Exchange Rates, Domestic Credit, and Macroprudential Policy

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Central Bank of Iceland Seminar
Reykjavik, October 7, 2019

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Introduction

Macroprudential policy
Currency appreciation
Credit expansion
Cross-border funding

Capital flow management
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.
1) Empirical Approach and Baseline Results

2) Addressing Simultaneity and Reverse Causality Concerns

3) Extension: Leakages and Complementary Role of Capital Controls
• 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

\[ Y_{i,t} = \rho Y_{i,t-1} + \beta_1 \Delta^4 RER_{i,t-1} + \beta_2 MaPP_{t-1} + \beta_3 MaPP_{t-1} \times \Delta^4 RER_{i,t-1} + \theta Z_{i,t-1} + \mu_i + \epsilon_{i,t} \]

\[ Z_{i,t-1} = [MPS_{i,t-1}, \Delta^4 F_{RGDP_{i,t-1}}] \]
Baseline Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y_{i,t-1} )</td>
<td>0.982***</td>
<td>0.989***</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>( \Delta^4 RER_{i,t-1} )</td>
<td>-0.050**</td>
<td>-0.054***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>( MaPP_{t-1} )</td>
<td>-0.875*</td>
<td>-0.737</td>
</tr>
<tr>
<td></td>
<td>(0.463)</td>
<td>(0.461)</td>
</tr>
<tr>
<td>( \text{MaPP}<em>{t-1} \times \Delta^4 RER</em>{i,t-1} )</td>
<td>0.144***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.144***</td>
<td>(0.048)</td>
</tr>
<tr>
<td>( MPS_{i,t-1} )</td>
<td>-0.269***</td>
<td>-0.264***</td>
</tr>
<tr>
<td></td>
<td>(0.074)</td>
<td>(0.069)</td>
</tr>
<tr>
<td>( \Delta^4 F_{RGDP, i,t-1} )</td>
<td>0.504***</td>
<td>0.462***</td>
</tr>
<tr>
<td></td>
<td>(0.077)</td>
<td>(0.085)</td>
</tr>
</tbody>
</table>

- Exchange rate movements have significant and strong effects on domestic credit developments
- Macroprudential policy has a direct effect on domestic credit developments (stronger once controlled for endogeneity)
- Macroprudential policy weakens the extent to which exchange rate movements impact credit developments
- 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 result 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:

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

- We use the residuals from this regression to replace \( \Delta^4 RER_{i,t-1} \) 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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline</th>
<th>With “Purged” Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta^4 RER_{i,t-1}$</td>
<td>-0.050** (0.021)</td>
<td>-0.054*** (0.018)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.044** (0.022)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.054*** (0.019)</td>
</tr>
<tr>
<td>$MaPP_{t-1}$</td>
<td>-0.875* (0.463)</td>
<td>-0.737 (0.461)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.866** (0.414)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1.351*** (0.512)</td>
</tr>
<tr>
<td>$MaPP_{t-1} \times \Delta^4 RER_{i,t-1}$</td>
<td>0.144*** (0.048)</td>
<td>0.203** (0.085)</td>
</tr>
</tbody>
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Reverse Causality Concerns

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

![Macroprudential policy](image1) ![Domestic credit](image2)

- 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 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

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<td>-0.875* (0.463)</td>
<td>-0.737 (0.461)</td>
</tr>
<tr>
<td>( \text{MaPP}<em>{t-1} \times \Delta^4 \text{RER}</em>{i,t-1} )</td>
<td>0.144*** (0.048)</td>
<td>0.178*** (0.048)</td>
</tr>
</tbody>
</table>
Extension: Leakages and Complementary Role of Capital Controls
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.

\[
\begin{align*}
\text{CFLOW}_{DM_{i,t}} &= \rho \text{CFLOW}_{DM_{i,t-1}} + \beta_1 Y_{i,t-1} \\
&+ \beta_2 \text{CON}_{t-1} + \beta_3 \text{CON}_{t-1} \times Y_{i,t-1} \\
&+ \beta_4 \text{MaPP}_{i,t-1} + \beta_5 \text{MPS}_{DM_{i,t-1}} + \Delta^4 \text{RGDP}_{i,t-1} \\
&+ \mu_i + \mu_t + \vartheta_{i,t}
\end{align*}
\]
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.

### Extension: Empirical Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Aggregate iMaPP</th>
<th>Borrower-based tools</th>
<th>Borrower-based tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CFLOW_{DM_{i,t-1}}$</td>
<td>0.721*** (0.032)</td>
<td>0.720*** (0.032)</td>
<td>0.720*** (0.032)</td>
</tr>
<tr>
<td>$Y_{i,t-1}$</td>
<td>0.069*** (0.024)</td>
<td>0.068*** (0.025)</td>
<td>0.088*** (0.031)</td>
</tr>
<tr>
<td>$MaPP_{i,t-1}$</td>
<td>0.015 (0.086)</td>
<td>1.350*** (0.437)</td>
<td>1.324*** (0.441)</td>
</tr>
<tr>
<td>$CON_{t-1}$</td>
<td>-2.725* (1.574)</td>
<td>-2.755* (1.567)</td>
<td>-3.013 (1.851)</td>
</tr>
<tr>
<td>$MPS_{DM_{t-1}}$</td>
<td>0.156** (0.071)</td>
<td>0.158** (0.072)</td>
<td>0.155** (0.070)</td>
</tr>
<tr>
<td>$CON_{t-1} \times Y_{i,t-1}$</td>
<td></td>
<td>-0.061* (0.037)</td>
<td></td>
</tr>
</tbody>
</table>
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.