FE	Yes	Yes	Yes	Yes
R-squared	0.032	0.039	0.0564	0.0617
Number of observations	4,049	4,021	4,378	4,339
Panel B: Multi and Single-borrowing firms				
$\Delta supply_j^{AVE}$	0.044***	0.225***	-0.041***	-0.115*
	(0.007)	(0.038)	(0.015)	(0.050)
$\Delta supply_j^{AVE} \times \log$ revenue		-0.017***		0.007
		(0.003)		(0.006)
Fitted FE	No	No	No	No
R-squared	0.060	0.061	0.0271	0.0241
Number of observations	39,455	38,786	43,021	42,146
Bank controls	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Region × Industry	Yes	Yes	Yes	Yes

Table: The firm-level total capital growth rate

back

	(1)	(2)
	FE	OLS
	gm(loan)	gm(loan)
DMismatch^f	-0.027	-0.001
	(0.039)	(0.031)
IDMismatch	-0.017	0.004
	(0.041)	(0.029)
Bank Controls	Yes	Yes
R^2	0.429	0.015
Number of observations	9,154	9,154
Firm fixed effect	Yes	No
Bank type	Bank	Bank
Firm borrowing type	Multiple	Multiple

Table: Placebo test

back

	(1)	(2)
	FE	FE
	gm(loan)	gm(loan)
DMismatch^f	0.189***	
	(0.042)	
DMismatch^{swap}		0.064***
		(0.017)
IDMismatch	-0.084***	-0.081***
	(0.021)	(0.029)
Net Swap position	0.083***	
	(0.022)	
Bank Controls	Yes	Yes
R^2	0.398	0.396
Number of observations	10,052	10,052
Firm fixed effect	Yes	No
Bank type	Bank	Bank
Firm borrowing type	Multiple	Multiple

Table: Swap

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