

The Foreign Liability Channel of Bank Capital Requirements

**Luigi
Falasconi**

University of
Pennsylvania

**Pablo
Herrero**

Bank of Spain

**Caterina
Mendicino**

European Central Bank

**Dominik
Supera**

Columbia Business
School

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The views expressed are those of the authors and do not necessarily reflect the views of the ECB/ Eurosystem.

Motivation

- In the aftermath of the GFC, both advanced and **emerging markets (EM)** economies tightened bank capital regulation to pursue financial stability
 - Members of the international financial standard-setting bodies (e.g. Argentina, Brazil, China, India, Mexico, Turkey) committed to Basel III
 - Other (e.g. Colombia, Malaysia, Thailand, Peru) have adopted them voluntarily
- EM heavily exposed to **foreign currency liabilities** (e.g. Gopinath and Stein, 2021)
 - vulnerable to global financial cycle and sudden stops (e.g. Rey, 2005)

⇒ **eclectic approach** to financial stability

Research Questions

1. What costs and benefits of tighter bank capital regulation under foreign liabilities?
2. Are bank capital regulation and capital controls/FXI substitute or complementary?

⇒ Main Challenge: Macro-banking models of risky banks & international financial flows

Main Findings

1 Tighter CR boost banks dependence on foreign liabilities

- Higher CR by limiting banks leverage better protect against asset losses
- Reduced risk of default decreases the cost of foreign funding for banks

⇒ *Foreign liability channel* of bank capital requirements

2 Higher CR ⇒ economy more vulnerable to foreign funding shocks

⇒ *Novel trade-off between solvency risk and exposure to foreign liabilities*

3 Capital controls and FX interventions are complementary to increases in CR

- Policies that limit reliance on foreign liabilities and curb FX fluctuations are beneficial

⇒ *New insight on use of CFM/FXI as part of an integrated policy framework (IMF, 2023)*

Presentation Outline

Methodology

1. Tractable (non-linear) quantitative framework:

- risky financial intermediation + foreign liabilities
- embedded into an otherwise standard quantitative SOE framework

2. Quantitative model properties

- characterization of *foreign liability channel* of CR and trade-offs
- interaction with other prudential policies

3. Empirical test of foreign liability channel

- impact of bank capital requirements on bank foreign liabilities in Peru

Literature

1. Bank capital requirements in quantitative models

(see e.g. Van Den Heuvel, 2008; Martinez-Miera and Suarez, 2014; Clerc et al., 2015; Begenau, 2020; Mendicino et al., 2018, Corbae and D'Erasmus, 2021)

⇒ Novel trade-off in bank exposure to sources of instability

2. Interaction of macroprudential and FX/CFM in EM

(see e.g. Aoki, Benigno and Kiyotaki, 2016; Korinek and Sandri, 2016; Basu et al., 2020; Adrian et al., 2022; Das et al. 2023)

⇒ We explicitly consider role of bank default risk

3. Macroprudential (tax) policy in small open economies

(see e.g. Mendoza, 2010; Bianchi and Mendoza, 2011; Benigno et al., 2013; Bianchi, 2016; Schmitt-Grohe and Uribe, 2016; Fornaro and Romei, 2019)

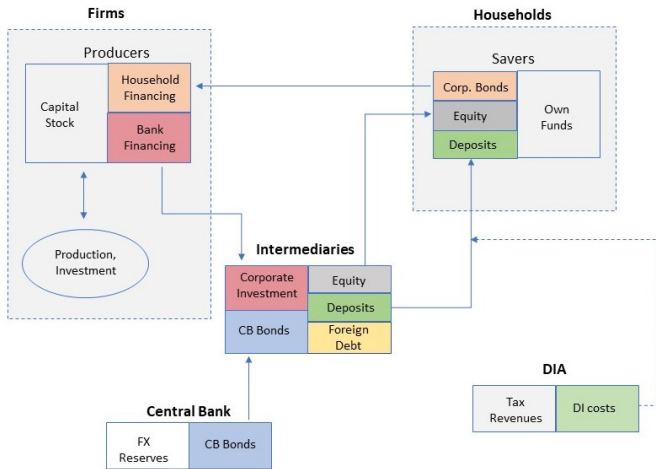
⇒ Inefficiencies arise from banks risk-taking incentives

4. Empirical impact of changes in bank capital requirements

(see e.g. Aiyar, et al. 2016; Peek and Rosengren, 1995; Gropp et al., 2018; Fraise and Thesmar, 2019, Fang et al. 2022)

Model Economy

Market Structure



Environment

- **Agents:** Households (HH), Firms, Banks, Foreigners, Gov't and Central Bank
- **Preferences:** $U(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma}$
- **Production Technology:** $Y_t = K_t^{\alpha_k} L_t^{\alpha_l} M_t^{\alpha_m}$ with $\alpha_k + \alpha_l + \alpha_m = 1$
 - Inputs are capital (K_t) labor (L_t) and imports (M_t)
- **Aggregate Risk:** domestic & foreign shocks
 - Shock to cross-sectional dispersion of bank's idiosyncratic risk ($\sigma_{\epsilon,t}$)
 - Shock to the availability of foreign funding ($\bar{d}_{t+1}^*$)

Key Distortions

1. Costly for HH to hold capital and for banks to issue equity
⇒ **banking sector matters for rest of economy**
2. Banks have limited liability and can default
⇒ **default is socially costly**
3. Banks issue local currency insured deposits
⇒ **excessive risk taking by banks**
4. Banks issue foreign currency uninsured liabilities
⇒ **cost of funding is responsive to bank default and FX risk**

Financial Intermediaries

Intermediaries operate under **limited liability** and max NPV of dividends

$$V_I(\mathcal{S}_{I,t}) = \max_{k_{I,t+1}, b_{I,t+1}, d_{I,t+1}, d_{I,t+1}^*, e_t} \phi_0 n_t - e_t + \epsilon_t + \mathbb{E}_t \left[\mathcal{M}_{t+1}^H \max\{V_I(\mathcal{S}_{I,t+1}), 0\} \right]$$

subject to

$$\begin{aligned} [BC] \quad & \underbrace{(1 - \phi^0)n_t}_{\text{ret earnings}} + \underbrace{e_t}_{\text{equity}} + \underbrace{q_{d,t}^* f_t d_{I,t+1}^* + q_{d,t} d_{I,t+1}}_{\text{debt}} \geq \underbrace{q_{k,t} k_{I,t+1}}_{\text{capital}} + \underbrace{q_{b,t} b_{I,t+1}}_{\text{CB bonds}} \\ & + \underbrace{\Psi_{d^*}(d_I^*, d_I)}_{\text{foreign debt cost}} + \underbrace{\Psi_e(e_t)}_{\text{eq. costs}} \end{aligned}$$

$$[LC] \quad \theta q_{k,t} k_{I,t+1}^I + q_{b,t} b_{I,t+1} \geq q_{d,t} d_{I,t+1}^I + q_{d,t}^* f_t d_{I,t+1}^{I,*}$$

$$[EBC] \quad \bar{d}_{t+1}^* \geq d_{t+1}^{I,*}$$

$$[NW] \quad n_{t+1}^I = [r_{k,t+1} + (1 - \delta)q_{k,t+1}]k_{I,t+1} + b_{I,t+1} - d_{I,t+1} - f_{t+1} d_{I,t+1}^*$$

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Banks are exposed to:

1. **Idiosyncratic shocks:** (ϵ_t): (unmodeled) heterogeneity in bank costs or revenues
2. **Bank risk shock** – time-varying variance ($\sigma_{\epsilon,t}$)
3. **Shock to availability of foreign funds:** ($\bar{d}_{t+1}^*$) – foreign funding shock

Bank Default and the Pricing of Foreign Liabilities

- **Ex-ante** identical
- Conditional on individual wealth n_t^I and profit shock ϵ_t , banks default if $V_t^I \leq 0$
- Bankrupt banks are liquidated and creditors recover portion of asset values RV_t
 - $\Theta_t RV_t$ accrues to foreign investors, and $(1 - \Theta_t)RV_t$ is taken over by government
- Foreign creditors offer D_t^* at price $q_{d,t}^*$ such that

$$q_{d,t}^* = \underbrace{\frac{1}{R_s^*}}_{\text{intn'l interest rate}} \mathbb{E}_t \left[\underbrace{\frac{\Theta_{t+1} RV_{t+1} F_{\epsilon_{t+1}}}{f_{t+1} D_{t+1}^*}}_{\text{payoff on defaulted debt}} + \underbrace{(1 - F_{\epsilon_{t+1}})}_{\text{payoff on performing debt}} \right]$$

$\Rightarrow$ sensitive to default probability $F_{\epsilon_{t+1}}$ and exchange rate movements f_{t+1}

Calibration

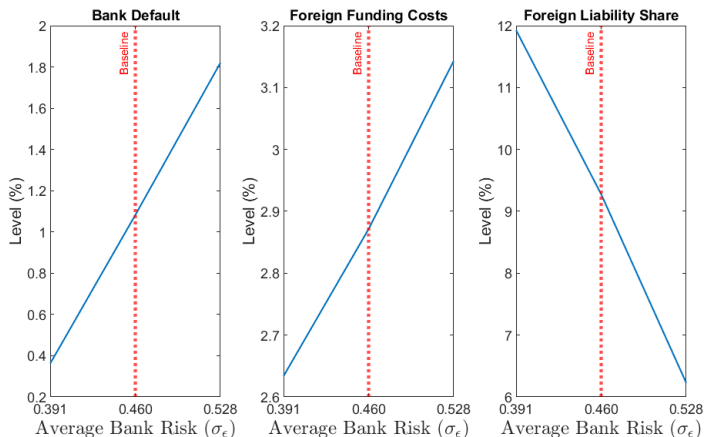
Targeted Moments

- Model calibrated to match macro, financial & banking data in **Peru over 2000–2019**

Moment	Data	Model
Av. Investment / GDP	22.56	22.20
Av. HH Capital Share	11.38	14.64
Av. Foreign Liability Share	10.12	9.22
Av. Bank Default Rate	1.05	1.02
Av. Export / GDP	21.84	19.45
Av. Reserves / GDP	24.39	24.72
Vol. Bank Default Rate	0.98	1.07
AC(1) Bank Default Rate	0.89	0.74
Vol. Foreign Liability Share	1.04	0.75
AC(1) Foreign Liability Share	0.79	0.97
Vol. HH Capital Share	0.36	1.22
Vol. Investment / Vol. GDP	4.19	3.46
Vol. Export / Vol. FX	5.22	3.26

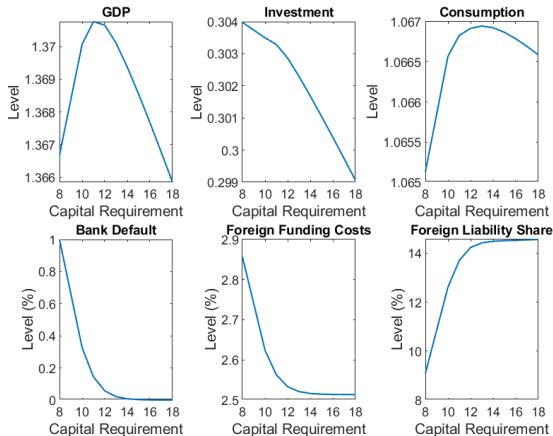
Long-run Effects

Bank Default Risk and Foreign Liabilities



- $\uparrow$ default risk $\Rightarrow \uparrow$ foreign funding costs $\Rightarrow \downarrow$ foreign liability share

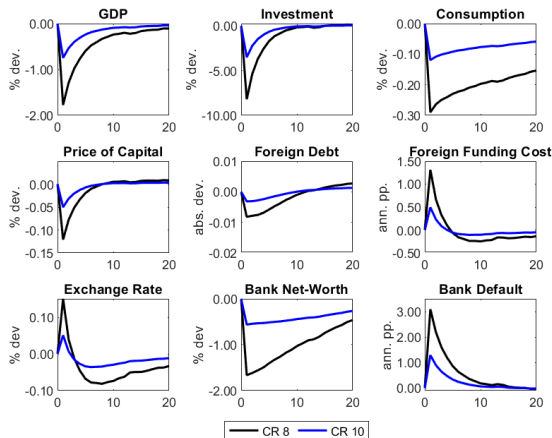
The Impact of Higher Capital Requirements



- **Financial Stability:** $\downarrow$ bank default $\Rightarrow \downarrow \downarrow$ default costs & $\uparrow$ consumption
- **Intermediation Capacity:** banks funded with more costly equity $\Rightarrow \downarrow$ investment
- **Foreign Liab. Channel:** $\downarrow$ foreign funding costs $\Rightarrow \uparrow$ foreign liability share

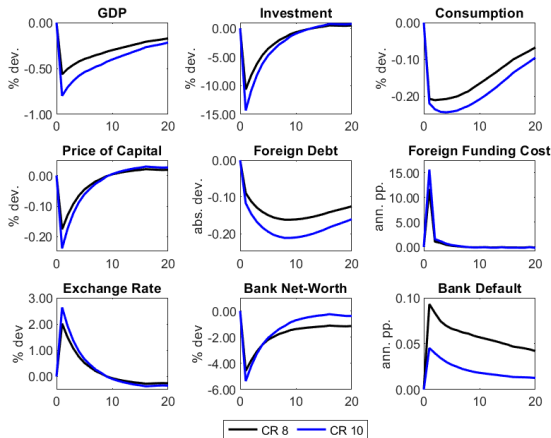
Responses to Shocks

Bank Risk Shock



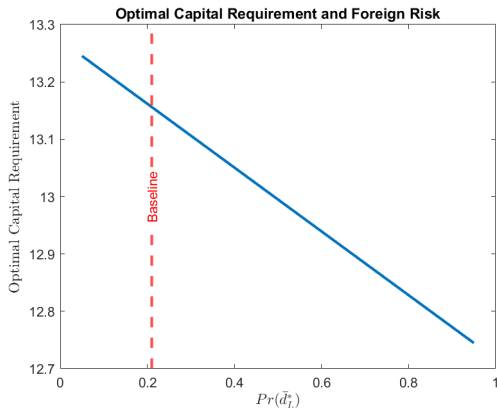
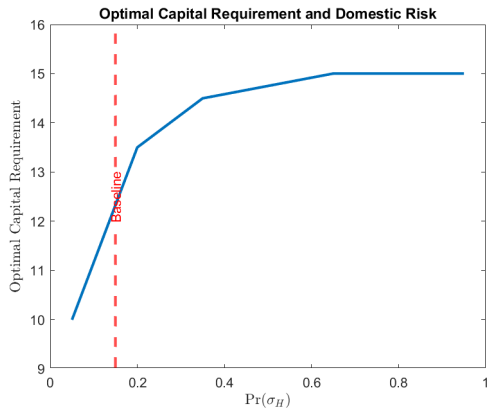
- **Financial Recession:** $\downarrow$ bank net worth $\Rightarrow$ $\uparrow$ bank default $\Rightarrow$ $\downarrow$ investment
- **Capital Outflow:** $\uparrow$ foreign. fund cost and $\uparrow$ real exchange rate (depreciates)
- **Higher CR:** less marked $\uparrow$ bank default $\Rightarrow$ mitigates real economy effects

Foreign Funding Shock



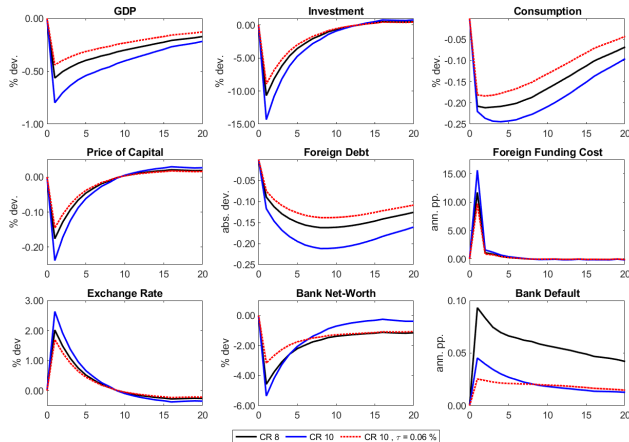
- **Capital Outflow:** $\uparrow$ real exchange rate (depreciates) $\Rightarrow$ real effects
- **Financial Recession:** $\uparrow$ bank funding cost & $\downarrow$ investment
- **Higher CR:** $\downarrow\downarrow$ investment but less marked $\uparrow$ bank default

Optimal Capital Requirements and Aggregate Risk Trade-off



- Probability of a **bank risk driven crisis** $\uparrow \Rightarrow$ optimal capital requirement $\uparrow$
- Probability of a **drop in the availability of foreign funds** $\uparrow \Rightarrow$ optimal capital requirement $\downarrow$

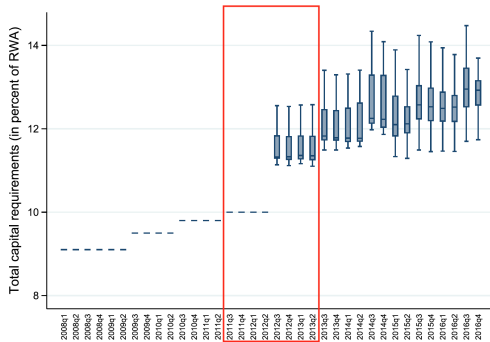
Foreign Funding Shock: Capital Flow Management Tax



- Higher capital control tax: $\downarrow$ foreign debt & $\uparrow$ equity so mitigated $\uparrow$ bank default $\rightarrow$ capital controls and capital requirements are complementary!
- Similar for FX interventions (in the paper)

Empirical Validation

Peru's transition to higher capital requirements (2009-2016)



Source: Fang, Jutrusa, Marrtines Peria, Presbitero, Ratnovski (2022)

- July 2008: gradual increase of uniform minimum capital requirements from 9.1% to 10% of RWA in 4 steps over 2009-2011
- July 2011: bank-specific compulsory capital buffer (anchored to bank loan portfolio characteristics) on top of the uniform 10% minimum capital requirement
⇒ substantial cross-sectional variation (16 Peruvian commercial banks)

Higher capital requirements and bank foreign liabilities

Diff-in-diff: effects of bank-specific changes of CR on foreign liabilities

$$y_{b,t} = \alpha_b + \alpha_t + \beta \text{CapitalRequirement}_{b,t-1} + \gamma X_{b,t-1} + \epsilon_{b,t}$$

- Key explanatory variable: time-varying **bank-specific** capital requirement
⇒ allows for **bank** and **time fixed-effects**
- Bank controls: bank size, liquidity, profitability, RWA, excess capital

	$\log(\text{ForeignDebt}_{b,t})$			$\frac{\text{ForeignDebt}_{b,t}}{\text{TotalLiabilities}_{b,t}}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{CapitalRequirement}_{b,t-1}$	6.29*** (1.82)	6.88*** (1.93)	6.72*** (1.92)	0.697*** (0.179)	0.520*** (0.176)	0.756*** (0.177)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	No	Yes	Yes	No	Yes
Time FE	No	Yes	Yes	No	Yes	Yes
N	185	185	185	245	245	245
R ²	0.975	0.877	0.977	0.822	0.569	0.838

⇒ Qualitatively and quantitatively consistent with model predictions Dynamic Setup

Conclusion

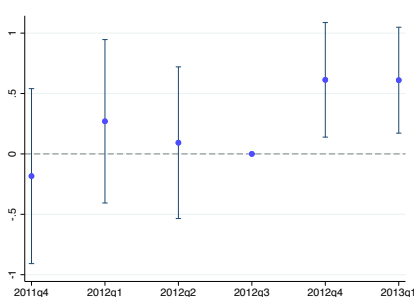
- Setting bank capital requirements to appropriate levels is essential to increase the resilience of the banking sector to domestic financial shocks
- Higher capital requirements $\Rightarrow$ increased reliance on foreign debt
 - Economy is more vulnerable to external financial shocks
- A combination of capital requirements and CC/FXI is desirable for stabilizing the response to external and domestic shocks

Appendix

Dynamic setup

- Estimate the dynamic impact of the higher capital requirements over time to test for pre-trends and the full dynamic propagation of the shock

$$\log(\text{ForeignDebt}_{b,t}) = \alpha_b + \alpha_t + \sum_{k \neq 2012q3} \beta_k \text{HighCapReq}_b \times 1_{k=t} + \gamma X_{b,t-1} + \epsilon_{b,t}$$



- Pre-reform implementation: no relation btw CR and foreign liabilities
- Post-reform implementation: banks in top quintile of capital requirement increased their foreign liabilities by more