Exchange Rates, Domestic Credit, and Macroprudential Policy

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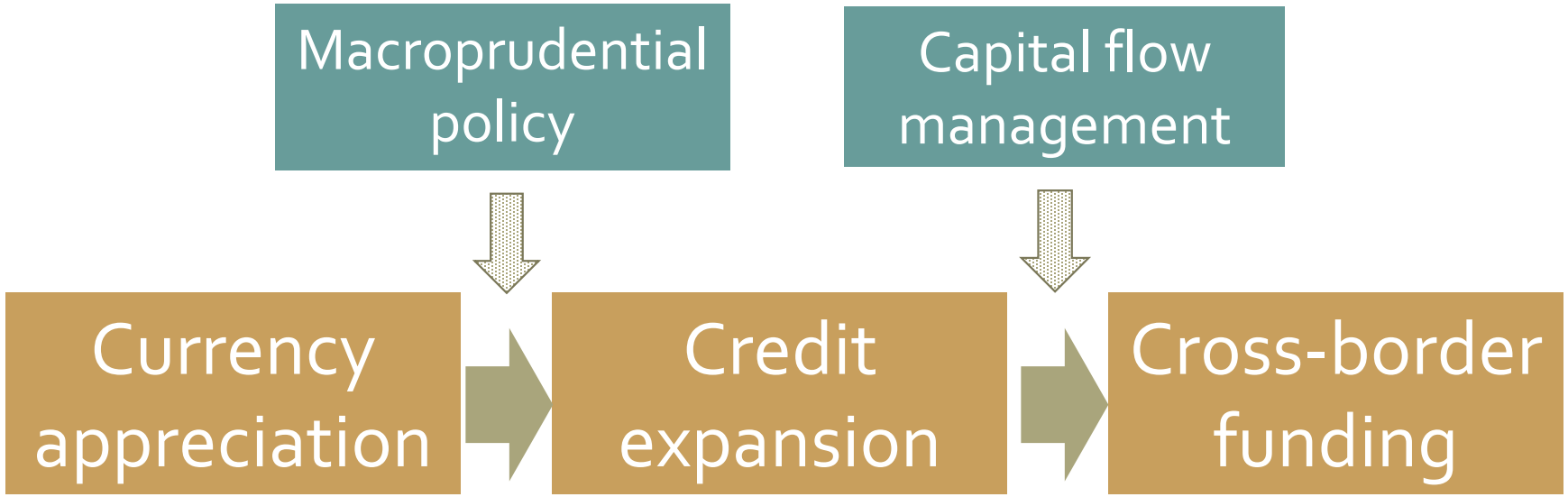
Introduction



Contributions

- **Emerging literature on currency appreciation and credit**
  - Use the **credit-to-GDP gap,** a continuous indicator of the build-up of systemic risk recommended by the BCBS, and the new iMaPP database
- **Literature on effectiveness of macroprudential policy**
  - Examine **interaction effect** of macroprudential policy in mitigating the impact of the exchange rate on credit
- **Literature on capital flows and credit**
  - Examine **the feedback effect** from credit to cross-border funding in the context of leakages of macroprudential measures
- **Literature on the effectiveness of capital controls**
  - Examine **complementary role** of targeted capital controls when macroprudential policy faces cross-border leakages

Summary of Key Findings

- **Exchange rate movements are found to have significant and economically strong effects on domestic credit**
  - An appreciation of the local exchange rate vis-à-vis the USD leads to an increase in the credit-to-GDP gap in the next quarter.
- **Macroprudential policy is found to have direct effect on domestic credit**
  - Where macroprudential policy is tightened, there is a reduction in the credit-to GDP gap in the next quarter (particularly strong when controlled for endogeneity).
- **Macroprudential policy weakens the extent to which exchange rate movements drive up domestic credit**
  - Impact of an appreciation on credit-to-GDP gap is weaker where macroprudential policies were tightened in the previous quarter (interaction effects).
- **Targeted capital controls can play a complementary role when macroprudential policy faces leakages**
  - Tighter monetary and macroprudential policy can further pull in cross-border funding, while targeted capital controls reduce it.

Outline of Presentation

1) Empirical Approach and Baseline Results

2) Addressing Simultaneity and Reverse Causality Concerns

3) Extension: Leakages and Complementary Role of Capital Controls

Empirical Approach

- Sample includes 62 economies (35 advanced and 27 emerging market economies) for the period 2000Q1-2016Q4
- Estimate a dynamic panel regression using a GMM estimator to avoid the Nickell bias and mitigate endogeneity concerns

$$\underbrace{Y_{i,t}}_{\text{Credit-to-GDP gap}} = \rho Y_{i,t-1} + \beta_1 \underbrace{\Delta^4 RER_{i,t-1}}_{\text{Direct exchange rate effect}} + \beta_2 \underbrace{MaPP_{t-1}}_{\text{Direct macroprudential effect}}$$

$$+ \underbrace{\beta_3 MaPP_{t-1} \times \Delta^4 RER_{i,t-1}}_{\text{Interaction effect of macroprudential policy}}$$

$$+ \underbrace{\theta Z_{i,t-1}}_{\text{Controls}} + \mu_i + \vartheta_{i,t}$$

$$Z_{i,t-1} = [MPS_{i,t-1}, \Delta^4 F\_RGDP_{i,t-1}]$$

Monetary policy and forecasted GDP growth

Baseline Results

- Exchange rate movements have significant and strong effects on domestic credit developments

- Macroprudential policy weakens the extent to which exchange rate movements impact credit developments

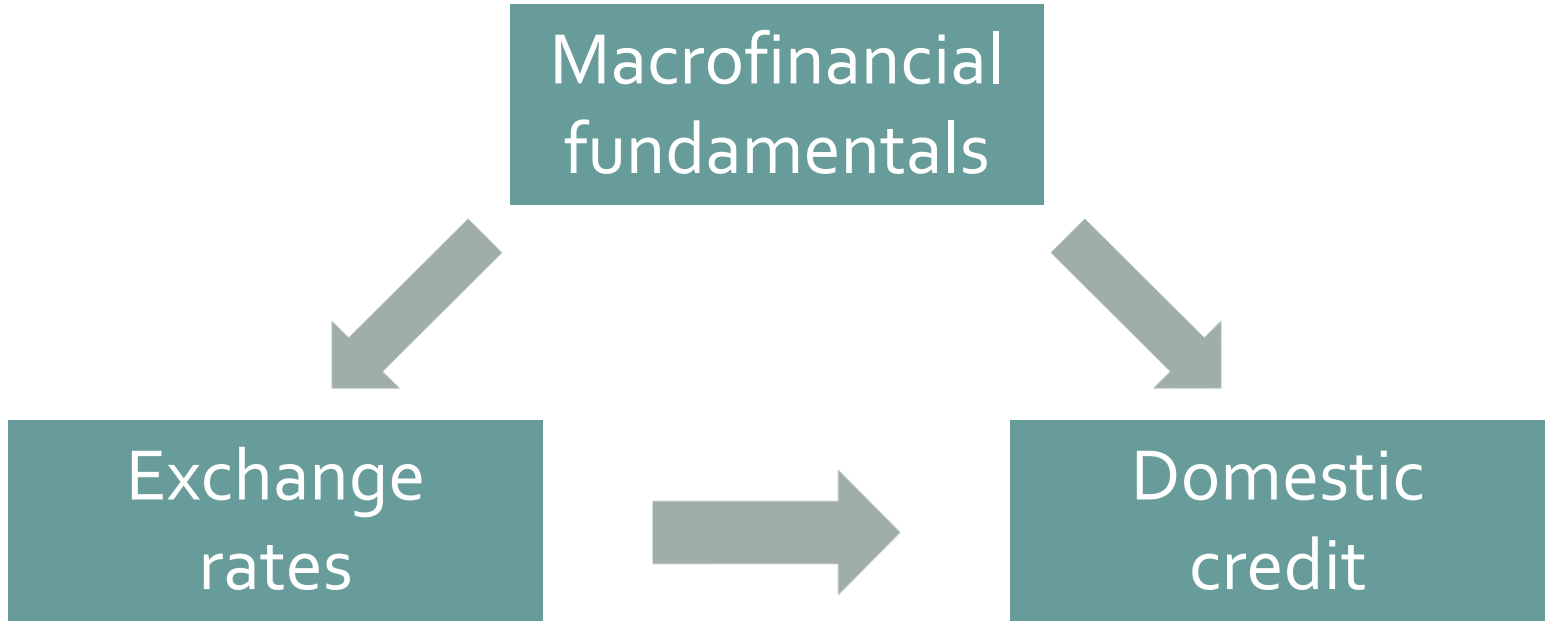
Variables	(1)	(2)
$Y_{i,t-1}$	0.982***	0.989***
	(0.020)	(0.018)
$\Delta^4 RER_{i,t-1}$	**-0.050****	**-0.054****
	(0.021)	(0.018)
$MaPP_{t-1}$	-0.875*	-0.737
	(0.463)	(0.461)
$MaPP_{t-1} \times \Delta^4 RER_{i,t-1}$		0.144***
		(0.048)
$MPS_{i,t-1}$	-0.269***	-0.264***
	(0.074)	(0.069)
$\Delta^4 F\_RGDP_{i,t-1}$	0.504***	0.462***
	(0.077)	(0.085)

- Macroprudential policy has a direct effect on domestic credit develop-ments (stronger once controlled for endogeneity)

- Monetary policy and forecasted GDP growth reduce and boost the credit-to-GDP, respectively

Simultaneity Concerns

- **Economic fundamentals may simultaneously be driving both exchange rate and credit developments**
  - Could results in simultaneity bias where coefficient on the exchange rate reflects both the causal effect and correlation through the simultaneity



Two-Step Approach

- **We "purge" the exchange rate from impact of fundamental factors,** by running a fixed-effect regression of the exchange rate on fundamentals:

$$\Delta^4 RER_{i,t} = \beta_1 \Delta^4 Inflation_t + \beta_2 \Delta^4 F\_RGDP_t + \beta_3 \Delta^4 CA\_Deficit_t + \eta_i + e_{i,t}$$

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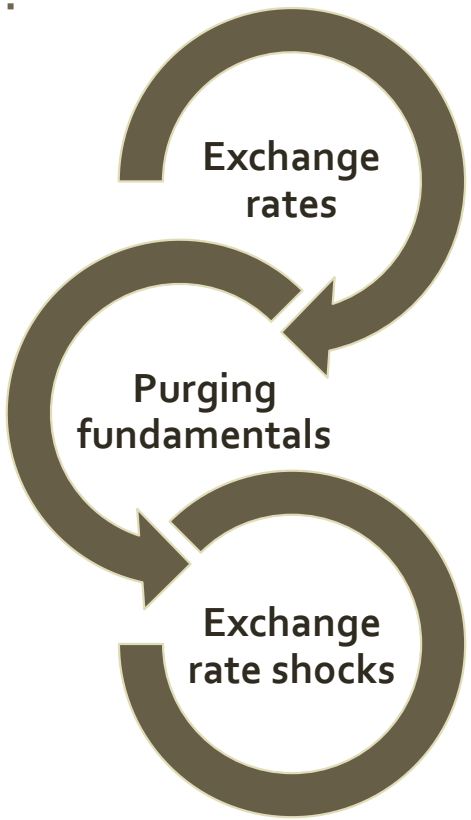


- **We use the residuals** from this regression to replace $\Delta^4 \mathrm{RER}_{i,t-1}$ in our baseline with those (lagged) "purged" exchange rate shocks

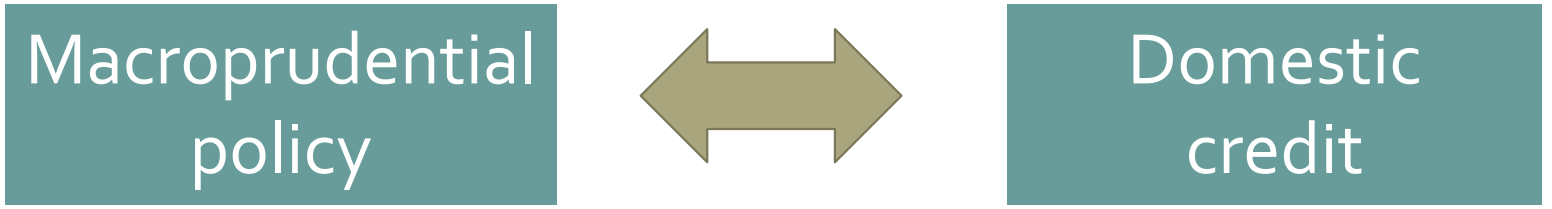
Results with "Purged" Exchange Rate Shocks

- **Results from the baseline regression continue to hold when we use "purged" exchange rates:**
  - Exchange rate shocks have a significant and strong effect on credit
  - Macroprudential policy affects credit, both directly and indirectly through reducing the impact of exchange rate shocks on credit

Variables	Baseline		With "Purged" Shocks	
$\Delta^4 RER_{i,t-1}$	-0.050** (0.021)	-0.054*** (0.018)	**-0.044**** (0.022)	**-0.054***** (0.019)
$MaPP_{t-1}$	-0.875* (0.463)	-0.737 (0.461)	**-0.866**** (0.414)	**-1.351***** (0.512)
$MaPP_{t-1} \times \Delta^4 RER_{i,t-1}$		0.144*** (0.048)		**0.203**** (0.085)

Reverse Causality Concerns

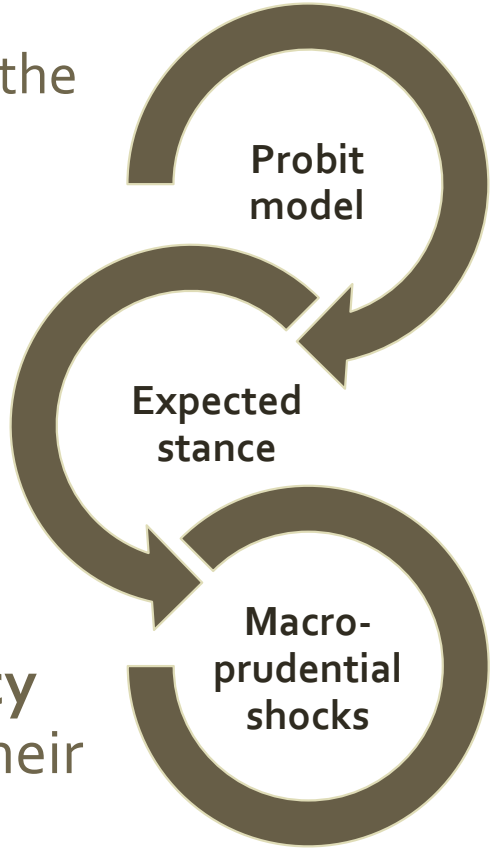
- **Macroprudential policy may react to credit developments as well as affect them**
  - Could results in **attenuation bias** where coefficient on the effects of macroprudential policy are biased towards zero (Alam et al., 2019)



- **Up until now we have addressed this by**
  - We **lag** the macroprudential indicator and control variables by one-quarter and also include the lagged dependent variable;
  - We use the **Arellano-Bond difference GMM methodology** which is suitable for independent variables that are not strictly exogenous
  - We focus on **the interaction term**, which should suffer less from an the endogeneity bias, since changes to exchange rates are not commonly taken into consideration when setting macroprudential policy.
- **Now we go a step further**

Three-Step Approach

1. We estimate **an ordered probit model of the macroprudential indicator** conditional on observables
   - Y-o-y change in the credit gap; change in the real exchange rate; change in net capital inflows; lagged policy actions; country indicator
2. We compute the **"expected" macroprudential policy stance**
   - Using the probabilities obtained in 1) conditional on the independent variables
3. We compute the **macroprudential policy shocks**, as the actual indicators minus their expected values—these shocks are orthogonal to credit developments (as well as exchange rate changes)



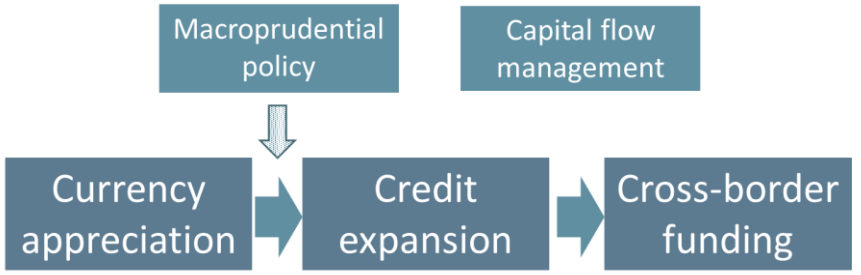
Results with Macroprudential Policy Shocks

- **Results from the baseline regression continue to hold when we use macroprudential policy shocks:**
  - In particular, **all the interaction terms are essentially the same**
  - At the margin, **the base effects** for macroprudential policy action are measured **larger and more significant** compared to the baseline
  - Overall, we find that **the attenuation bias** from reverse causality **is reduced** when we use the macroprudential policy shocks

Variables	Baseline		With Macro Pru Shocks	
$\Delta^4 RER_{i,t-1}$	-0.050** (0.021)	-0.054*** (0.018)	**-0.058***** (0.020)	**-0.055***** (0.019)
$MaPP_{t-1}$	-0.875* (0.463)	-0.737 (0.461)	**-1.088**** (0.490)	**-1.240**** (0.529)
$MaPP_{t-1} \times \Delta^4 RER_{i,t-1}$		0.144*** (0.048)		**0.178***** (0.048)

Extension: Leakages and Complementary Role of Capital Controls

Extension



- **We examine how credit and policies affect "other investment flows" that further increase systemic risk**
  - Other investment flows capture cross-border funding of financial institutions (non-core funding) and non-financial corporates.
  - Estimation embedded in standard regression on "pull" and "push" factors

Other investment flows

Credit-gap effect

$$\overbrace{CFLOW\_DM_{i,t}} = \rho CFLOW\_DM_{i,t-1} + \beta_1 \overbrace{Y_{i,t-1}}$$

$$+\beta_2 \underbrace{CON_{t-1}} + \boxed{\beta_3 CON_{t-1} \times Y_{i,t-1}}$$

Interaction effects of capital controls

Direct effect of capital controls

$$+\beta_4 MaPP_{i,t-1} + \beta_5 \underbrace{MPS\_DM_{i,t-1} + \Delta^4 RGDP_{i,t-1}}$$

Standard domestic "pull" factors

$$+ \mu_i + \underbrace{\mu_t} + \vartheta_{i,t}$$

Quarterly-fixed effects to capture global "push" factors

Important to address reverse causality concerns

Extension: Empirical Results

Variables	Aggregate iMaPP	Borrower-based tools	Borrower-based tools
$CFLOW\_DM_{i,t-1}$	0.721***	0.720***	0.720***
	(0.032)	(0.032)	(0.032)
$Y_{i,t-1}$	**0.069*** **	**0.068*** **	**0.088*** **
	(0.024)	(0.025)	(0.031)
$MaPP_{i,t-1}$	0.015	**1.350*** **	**1.324*** **
	(0.086)	(0.437)	(0.441)
CON_{t-1}	-2.725*	-2.755*	-3.013
	(1.574)	(1.567)	(1.851)
MPS_DM_{t-1}	0.156**	0.158**	0.155**
	(0.071)	(0.072)	(0.070)
$CON_{t-1} \times Y_{i,t-1}$			**-0.061***
			(0.037)

Strong domestic credit associated with increase in cross-border funding

Monetary policy tightening leads to (further) increases in cross-border funding

Macroprudential policy tightening does not reduce capital inflows but is associated with cross-border leakages, especially for borrower based tools.

In contrast, targeted capital controls have sizeable direct and indirect effects in reducing cross-border flows.

Conclusions

- **We examine the effectiveness of macroprudential policy in attenuating the impact of exchange rates on domestic credit cycles**
- **We find evidence that currency appreciations is associated with subsequent increases in the credit-gap**
- **Tighter macroprudential policy can mitigate this effect**
- **Both monetary and macroprudential tightening leads to increases in cross-border funding (leakages)**
  - Targeted capital controls attenuate increase in cross-border funding.
- **Therefore, tradeoffs need to be considered carefully**
  - Policymakers may consider combining macroprudential policy with targeted capital controls.