Risky Banks and MacroPrudential Policy for Emerging Economies

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1The views expressed herein are those of the authors and do not necessarily reflect those of Bank of Mexico.
Motivation

Degree of interconnectedness among financial institutions $\uparrow \Rightarrow$ exposure of EMEs to AE financial shocks $\uparrow$, global banks played a key role

Portfolio capital flows and cross-border banking flows (non-core liabilities) create challenges for EMEs financial stability

- volatile, short-term, and pro-cyclical
- Hungarian case: banks borrowed from CH to finance mortgages
- important channel of international transmission of foreign shocks

What can EMEs do to mitigate the effects of volatile portfolio capital flows and cross-border banking flows, i.e. non-core liabilities? Implement MacroPrudential measures
This paper

What are the effects of the volatility of cross-border banking flows (non-core liabilities) in EMEs’ credit?

What can EMEs do to mitigate these effects on credit?

1. Empirical Evidence + VAR on the transmission of financial shocks from the U.S. to Mexico and Turkey (risky banks)

2. Two-country DSGE model
   - banks in the AE lend to banks in the EME
   - cross-border banking flows and risky EME banks
   - endogenous credit constraint faced by financial intermediaries (Gertler and Kiyotaki, 2010)

3. MacroPrudential policy in the EME to mitigate the effects of banks’ non-core liabilities
Results

1. VAR, a negative quality of capital shock in the U.S. prompts a negative impact in the EME
   - loans from U.S. banks to EME ↓
   - financial instability in the EME, credit ↓, GDP ↓
   - asset price co-movement across countries
   - when EME banks are risky for U.S. banks the crisis is deeper in the EME

2. Model replicates the facts from the VAR

3. MacroPrudential policy in the EME by ↓ the volatility of cross-border banking flows
   - ↓ sources of financial instability
   - EME consumers are better off
Mechanism

U.S. (AE)

↓ quality of K
↓ net worth
↓ credit
↓ investment
↓ output

tightening of borrowing constraint

EME

↓ net worth
↓ credit
↓ output
↓ investment
↓ asset price

Risky Banks: ↓↓ global lending ⇒ ↓↓ credit

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Empirical Evidence

In the last few years, cross-border banking flows have been very volatile

- financial crisis ⇒ ↓ of how much the U.S. lent to EMEs
- UMP, ZLB interest rate ⇒ ↑ of capital flows to EMEs
- normalization of MP ⇒ a new reverse of the capital flows

Non-core liabilities have been financing the increase in credit with respect to deposits in EMEs (Lane and McQuade, 2013)

How much are cross-border banking flows with respect to households’ deposits for Turkish and for Mexican commercial banks?

- Turkey: 6.5%
- Mexico: 1.9%

⇒ not big numbers but they can create lots of noise in the EME
Empirical Evidence

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Empirical Evidence: Credit to Deposits Ratio

Bank Credit to Bank Deposits, Percent, Annual

Source: FRED, Federal Reserve Bank of St. Louis.

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Empirical Evidence

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Graph

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How much are cross-border banking flows with respect to households’ deposits for Turkish and for Mexican commercial banks?

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⇒ not big numbers but they can create a lot of noise in the EME
Empirical Evidence: VAR for Mexico and Turkey

Impulse Responses to Cholesky One-Std-Dev. Innovation to NCO on Commercial US Banks.

- U.S. NCO
- S&P 500
- Foreign claims of U.S. banks
- EME GDP
- Dom. Bank Credit
- EME Exchange Rate
- EME Stock Mkt Index

Note: VAR estimated for 2002Q1 to 2013Q4 for Mexico, and for 2001Q3 to 2013Q3 for Turkey.

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The Model

1. Two-country DSGE model
   - builds on Gertler and Kiyotaki (2010)
   - banking sector
   - endogenous credit constraint faced by financial intermediaries
   - U.S. (AE) banks invest (via EME banks) abroad ⇒ external financing
     - U.S. is a relatively big economy with a big financial sector
     - EME is a relatively small open economy with a small financial sector
   - EME banks might run away with debt from AE banks - risky EME banks

2. Study the transmission of a shock to the quality of capital in the U.S.

3. Analysis of MacroPrudential policy in the EME
   - welfare evaluation
General Setting

- **Households**: Deposits to Banks
- **Banks**: Loans to Non-financial firms
  - Cross-border banking flows
  - Eq. injection to CB
  - Levy
- **Non-financial firms**: Loans from Banks
- **Households**: Deposits
  - AE - m
  - EME - [1-m]

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Financial Frictions: AE Banks

Gertler and Kiyotaki with international flows

- raise deposits from AE households, $d_t$
- lend
  - to AE non-financial firms, $s_t$
  - to EME banks, $b_t$

Incentive compatibility constraint

$$V_t(s_t, b_t, d_t) \geq \theta (Q_t s_t + Q_b t b_t)$$

Net worth of AE banks

$$N_t = (\xi + \sigma) \{ R_{k, t} Q_{t-1} S_{t-1} \psi_t + R_{b, t} Q_{b, t-1} B_{t-1} \} - \sigma R_t D_{t-1}$$

At the end of the period $t - 1$ the value of the banks satisfies

$$V(s_{t-1}, b_{t-1}, d_{t-1}) = E_{t-1} \Lambda_{t-1, t} \left\{ (1 - \sigma) n_t + \sigma \max_{s_t, b_t, d_t} V(s_t, b_t, d_t) \right\}$$
Financial Frictions: EME Banks

- raise funds from
  - EME households, $d^*_t$
  - AE banks, $b^*_t$
- make loans to EME non-financial firms, $s^*_t$

Incentive compatibility constraint

- $\omega = 1$, safe EME banks
  \[
  V_t(s^*_t, b^*_t, d^*_t) \geq \theta^* (Q^*_t s^*_t - Q^*_t b^*_t)
  \]
- $0 < \omega < 1$, risky EME banks
  \[
  V_t(s^*_t, b^*_t, d^*_t) \geq \theta^* (Q^*_t s^*_t - \omega Q^*_t b^*_t)
  \]

Net worth of EME banks

\[\mathcal{N}_t^* = (\sigma^* + \xi^*)[Z^*_t + (1 - \delta) Q^*_t] S^*_{t-1} - \sigma^*(R^*_t D^*_{t-1} + R^*_{bt} Q^*_{b,t-1} B^*_{t-1})\]
IRF to a Neg. Quality of $K$ Shock in the AE

1. Model with safe global banks (GB)
   - transmission across countries with asset price co-movement
   - cross-border banking flows fall
   - collapse of EME’s credit, financial instability
   - global financial crisis

2. Safe vs. risky EME banks
   - cross-border banking flows fall more
   - deeper transmission of the financial crisis

3. MacroPrudential policy by the EME CB

Calibration
- real sector: previous literature and Mexican data
- banking sector: previous literature and Mexican data on cross-border banking flows
IRF to a Neg. Quality of $K$ Shock - Global Banks

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IRF to a Neg. Quality of $K$ Shock - Risky Banks

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MacroPrudential Policy (MPP) in the EME

The Korean Experience

- August 2011, the Bank of Korea put a **levy on non-core liabilities**
- Purpose: non-core liabilities can generate systemic risk (procyclical and global interconnection of financial institutions)
- Result: share of short-term in total foreign borrowing by banks dropped from 64% as of end-June 2010 to 47% at end-December 2012

In the Model

- There is a cost (tax) when assets grow faster than deposits

\[
\rho^*_t = \left( \frac{S^*_{t+1} - S^*_t}{S^*_t} \right) \tau^* g_t
\]

- Total net worth of EME banks

\[
N^*_t = (\sigma^* + \xi^*) R^*_k Q^*_{t-1} S^*_{t-1} - \sigma^* \left[ R^*_t D^*_{t-1} + \rho^*_t R^*_b Q^*_{t-1} B^*_{t-1} \right]
\]
IRF to a Neg. Quality of $K$ Shock - MPP

- AE capital
- AE asset price
- AE net worth
- AE investment
- AE consumption
- AE final dom. demand
- TOT
- Global asset
- EME capital
- EME asset price
- EME net worth
- EME investment
- EME consumption
- EME final dom. demand
- $\bar{\rho}_g$

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Welfare Analysis

- Moments of the second order approximation of the model

\[ \text{Welf}_t = U(C_t, L_t) + \beta E_t \text{Welf}_{t+1} \]

- **Consumption Equivalent**: fraction of households consumption that would be needed to equate the welfare under no policy to the welfare under policy
AE and EME Consumption Equivalents for different $\tau_g^*$

$\rho_{gt}^* \equiv \left( \frac{\text{asset growth}}{\text{deposits growth}} \right)^{\tau_g^*}$

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Conclusions

What are the effects of the volatility of cross-border banking flows (non-core liabilities) in EMEs’ credit?

- prompt instability for the EME
- specially when EME banks are risky for the AE
- model matches qualitative evidence from the VAR

What can EMEs do to mitigate these effects on credit?

- Macropudrential Policy: levy on non-core liabilities, i.e. foreign debt, cross-border banking flows
- EME shows a smoother reaction with the intervention
- EME households are better off with the policy
Related Literature

Empirical Evidence

- Cross-border banking flows channel
  Cetorelli and Goldberg (2011) and Morais, Peydró, and Ruiz (2014)

- Large capital inflows increase the probability of credit booms
  Mendoza and Terrones (2008), Avdjiev, McCauley, and McGuire (2012), and Magud, Reinhart, and Vesperoni (2014)

- Credit growth associated with banks’ net debt flows
  Lane and McQuade (2013)

Theoretical Analysis

- Relevance of non-core liabilities
  Shin (2010), Shin and Shin (2010)

- 2-country model with global banks
  Dedola, Karadi, and Lombardo (2013) and Nuguer (2015)

This Paper’s Contribution

- VAR for different EME with a US net charge-off banks shock (risky banks)

- Theoretical model with global banks with cross-border banking flow channel for EMEs and MPP

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Empirical Evidence

Foreign claims of US reporting banks on individual countries

Empirical Evidence: Funding of Commercial Banks

Turkey: Deposit Money Banks Liabilities, Annual

Mexico: Deposit Money Banks Liabilities, Annual

Source: Turkish Central Bank and Bank of Mexico.

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Empirical Evidence: Funding of Non-Financial Firms

Source: Bank of Mexico.

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Benchmark: The RBC Model in Financial Autarky

Advanced Economy (AE)

\[ E_0 \sum_{t=0}^{\infty} \beta^t \left[ \ln C_t - \frac{\chi}{1 + \gamma} L_t^{1+\gamma} \right] \]

\[ X_t = A_t K_t^{\alpha} L_t^{1-\alpha} = X_t^H + X_t^* H \frac{1-m}{m} \]

\[ Y_t = \nu \frac{1}{\eta} X_t^H \frac{n-1}{n} + (1-\nu) \frac{1}{\eta} X_t^F \frac{n-1}{n} \]

\[ Y_t = C_t + \left[ 1 + f \left( \frac{l_t}{l_{t-1}} \right) \right] l_t + G_t \]

\[ S_t = I_t + (1-\delta) K_t \]

\[ K_{t+1} = S_t \psi_{t+1} \]

quality of capital shock

Financial autarky case: \[ CA_t = \frac{1-m}{m} X_t^{H*} - X_t^{F*} \tau_t = 0 \]

EME is similar with variables with *. \[ \psi_t \] and \[ \psi^*_t \] are i.i.d. and mutually independent. We study a shock in \[ \psi_t \].

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Financial Frictions: Households

Each household consists of a continuum of members

1. Worker
   - supplies labor

2. Banker
   - with prob. $\sigma$ continues being a banker
   - with prob. $1 - \sigma$ exits the banking business

Perfect consumption insurance within the household.

Problem

$$\max_{C_t, L_t, D_t} E_0 \sum_{t=0}^{\infty} \beta^t \left[ \ln C_t - \frac{\chi}{1+\gamma} L_t^{1+\gamma} \right]$$

s.t. $C_t + D_t = W_t L_t + \Pi_t + R_t D_{t-1} + T_t$
Financial Frictions: Non Financial Firms

1. Good producers
   Profit per unit of capital
   
   \[ Z_t = \frac{X_t - W_t L_t}{K_t} = \alpha A_t \left( \frac{L_t}{K_t} \right)^{1-\alpha} \]

   In order to finance new investment, they sell state-contingent claims, \( S_t \), to banks.

2. Capital good producers
   They choose investment to maximize profit
   
   \[ Q_t = 1 + f \left( \frac{l_t}{l_{t-1}} \right) + \frac{l_t}{l_{t-1}} f' \left( \frac{l_t}{l_{t-1}} \right) - E_t \Lambda_{t,t+1} \left[ \frac{l_{t+1}}{l_t} \right]^2 f' \left( \frac{l_{t+1}}{l_t} \right) \]

   with \( \Lambda_{t,t+1} = \beta \frac{C_t}{C_{t+1}} \)
Non-financial firms

No-cost technology for the final good production, problem:

$$\max_{X_t^H, X_t^F} Y_t = \left[ \nu^\frac{1}{\eta} X_t^H \frac{H - 1}{\eta} + (1 - \nu)^\frac{1}{\eta} X_t^F \frac{H - 1}{\eta} \right]^\frac{\eta}{\eta - 1}$$

s.t. $P_t Y_t = Z_t = P_t^H X_t^H + P_t^F X_t^F$

The optimization problem yields

$$P_t = \left[ \nu (P_t^H)^{1-\eta} + (1 - \nu) (P_t^F)^{1-\eta} \right]^{\frac{1}{1-\eta}}.$$

We can define everything in terms of TOT ($\tau = \frac{P_t^F}{P_t^H}$),

$$\frac{P_t^F}{P_t^H} = \left[ \nu + (1 - \nu) \tau_t^{1-\eta} \right]^{\frac{1}{1-\eta}}.$$

The demands are defined by

$$X_t^H = \nu Y_t \left[ \frac{P_t^H}{P_t} \right]^{-\eta} \text{ and } X_t^F = (1 - \nu) Y_t \left[ \frac{P_t^F}{P_t} \right]^{-\eta}$$

Law of one price + home bias, the real exchange rate is

$$\varepsilon_t = \frac{S_t P_t^*}{P_t} = \left[ \frac{\nu^* + (1 - \nu^*) \tau_t^{1-\eta}}{\nu + (1 - \nu) \tau_t^{1-\eta}} \right]^{\frac{1}{1-\eta}}$$
Non-financial firms - Adjustment Costs

CEE (2005)

\[ F(i_t, i_{t-1}) = \left[ 1 - S\left( \frac{i_t}{i_{t-1}} \right) \right] i_t, \]

with \( S(1) = S'(1) = 0, \quad \varphi \equiv S''(1) > 0. \)

GK (2010) problem

\[ \max_{l_t} E_t \sum_{\tau=t}^{\infty} \Lambda_{t,\tau} \left\{ Q_\tau l_\tau - \left[ 1 + f\left( \frac{l_\tau}{l_{\tau-1}} \right) \right] l_\tau \right\} \]

with \( f\left( \frac{l_\tau}{l_{\tau-1}} \right) = \left[ \varphi \frac{l_\tau}{l_{\tau-1}} - \varphi \right]^2 \)

\( f(1) = 0, \quad f'( \frac{l_t}{l_{t-1}} ) = 2\varphi \left[ \varphi \frac{l_t}{l_{t-1}} - \varphi \right], \quad f'(1) = 0, \quad f''\left( \frac{l_t}{l_{t-1}} \right) = 2\varphi^2 \equiv \varphi > 0. \)

The optimization problem yields

\[ Q_t = 1 + f\left( \frac{l_t}{l_{t-1}} \right) + \frac{l_t}{l_{t-1}} f'\left( \frac{l_t}{l_{t-1}} \right) - E_t \Lambda_{t, t+1} \left( \frac{l_{t+1}}{l_t} \right)^2 f'\left( \frac{l_{t+1}}{l_t} \right) \]

\[ = 1 + \left[ \varphi \frac{l_t}{l_{t-1}} - \varphi \right]^2 + \frac{l_t}{l_{t-1}} 2\varphi \left[ \varphi \frac{l_t}{l_{t-1}} - \varphi \right] - E_t \Lambda_{t, t+1} \left( \frac{l_{t+1}}{l_t} \right)^2 \left[ \varphi \frac{l_{t+1}}{l_t} - \varphi \right] \]
AE Banks Optimization

Bellman equation

\[
V(s_t, b_t, d_t) = \nu_{st}s_t + \nu_{bt}b_t - \nu_{dt}d_t
\]

\[
= E_t\Lambda_{t,t+1} \left\{ (1 - \sigma)n_{t+1} + \sigma \max_{d_{t+1},s_{t+1},b_{t+1}} V(s_{t+1}, b_{t+1}, d_{t+1}) \right\}
\]

The optimization implies

\[
\nu_t = E_t[\Lambda_{t,t+1}\Omega_{t+1}R_{t+1}]
\]

\[
\mu_t = E_t[\Lambda_{t,t+1}\Omega_{t+1}(R_{kt+1} - R_{t+1})]
\]

\[
\phi_t = \frac{\nu_t}{\theta - \mu_t}
\]

\[
\mu_t = \frac{\nu_{st}}{Q_t} - \nu_t
\]

\[
\frac{\nu_{st}}{Q_t} = \frac{\nu_{bt}}{Q_{bt}} \Rightarrow E_t\Lambda_{t,t+1}\Omega_{t+1}R_{kt+1} = E_t\Lambda_{t,t+1}\Omega_{t+1}R_{bt+1}
\]

where

\[
\Omega_{t+1} = 1 - \sigma + \sigma(\nu_{t+1} + \mu_{t+1}\phi_{t+1})
\]

\[
R_{kt+1} = \psi_{t+1} \frac{Z_{t+1} + (1 - \delta)Q_{t+1}}{Q_t}
\]
EME Banks Optimization

Bellman equation

\[ V(s^*_t, b^*_t, d^*_t) = \nu^*_{st} s^*_t - \nu^*_{bt} b^*_t - \nu^*_t d^*_t \]

\[ = E_t \Lambda^*_{t, t+1} \left\{ (1 - \sigma^*) n^*_{t+1} + \sigma^* \max_{d^*_{t+1}, s^*_{t+1}, b^*_{t+1}} V(s^*_{t+1}, b^*_{t+1}, d^*_{t+1}) \right\} \]

The optimization implies

\[ \nu^*_t = E_t [\Lambda^*_{t, t+1} \Omega^*_{t+1} R^*_t] \]

\[ \mu^*_t = E_t [\Lambda^*_{t, t+1} \Omega^*_{t+1} (R^*_t - R^*_t)] = \frac{\nu^*_{st}}{Q^*_t} - \nu^*_t \]

\[ \phi^*_t = \frac{\nu^*_t}{\theta^* - \mu^*_t} \]

\[ \mu^*_{bt} = E_t [\Lambda^*_{t, t+1} \Omega^*_{t+1} (R^*_t - R^*_t)] = \frac{\nu^*_{bt}}{Q^*_t} - \nu^*_t \]

\[ \phi^*_{bt} = \frac{\nu^*_t}{\theta^* \omega - \mu^*_t} \]

\[ \omega = 1 \frac{\nu^*_{st}}{Q^*_t} = \frac{\nu^*_{bt}}{Q^*_t} \Rightarrow E_t \Lambda^*_{t, t+1} \Omega^*_{t+1} R^*_t = E_t \Lambda^*_{t, t+1} \Omega^*_{t+1} R^*_t = E_t \Lambda^*_{t, t+1} \Omega^*_{t+1} R^*_t \]

\[ \omega < 1 \frac{\nu^*_{st}}{Q^*_t} = \left[ \frac{\nu^*_{bt}}{Q^*_t} - (1 - \omega) \nu^*_t \right] \frac{1}{\omega} \Rightarrow \mu^*_{bt} = \omega \mu^*_t \]

where

\[ \Omega^*_{t+1} = 1 - \sigma^* + \sigma^* (\nu^*_t + \mu^*_t + \phi^*_t) \]

\[ R^*_t = \psi^*_{t+1} \frac{Z^*_{t+1} + (1 - \delta^*) Q^*_t}{Q^*_t} \]
Risky EME Banks

The parameter \( \omega \) introduces a level of riskiness in the EME’ cross-border banking flows. EME banks can run away with a fraction \( \theta^*(1 - \omega) \) of international flows. ⇒ risky EME banks

For \( 0 < \omega < 1 \)

\[
E_t \Lambda^*_{t,t+1} \Omega^*_{t+1} R^*_kt_{t+1} > E_t \Lambda^*_{t,t+1} \Omega^*_{t+1} R^*_bt_{t+1} > E_t \Lambda^*_{t,t+1} \Omega^*_{t+1} R^*_bt_{t+1} 
\]

vs. \( \omega = 1 \)

\[
E_t \Lambda^*_{t,t+1} \Omega^*_{t+1} R^*_kt_{t+1} = E_t \Lambda^*_{t,t+1} \Omega^*_{t+1} R^*_bt_{t+1} > E_t \Lambda^*_{t,t+1} \Omega^*_{t+1} R^*_bt_{t+1} 
\]

When EME banks can run away with a fraction of cross-border banking flows, EME banks borrow more from AE banks and they are more exposed to events in the AE.
IRF to a Neg. Quality of $K$ Shock in the AE

1. Benchmark (no financial frictions and in financial autarky) vs. banks in financial autarky ▶ IRF
   - amplification of the shock
   - transmission across countries very small

2. Model with banks and in financial autarky vs. model with global banks (GB) ▶ IRF
   - transmission across countries with asset price co-movement
   - cross-border banking flows work as an insurance
   - global financial crisis

3. Model with GB and safe vs. risky EME banks
   - cross-border banking flows fall more
   - deeper transmission of the financial crisis

4. MacroPrudential policy by the EME CB

Calibration
## Calibration

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<th>EME</th>
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$\Rightarrow \theta$ matches $R_k - R = 110$ basis point per year and $\theta^*, R_k^* - R^* = 115$
IRF to a Neg. Quality of $K$ Shock - Benchmark
IRF to a Neg. Quality of $K$ Shock - No global banks

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IRF to a Neg. Quality of K Shock - Global Banks

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IRF to a Neg. Quality of $K$ Shock - Risky Banks

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Consumption Equivalent

AE and EME Consumption Equivalents for different $\omega$

- AE all shocks
- EME all shocks

Cuadra and Nuguer (Banco de México) - Risky Banks and MacroPrudential Policy for Emerging Economies
IRF to a Neg. Quality of $K$ Shock - MPP+UMP

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