Prudential Regulation for Financial Stability in Economies with Financial Dollarization

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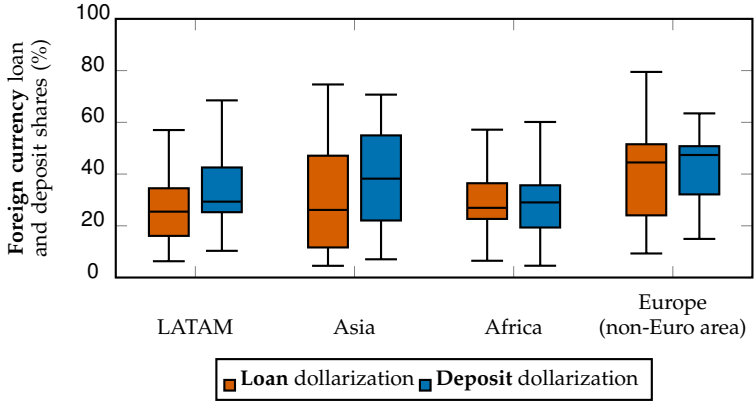
[1]The views presented are those of the author and do not necessarily represent the official positions of the Central Bank of the Republic of Türkiye.

Motivation

Definition — The use of foreign currencies (≈ dollars) in financial contracts

Financial dollarization is common in advanced and emerging market economies



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Benefits of financial dollarization

- investors/depositors safeguard against domestic price instability (liability dollarization)
- borrowers access to cheap dollar credit (asset dollarization)
- foreign (financial) capital flows into the domestic economy (asset and liability dollarization)

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- financial instability $\Rightarrow$ externalities of capital flows (over-borrowing in foreign currency)
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Regulations are **heterogeneous** $\Rightarrow$ No unified framework of financial dollarization (IMF, 2020)

IMF Macroprudential Database (iMaPP)

This paper

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Approach: Develop and estimate a structural empirical model of the banking industry with

- asset/liability dollarization, and endogenous exchange rate
- imperfect competition (in loan and deposit markets) and regulatory constraints
- run-prone foreign currency wholesale funding from non-resident banks
- endogenous bank default, contagion, and multiple equilibria

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Main findings:

- **Banking sector fragility** is $\approx$ 13pp. higher in alternative equilibria than in the data
- **Tightening domestic monetary policy** increases banking sector fragility by promoting dollarization
- **Prudential tax on banks' foreign currency borrowing from abroad**
  - banking fragility ($\downarrow$) and domestic monetary policy transmission improves
  - but also borrower surplus ($\downarrow$) and exchange rate depreciates

Literature + Contribution

Structural industrial organization of banking systems. Egan et al. (2017), Xiao (2020), Wang et al. (2022), Albertazzi et al. (2022), Diamond et al. (2024)

This paper. The industrial organization of multi-currency banking systems

International monetary policy transmission. Schnabl (2012), Rey (2013), Bruno et al. (2015), Brauning et al. (2020)

This paper. Interaction between deposit and non-deposit funding dollarization

Macroprudential and capital flow management measures. Ostry et al. (2012), Benigno et al. (2013), Korinek et al. (2016), Acharya et al. (2024), Keller (2024)

This paper. Granular, micro-level data + micro-structural framework

Outline of the presentation

I. Institutional Background

II. Data and Facts

III. Model and Estimation

IV. Counterfactual Experiments

V. Conclusion

Institutional Background

Dual-currency banking (in Türkiye)

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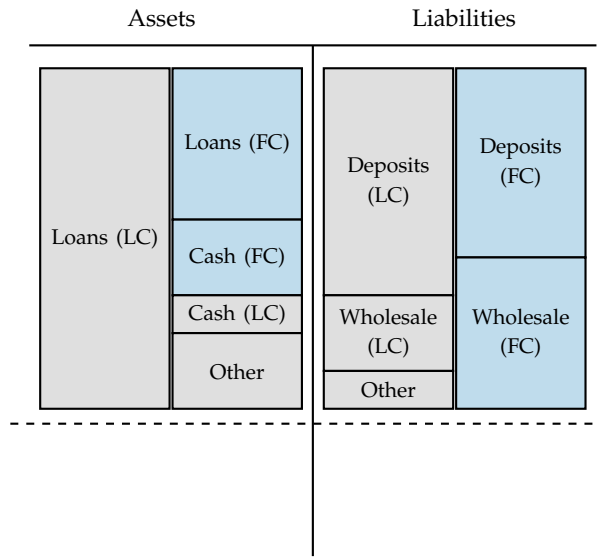
- **Foreign currency (FC) loans:** ≈ 30% of all loans and ≈ 20% of total assets

Liability dollarization: ≈ 45%

- **FC deposits:** ≈ 40% of all deposits and ≈ 25% of total liabilities
- **FC wholesale funding:** ≈ 20% of total liabilities



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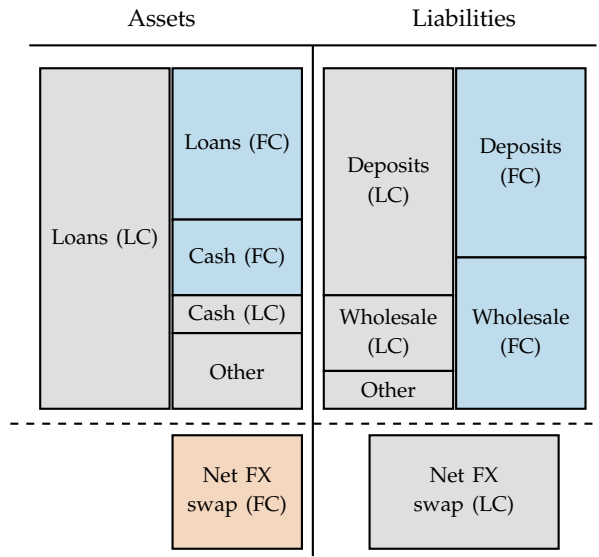
Regulation: No foreign currency exposure

- via (synthetic) forward creation How?
- Net open FX position/Equity ≈ 0.01



Data and Facts

Data and Facts

Data. Supervisory data from Türkiye for the years 2010 to 2017, which includes

- transaction-level data on domestic bank lending to firms and households
- transaction-level data on domestic banks' dollar borrowing from non-resident banks
- monthly on- and off-balance sheets, income statements, and offered deposit rates of banks
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Fact #4. More FC wholesale funding $\Rightarrow$ Weaker policy transmission. Fact #4

Model and Estimation

Model overview: Dual-currency banking industry equilibrium

Demand systems

- **Depositors** have a unit of local currency and choose where to invest
- **Borrowers** have a unit of local currency funding need and choose how to borrow
  - they can also default on their loans
- **Bond investors** choose their portfolio allocation to LC-denominated government bonds

Supply systems

- **Domestic banks** maximize their equity value under limited liability and subject to
  - two types of regulations: (i) no foreign currency exposure, and (ii) reserve requirements
- **Non-resident banks** maximize profits by setting the cross-border loan rate
  - sensitive to domestic banks' probability of default
- **Non-resident traders** maximize their MV utility, supplying dollars in FX markets

Markets: Deposit and loan markets, local currency government bond market, and FX markets

- deposit and loan rates, bond prices, and exchange rates clear these markets

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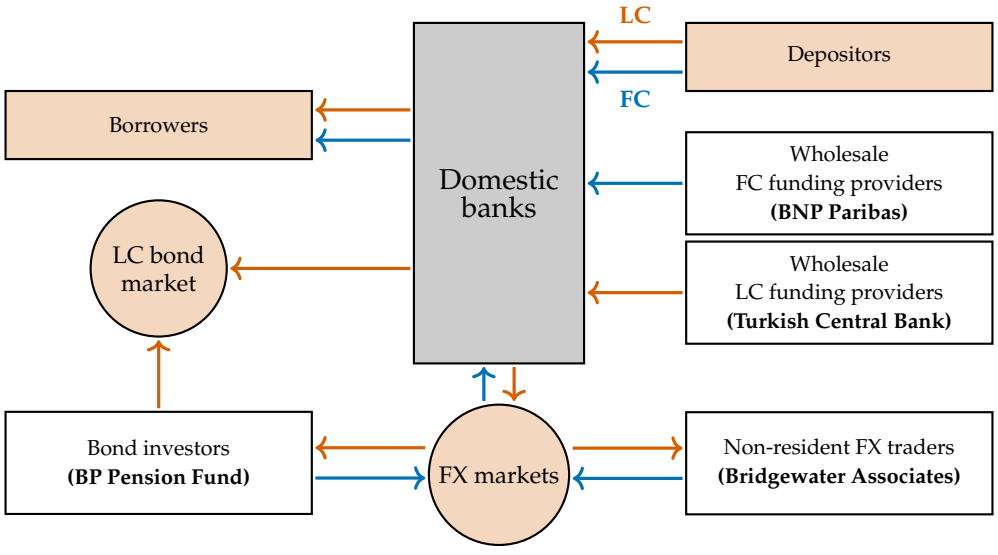

Demand: Depositors

$\mathcal{J}$ **oligopolistic banks** compete in the deposit market

There are **two groups of depositors**: Households ($d = H$) and Firms ($d = F$)

Each depositor holds one unit of local currency and chooses **a deposit product**

Product definition. Issuing bank $\times$ Currency denomination $\times$ Account type

	Interest rate	Hedging benefit	Transaction convenience
LC demand deposits	–	–	Yes
LC term deposits	Yes	–	–
FC demand deposits	–	Yes	–
FC term deposits	Yes	Yes	–

Depositors' problem

The indirect utility derived by depositor i of type d from product k at time t is:

$$\mathcal{U}_{ikt}^{d} = \underbrace{\alpha^{d}\mu_{kt}^{d} + \beta^{d}X_{kt} + \zeta_{kt}^{d}}_{\overline{U}_{kt}^{d}} + \varepsilon_{ikt}^{d}$$

$\overline{U}_{kt}^{d}$: mean utility of product k at t

- $\mu_{kt}^{d} = r_{kt}^{d} + \mathbb{1}\{FC_{c(k)} = 1\}\mathbb{E}_t[\Delta e_{t+1}]$ is the expected return in local currency terms
  - r_{kt}^{d} is the interest rate offered to depositors of type d for product k at time t
  - Δe_{t+1} is the change in the spot exchange rate between t and $t+1$

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- X_{kt} includes the observable product characteristics
  - hedging benefit, transaction convenience, number of branches, employees per branch, ATMs etc.

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Assuming $\varepsilon^d_{ikt} \sim$ i.i.d. T1EV, the resulting product market shares are as follows:

$$s_{kt} = \frac{\exp(\overline{U}^d_{kt})}{1 + \sum_{k'} \exp(\overline{U}^d_{k't})}$$

Estimation: Interest rate elasticity

The estimation equation derived from the economic model then takes the form:

$$\ln(s^d_{kt}) \quad = \quad \alpha^d r^d_{kt} + \beta^d \widetilde{X}_{kt} + \delta^d_{j(k)} + \eta^d_{c(k)t} + \xi^d_{kt}$$

Instrument. the pass-through of interbank rates into deposit rates (Egan et al., 2017)

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	Retail deposits	Corporate deposits
Market shares		
Interest rate	51.86	21.41
	(0.80)	(0.57)

Retail depositors are sensitive to interest rates (with elasticity around 2.4)

Corporate depositors are less sensitive to interest rates (with elasticity around 1.1)

Estimation: Hedging benefit

Obtain and regress the estimated currency-time fixed effects on:

$$\widehat{\eta^d_{ct}} = \eta^d_0 + \eta^d_1 \mathbb{1}\{FC_{c(k)} = 1\} + \eta^d_2 \Delta e_t + \eta^d_3 \left(\Delta e_t \times \mathbb{1}\{FC_{c(k)} = 1\}\right) + \nu^d_{ct}$$

	Retail deposits	Corporate deposits
Currency-time FEs		
FC dummy	2.65	1.13
	(0.04)	(0.03)
Δe_t	-1.92	-1.29
	(0.21)	(0.14)
FC dummy $\times$ Δe_t	2.60	1.79
	(0.31)	(0.41)

Depositors forgo $\approx$ 500bps in local currency returns to save in dollars (hedging benefit)

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The hedging benefit is more pronounced during the periods of FX depreciation

Demand: Borrowers

Modeling choice mirrors that for deposits …

- key difference. **stock** of deposits vs loan **originations**

Mortgages, **unsecured consumer loans**, and **corporate loans** are estimated separately

Instrument. Interest rate swap rates as cost-shifter (Benetton, 2021)

Key findings …

- demand curves are downward-sloping for each loan type
- high interest rates ⇒ increased default rates for consumer loans (adverse selection/moral hazard)
- borrowers favor FC over LC loans during periods of currency appreciation

Problem Estimates

Demand: Bond investors

The demand system approach to asset pricing (Koijen and Yogo, 2019)

Instrument. Changes in the maturity-specific haircuts on the LC government bonds

Key findings . . .

- the demand curve for non-resident bond investors is downward-sloping
- the median yield elasticity is around 2.7

Problem Estimates

Supply: Domestic banks

Banks (j) operate nationally, and are protected by limited liability

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Banks are subject to **constraints**:

- on-balance sheet identity,
- reserve requirements (in both currencies), and
- no foreign currency exposure (on- plus off-balance sheet)

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Balance sheet **costs:**

- $\mathcal{C}_j^O(\Theta_j; \Gamma_j)$ is the operational (deterministic) costs
- $\mathcal{C}^H(\mathbb{H}_j; \Omega_j)$ is the wholesale funding cost; and $c_j \sim N(\mu_j, \sigma_j)$ is the cost of per-unit wholesale funding

Banks **default if** $\Pi_j + \mathcal{E}_j / \overline{R} < 0$

Domestic banks: Revenue | Domestic banks: Cost | Supply: Non-resident banks

Domestic banks' problem

Each bank maximizes its equity value under limited liability, subject to the given constraints:

$$\max_{\{R^d_{kt}, R^b_{lt}, S_{jt}\}} \int_{-\infty}^{\bar{c}_{jt}} \left\{ \Pi_{jt} + \mathcal{E}_{jt} / \overline{R} \right\} dF(c_{jt})$$

Formula Estimates

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Formula Estimates

FOC with respect to **dollar loan rates** for bank j:

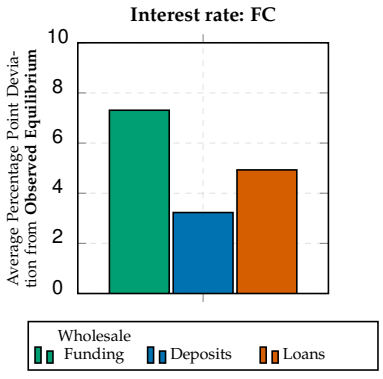
$$\underbrace{R^N_j\left(1-\Phi^N_j d^{N,D}_j\right)}_{\text{Expected return}} = \underbrace{\left(\mathbf{P}^n_j + c_j\mathbf{H}_j - \rho_j\mathcal{S}_j + c^N_j\right)}_{\text{I. Effective marginal cost}} +$$

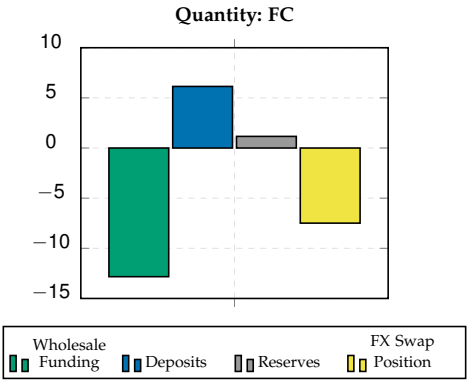
$$\underbrace{\left(\frac{-1}{\alpha^N(1-s^N_j)}\right)\left(1-\alpha^{N,D}\Phi^N_j d^{N,D}_j\left(1-d^{N,D}_j\right)R^N_j\right)}_{\text{II. Effective mark-up}} + \underbrace{\frac{\widetilde{s}^N}{1-s^N_j}\left(\frac{F}{S}\widetilde{R}^N_j - \left(\mathbf{P}^n_j + c_j\mathbf{H}_j - \rho_j\mathcal{S}_j\right) - \widetilde{c}^N_j\right)}_{\text{III. Multi-product feature of the bank}}$$

- **black:** data; **blue:** estimated parameters; **red:** unobserved (backed out via FOCs)

Counterfactual Experiments

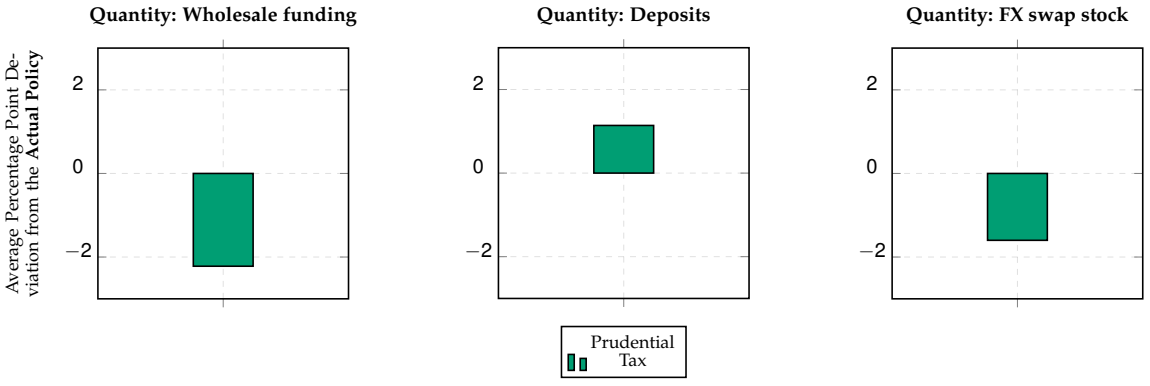
Experiment (#1): Realized vs. Alternative equilibria under actual policy





- Can seemingly stable banks quickly become unstable with **the same estimated fundamentals**?
  - banking sector fragility (↑) by 13pp; and exchange rate depreciates by 16%
  - banking sector equity (↓) by 58%; borrower surplus (↓) by 11%; and depositor surplus (↑) by 23%

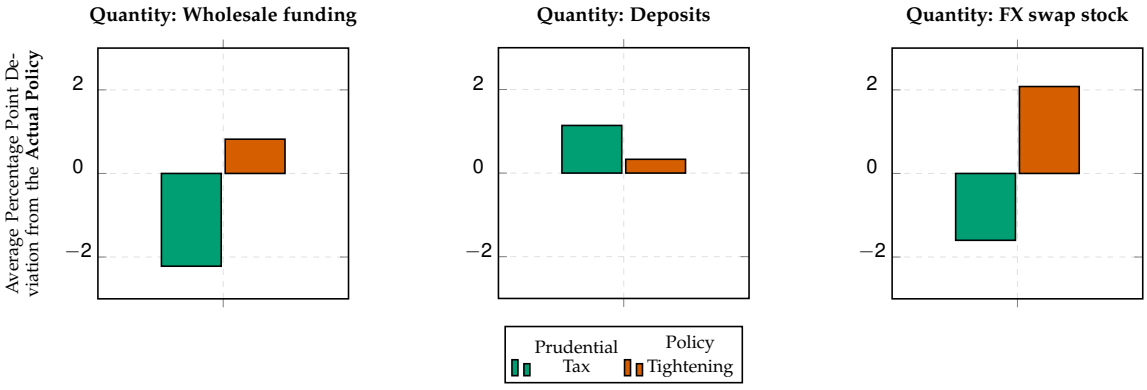
ΔQ^{FC}: Changes in quantities (in foreign currency) across policy experiments



- **Experiment** (#2): 5% prudential tax on domestic banks' FC borrowing from abroad
  - domestic banks decrease their reliance on FC wholesale funding
  - the default risk of domestic banks decreases by 12%
  - the exchange rate depreciates by 2%, and borrower surplus declines by 5%.

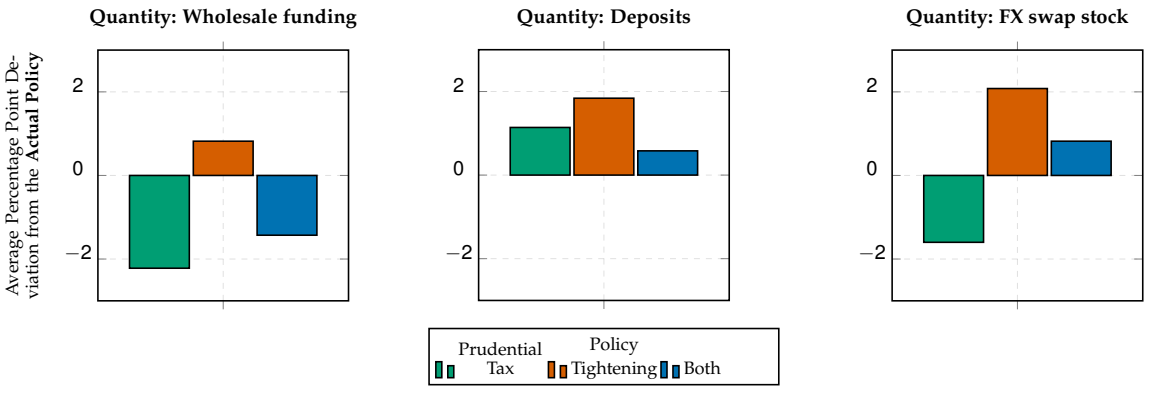
ΔP^{FC}

ΔQ^{FC}: Changes in quantities (in foreign currency) across policy experiments



- **Experiment** (#2): 5% prudential tax on domestic banks' FC borrowing from abroad
- **Experiment** (#3): 100bps domestic monetary policy tightening
  - domestic banks substitute LC wholesale funding with FC funding.
  - bank default risk increases by 7%, while the exchange rate appreciates by 4%

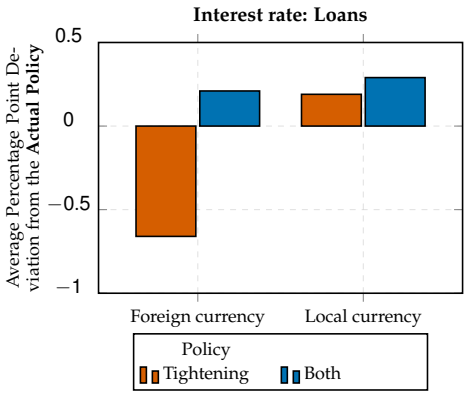
ΔQ^{FC}: Changes in quantities (in foreign currency) across policy experiments

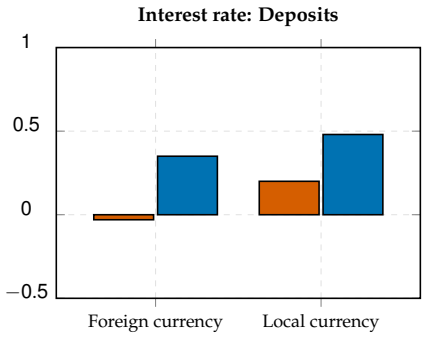


- **Experiment** (#4): Domestic monetary policy tightening in the presence of a prudential tax
  - substituting LC wholesale funding with FC wholesale funding becomes more costly

ΔQ^{LC}

ΔP: Changes in prices across policy experiments





- **Experiment** (#4): Domestic monetary policy tightening with in the presence of a prudential tax
  - substituting LC wholesale funding with FC wholesale funding becomes more costly
  - the prudential tax enhances the transmission of policy tightening to deposit and loan markets

Conclusion

This paper is the first to explore the IO of **multi-currency banking systems**

- The model is estimated using **unique supervisory data** from Türkiye
- **Financial dollarization** $\Rightarrow$ Fragile banking system and less effective monetary policy
- Prudential regulation
  - **Benefits:** banking sector fragility ($\downarrow$) & the effectiveness of monetary policy transmission ($\uparrow$)
  - **Costs:** exchange rate depreciates & borrower surplus ($\downarrow$)

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  - **Costs:** exchange rate depreciates & borrower surplus (↓)

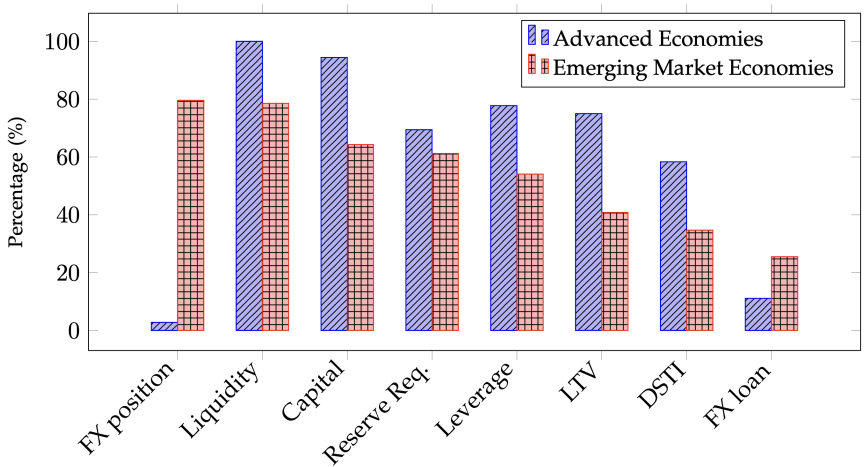
Ongoing and Future Research ⇒ Financial stability (Banks + NBFIs + Households)

- **Financial intermediation and regulation**
  - **Turkish Central Bank.** Banks' money creation in dual-currencies
  - **Bank of England.** Dealer intermediation and pricing in the Sterling repo market
- **Household finance & Regulation in consumer credit markets**
  - **Dutch Central Bank.** The effect of P2P rental platforms on Dutch mortgage & housing markets
- **Financial technologies** (payments leading to credit)
  - Payment systems: Credit cards, CBDCs, and Instant Payment Systems (IPSs)
  - The complementarity between credit cards and deposits in modern payment systems

Thank you!

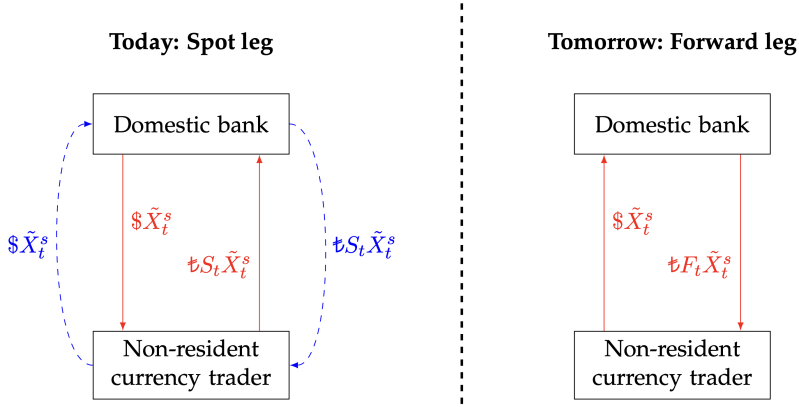
Appendix

IMF Macroprudential Database (iMaPP)



Back

Balance sheet view of banks' synthetic forward creation



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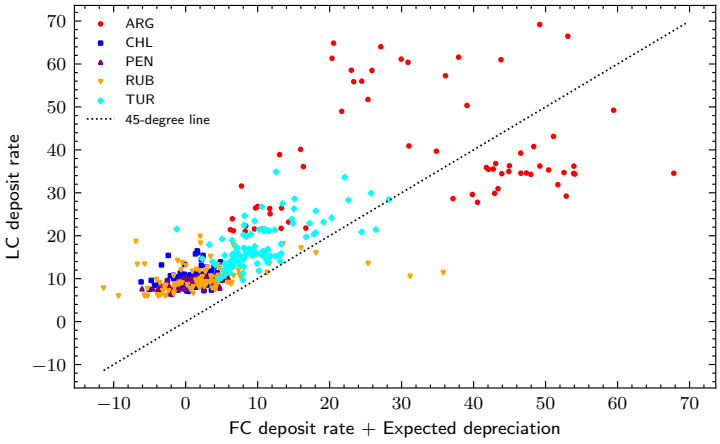
Fact #1. Depositors are willing to pay a premium to save in foreign currency.



- Depositors demand higher rates for local currency deposits compared to foreign currency deposits.
- Foreign currency deposits are cheaper funding source for banks than local currency deposits.

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Fact #2. Foreign currency loans are cheaper compared to local currency loans.

	UIP-adjusted credit spread			CIP-adjusted credit spread		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign currency dummy	-5.77	-6.41	-6.41	-0.35	-1.03	-1.04
	(0.18)	(0.19)	(0.19)	(0.08)	(0.07)	(0.08)
Loan controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	No	Yes	Yes	No
Bank-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Firm-time FEs	No	No	Yes	No	No	Yes
Observations	11,434,830	662,394	662,394	11,434,830	662,394	662,394
adj. R-squared	0.56	0.53	0.53	0.11	0.10	0.10

- Dollar borrowing is 577 bps (35 bps) cheaper than LC borrowing when unhedged (hedged)
- **Turkish firms** are mostly unhedged − as in Peru and Chile (Ivashina et. al, 2023; Alfaro et. al, 2022).

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Fact #2. Foreign currency loans are cheaper compared to local currency loans.

Estimating equation:

$$spread_{lt} = \beta D_{c(l)} + \Gamma X_{lt} + \alpha_{b(l),t} + \gamma_{j(l),t} + \varepsilon_{lt}$$

where

- $D_{c(l)}$ is an indicator that equals one if loan l is in a foreign currency
- X_{lt} includes controls for loan amount and maturity as the loan characteristics,
- $\alpha_{b(l),t}$ and $\gamma_{j(l),t}$ represent fixed effects for bank-time and firm-time, and

$$spread_{lt} \equiv \left(i_{lt} - r_t^{c(l)}\right) + D_{c(l)}\left[r_t^{LC} - r_t^{FC} + (z_t - e_t)\right]$$

- i_{lt} is the interest rate on loan l originated in month t
- $r_t^{c(l)}$ is the risk-free rate in the loan's currency,
- e_t represents the log spot exchange rate, quoted in local currency per foreign currency, and
- z_t is used for the log forward rate in the case of CIP adjustments or the survey expectation of the exchange rate for UIP adjustments

Back

Fact #3. Foreign currency wholesale funding is more run-prone than deposits.

Run-prone uninsured deposits

- main source of financial instability in **advanced economies** (e.g., the March 2023 turmoil)

EM economies: FC wholesale funding ⇒ sudden stops (Gourinchas and Obstfeld, 2012)

	%Δ Uninsured deposits	%Δ Wholesale FC funding
Bank probability of default	1.42	-3.16
	(1.57)	(1.31)
Bank FEs	Yes	Yes
Time FEs	Yes	Yes
Observations	693	693
adj. R-squared	0.11	0.23

- 100 bps (↑) in a bank's probability of default ∼ 3 percent (↓) the growth rate of banks' FC borrowing

Back

Fact #4. More FC wholesale funding ⇒ Weaker policy transmission.

Specification I. A cumulative 100 bps increase in the policy rate from last quarter

Specification II. A cumulative 100 bps increase in the policy rate from last quarter when Wu-Xia shadow federal funds rate is lower by 100 bps

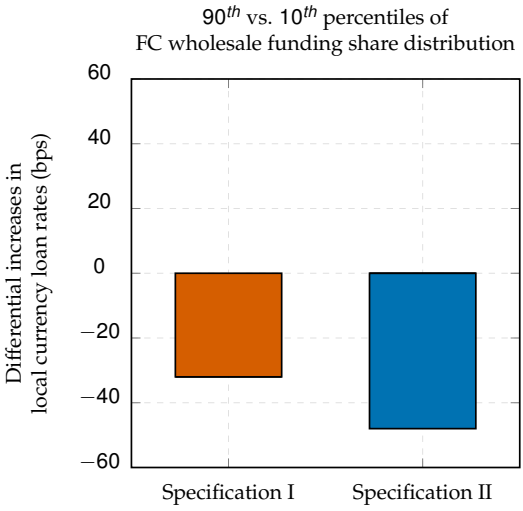
Fact #4. More FC wholesale funding ⇒ Weaker policy transmission.

Specification I. A cumulative 100 bps increase in the policy rate from last quarter

Specification II. A cumulative 100 bps increase in the policy rate from last quarter when Wu-Xia shadow federal funds rate is lower by 100 bps

Banks relying more on wholesale FC funding increase LC loan rates less as monetary policy tightens

- even less during favorable global funding conditions



Estimating equations | Estimates | Back

Fact #4. More FC wholesale funding ⇒ Weaker policy transmission.

Specification I:

$$i_{lt} = \alpha_{j(l),t} + \delta_{b(l)} + \sum_{\tau=0}^{3} \gamma_\tau \times \left(\Delta r_{t-\tau} \times \text{Wholesale USD Funding Share}_{j(l),t-\tau}\right) + \varepsilon_{lt}$$

Specification II:

$$i_{lt} = \alpha_{j(l),t} + \delta_{b(l)} + \sum_{\tau=0}^{3} \gamma_\tau \times \left(\Delta r_{t-\tau} \times \text{Wholesale USD Funding Share}_{j(l),t-\tau} \times \Delta r_t^{USD}\right) + \varepsilon_{lt}$$

where

- i_{lt} represents the interest rate level on the local currency loan l originated in month t,
- $\Delta r_{t-\tau}$ denotes the change in the local monetary policy rate from month $t-\tau$ to t,
- Δr_t^{US} is the change in the Wu-Xia Shadow Federal Funds Rate,
- $\alpha_{j(l),q(t)}$ accounts for bank-time fixed effects, and
- $\delta_{b(l)}$ represents borrower fixed effects

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Fact #4. More FC wholesale funding ⇒ Weaker policy transmission.

	(1)	(2)
$\sum_\tau \Delta r_{t-\tau} \times$ Global funding share$_{j,t-\tau}$	-1.36	-1.56
	(0.00)	(0.00)
$\sum_\tau \Delta r_{t-\tau} \times$ Global Funding Share$_{j,t-\tau} \times \Delta r_t^{US}$		2.01
		(0.00)
90^{th} vs. 10^{th} percentile of Global Funding Share	-31.93	-47.78
Additional controls	Yes	Yes
Bank-year-quarter FEs	Yes	Yes
Firm FEs	Yes	Yes
Observations	361,976	361,976
adj. R-squared	0.05	0.10

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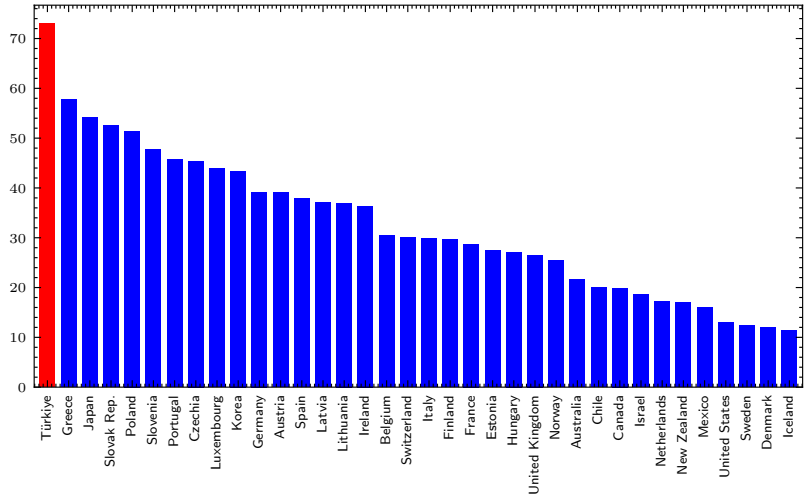

Currency and deposits, % of households' total financial assets (OECD, 2021)

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Borrowers' problem

Mortgage ($b = M$), unsecured consumer loan ($b = C$), corporate loan ($b = F$)

The demand function borrower type b for product l at time t:

$$\mathcal{D}_{lt}^{b}(r_{lt}^{b}, \mathbf{r}_{-lt}^{b}, s_t) = \mathcal{F}_{t}^{b}\left[\frac{\exp(\overline{U}_{lt}^{b})}{1 + \sum_{l'} \exp(\overline{U}_{l't}^{b})}\right]$$

with the following share of defaulting borrowers of type b on product l:

$$d_{lt}^{b,D}(r_{lt}^{b,D}, s_t) = \frac{\exp(\overline{U}_{lt}^{b,D})}{1 + \exp(\overline{U}_{l't}^{b,D})}$$

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Estimation: Borrower preferences

	A. Demand estimates			B. Default estimates		
	Mortgages	Consumer loans	Corporate loans	Mortgages	Consumer loans	Corporate loans
	(1)	(2)	(3)	(4)	(5)	(6)
Interest rate	-17.33	-73.15	-8.73	17.86	26.92	-1.50
	(78.19)	(9.68)	(1.51)	(10.98)	(6.48)	(5.28)
Observations	837	837	1674	837	837	837
adj. R-squared	0.87	0.62	0.90	0.83	0.67	0.75
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FEs	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	No	Yes	Yes	Yes
Currency-time FEs	No	No	Yes	No	No	No

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Bond investors' problem

Two group of bond investors. Non-bank residents and non-resident

The portfolio weights are

$$\delta_t^i(m) \equiv \mathcal{D}_t^i(m)/\mathcal{O}_t^i = \exp\left(\alpha^i + \beta^i y_t(m) + \gamma^i X_t(m)\right)\varepsilon_t^i(m)$$

where

- $\mathcal{D}_t^i(m)$ is the MV of investor group i's holdings of lira-denominated government bonds within maturity bucket m
- $\mathcal{O}_t^i$ is the investor group i's holdings of the outside asset

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Estimation: Bond investors' preferences

	A. Non-bank residents	B. Non-residents
	(1)	(2)
$y_t(m)$	-7.32	9.84
	(3.29)	(4.09)
Observations	480	480
adj. R-squared	0.78	0.80
Bond characteristics	Yes	Yes
Outside characteristics	Yes	Yes
Trend controls	Yes	Yes
Maturity FEs	Yes	Yes

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Non-resident banks

Non resident banks' problem is

$$\max_{\tilde{R}^n_{jt}} \ \Pi^n_{jt} = \widetilde{\mathcal{N}}_{jt}\left[\tilde{R}^n_{jt}(1-\phi_{jt}\Phi^n_{jt}) - mc^n_{jt}\right]$$

where

- $\widetilde{\mathcal{N}}_{jt}$ is bank j's demand for cross-border credit at time t,
- ϕ_{jt} is the endogenous probability of default of bank j at time t,
- $(1-\Phi_{jt})$ is the bank-specific recovery rate, and
- mc^n_{jt} is the global bank's (unobserved) marginal cost of lending to local bank j at time t.

Back

Domestic banks: Investment Portfolio

Bank j's revenue at time t (in local currency terms)

$$\mathbb{R}_{jt} = \underbrace{\sum_{b\in\{M,C,F\}} \sum_{l\in L_j, c(l)=LC} \mathcal{D}^b_{lt}(R^b_{lt}, R^b_{-lt}) \left[R^b_{lt}\left(1 - \Phi^b_{lt} d^{b,D}_{lt}(R^b_{lt})\right)\right] + \mathcal{R}_{jt} R^r_t + \mathcal{S}_{jt}\Sigma_s(\mathbf{N}_{jt})}_{\text{Local currency assets}}$$

$$+\mathbb{E}_t[S_{t+1}/S_t] \underbrace{\left\{ \sum_{l\in L_j, c(l)=FC} \mathcal{D}^F_{lt}(R^F_{lt}, R^F_{-lt}) \left[R^F_{lt}\left(1 - \Phi^F_{lt} d^{F,D}_{lt}(R^b_{lt})\right)\right] + \widetilde{\mathcal{R}}_{jt} \widetilde{R}^r_t \right\}}_{\text{Foreign currency assets}}$$

where

$$\Sigma_s(\mathbf{N}_{jt}) = \mathbb{E}_t[R^s_{t+1}] + \rho_{jt}\mathbf{N}_{jt}$$

is the (net) benefit of holding per-unit lira-denominated government bond.

Back

Domestic banks: Funding Sources

Bank j's cost at time t (in local currency terms)

$$\mathbb{C}_{jt} = \underbrace{\sum_{d\in\{H,F\}} \sum_{k\in\mathcal{K}_j, c(k)=LC} \mathcal{D}^d_{kt}(R^d_{kt}, R^d_{-kt}) R^d_{kt} + \mathcal{M}_{jt} R^m_{jt}}_{\text{Local currency funding}}$$

$$+\mathbb{E}_t[S_{t+1}/S_t] \underbrace{\left\{ \sum_{d\in\{H,F\}} \sum_{k\in\mathcal{K}_j, c(k)=FC} \mathcal{D}^d_{kt}(R^d_{kt}, R^d_{-kt}) R^d_{kt} + \widetilde{\mathcal{M}}_{jt} \widetilde{R}^m_{jt} \right\}}_{\text{Foreign currency funding}}$$

$$+ \underbrace{\mathcal{C}^N_{jt}(\mathbf{N}_{jt}; \Omega_{jt})}_{\text{Wholesale funding costs}} + \underbrace{\mathcal{C}_{jt}(\Theta_{jt}; \Gamma_{jt})}_{\text{Administrative costs}}$$

Back

Domestic banks' problem

$$
\begin{aligned}
\max_{\{R^d_{kt},R^b_{lt},\mathcal{S}_{jt}\}} \Bigg\{ & \sum_{b\in\{M,C,F\}} \sum_{l\in L_j, c(l)=LC} \mathcal{D}^b_{lt}(r^b_{lt};\mathbf{r^b_{-lt}},S_t)\left[R^b_{lt}\left(1-\Phi^b_{lt}d^{b,D}_{lt}(r^b_{lt};S_t)\right)\right] \\
& + \sum_{l\in L_j, c(l)=FC} \mathcal{D}^F_{lt}(r^F_{lt};\mathbf{r^F_{-lt}},S_t)\left[\frac{F_t}{S_t}R^F_{lt}\left(1-\Phi^F_{lt}d^{F,D}_{lt}(r^b_{lt};S_t)\right)\right] \\
& - \sum_{d\in\{H,F\}} \sum_{k\in\mathcal{K}_j, c(k)=LC} \mathcal{D}^d_{kt}(r^d_{kt};\mathbf{r^d_{-kt}},S_t)\left[R^d_{kt}-\theta_t R^r_t\right] \\
& - \sum_{d\in\{H,F\}} \sum_{k\in\mathcal{K}_j, c(k)=FC} \mathcal{D}^d_{kt}(r^d_{kt};\mathbf{r^d_{-kt}},S_t)\frac{F_t}{S_t}\left[R^d_{kt}-\widetilde{\theta}_t\widetilde{R^r_t}\right] \\
& + \mathcal{S}_{jt}\Sigma_s(\mathbb{N}_{jt};\rho_{jt}) - \mathcal{C}^N_{jt}(\mathbb{N}_{jt};\Omega_{jt}) - \mathcal{C}_{jt}(\Theta_{jt};\Gamma_{jt}) - R^m_{jt}\mathcal{M}_{jt} - \frac{F_t}{S_t}\widetilde{R}^m_{jt}\widetilde{\mathcal{M}}_{jt}\Bigg\}\Phi\left(\frac{\overline{c}_{jt}-\mu_{jt}}{\sigma_{jt}}\right)
\end{aligned}
$$

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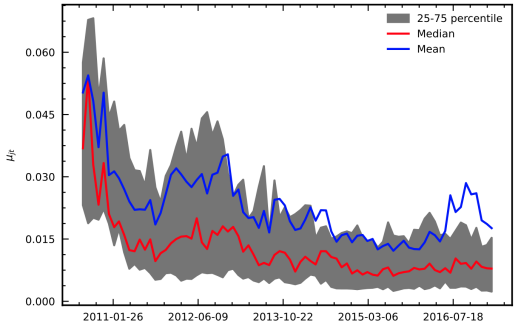
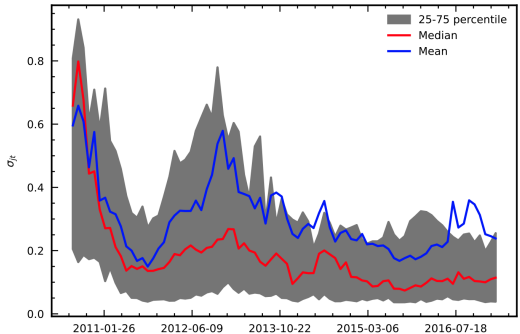
Stochastic cost of per-unit wholesale funding: Moments





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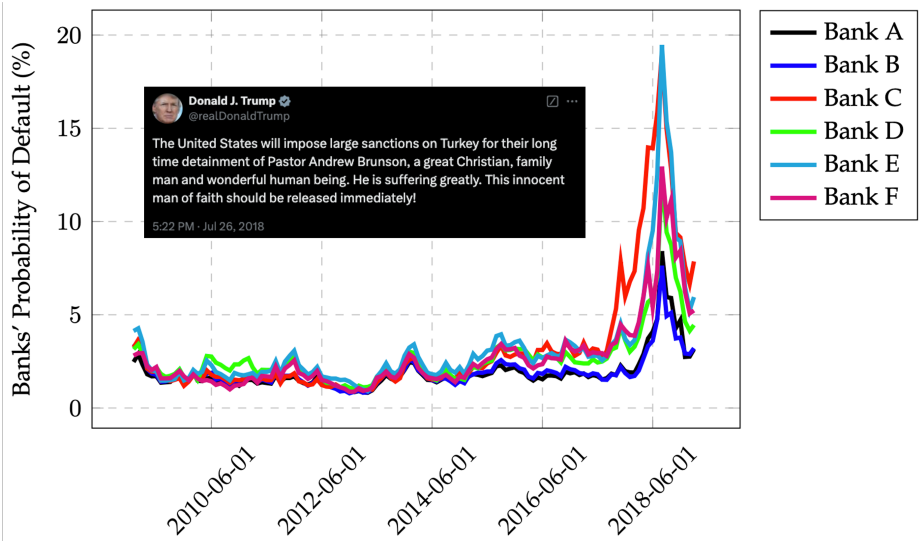
The 2018 Debt Crisis in Türkiye



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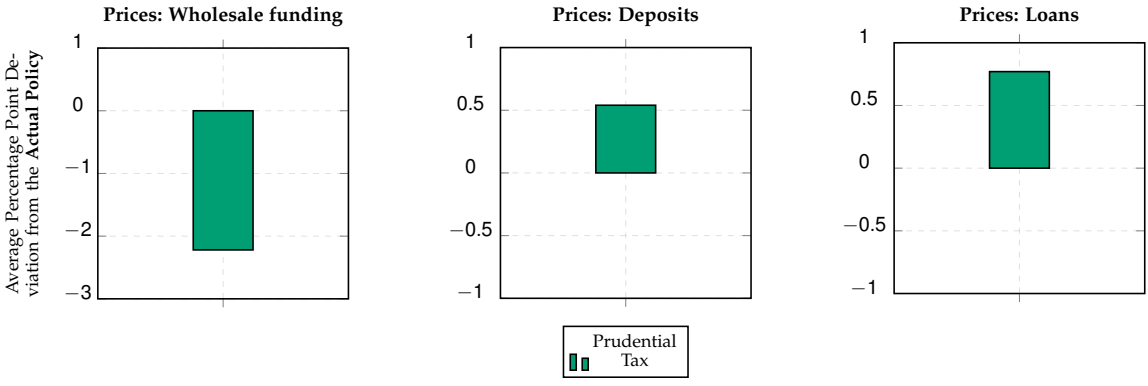
ΔP across policy experiments



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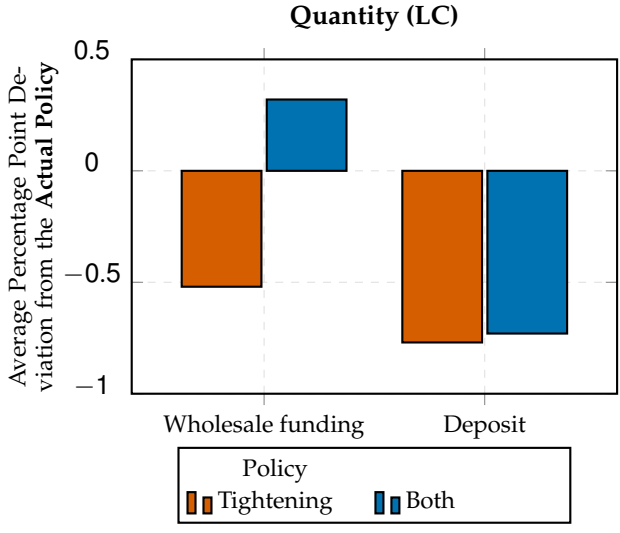
ΔQ^{LC} across policy experiments



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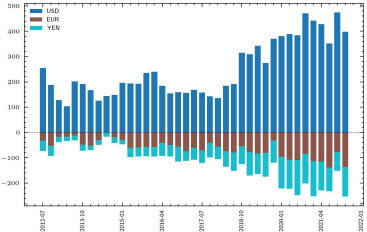
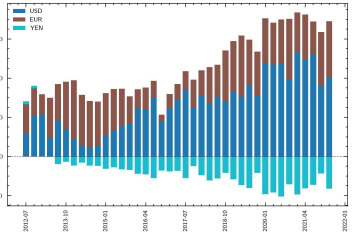
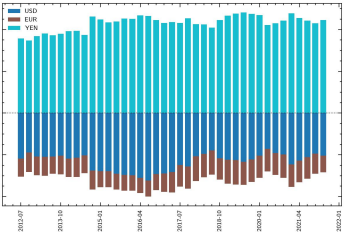
Banks' on-balance sheet net positions in USD, EUR, YEN (BIS, 2023)



(a) US banks



(b) European banks



(c) Japanese banks

ON-balance sheet ⇒ Cross-currency lending/borrowing to pick up the currency basis

OFF-balance sheet ⇒ Hedging foreign currency risks via FX swaps and forwards

Lending and Deposit Rates in Local and Foreign Currencies

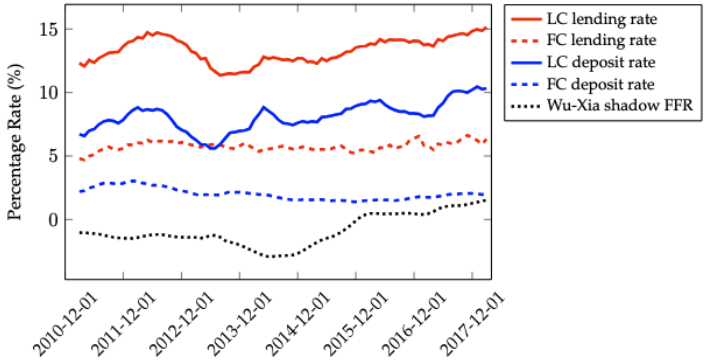
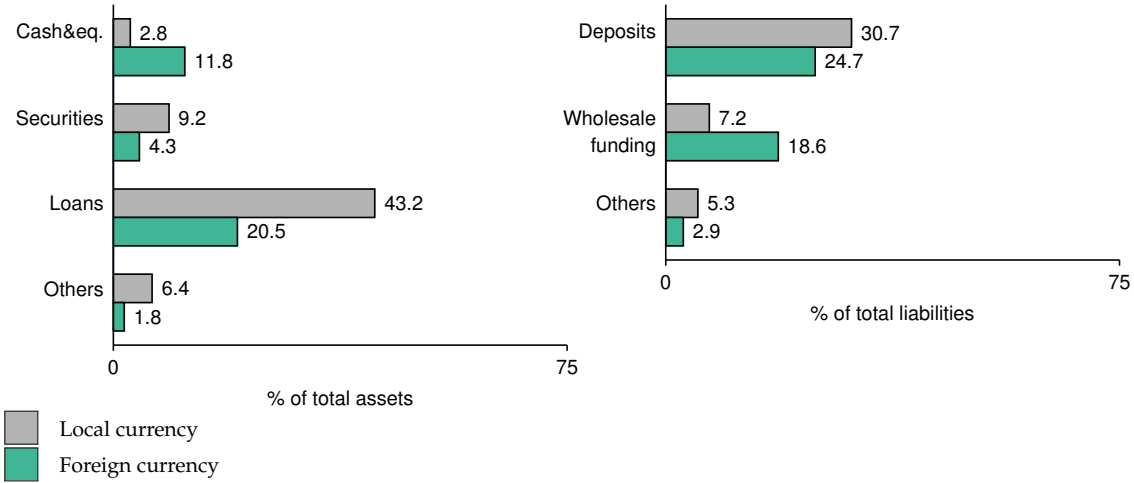


Figure 2. Lending and Deposit Rates in Local and Foreign Currencies (2010–2018). This graph presents monthly data from December 2010 to April 2018, illustrating sector-wide lending and deposit rates offered by Turkish banks in local currency (solid lines) and foreign currency (dashed lines). Lending rates, which include interest expenses and origination fees, are shown in red, while deposit rates are represented in blue. The black dotted line denotes the Wu-Xia shadow federal funds rate (FFR), a benchmark for low-yield, liquid foreign currency assets. In the legend, LC stands for local currency, and FC for foreign currency.

Data: Banks' balance sheets

Deposit-creating banks hold approx. 85% of the total assets in the financial sector



Fact #5. Original-sin Redux

$$\Delta y_t = \alpha_t + \beta_t^{\text{VIX}} \Delta \ln(VIX_t) + \varepsilon_t$$