Targeting Financial Stability: Macroprudential or Monetary Policy

David Aikman, Julia Giese, Sujit Kapadia and Michael McLeay, Bank of England*

Boston Policy Workshop,
Federal Reserve Bank of Boston, 9 July 2017

* The views expressed in this presentation are those of the presenter and should not be thought to represent those of the Bank of England, Monetary Policy Committee members, or Financial Policy Committee members.
Pre-crisis: UK monetary policy and financial stability

Real economy stability...

- Inflation target
- CPI Inflation
- Official bank rate
- Nominal GDP growth

Per cent

[Graph showing economic indicators over time]

...financial instability

- Maximum-minimum range
- Interquartile range
- Median

[Graph showing financial stability indicators over time]

(a) Date MPC shifted to a 2% CPI inflation target

Sources: Published accounts and Bank calculations.
Post-crisis views

• Broad agreement on need for tougher structural regulation of financial sector and the role of macroprudential policy

• Divergence on role of monetary policy:
  – Stein (2013) only ‘monetary policy gets in all the cracks’
  – Shin (2015) ‘both monetary policy and macroprudential policies have some effect in constraining credit growth and the two tend to be complements’
  – Svensson (2015) ‘little or no support for leaning against the wind for financial stability purposes’
A simple, common framework for policymakers

• Articulate monetary-macroprudential interactions and trade-offs using a simple New-Keynesian model which:
  – introduces a role for credit and the possibility of a financial crisis (similar to Woodford, 2012; Ajello et al, 2016; Svensson, 2016)
  – augments standard loss function for financial stability objectives, including possibility of (financial crisis) hysteresis effects
  – includes macroprudential policy via countercyclical capital buffer (CCB)
  – examines jointly optimal policy and considers when monetary and macroprudential policies are substitutes or complements, including under different shocks
  – considers the implications of the zero lower bound, market-based finance and the risk-taking channel of monetary policy, and whether monetary policy should lean against the wind
Benchmark two-period model

IS curve:
\[ y_1 = E^{(ps)}_1 y_2 - \sigma(i_1 - E^{(ps)}_1 \pi_2 + \omega s_1) + \xi y_1 \]

Phillips curve:
\[ \pi_1 = \kappa y_1 + E^{(ps)}_1 \pi_2 + \nu s_1 + \xi \pi_1 \]

Real credit growth:
\[ B_1 = \varphi_0 + \varphi_i i_1 + \varphi_s s_1 + \xi B_1 \left[ + \varphi_{is} i_1 s_1 \right] \]

Macroprudential policy:
\[ s_1 = \psi k_1 + \xi B_1 \]

Crisis probability (based on cross-country estimation):
\[ \gamma_1 = \frac{\exp(h_0 + h_1 B_1 + h_2 k_1)}{1 + \exp(h_0 + h_1 B_1 + h_2 k_1)} \]
Loss function, expectations and calibration

Loss function: \[ L = \pi_1^2 + \lambda y_1^2 \ldots \]
\[ \beta(1 - \gamma_1)(\pi_{2nc}^2 + \lambda y_{2nc}^2)\ldots \]
\[ + \beta(1+\zeta)\gamma_1(\pi_{2c}^2 + \lambda y_{2c}^2) \]

Private sector assumes crisis will not occur so does not:

- react to changes in crisis probability
- internalise the effect of its behaviour on crisis probability

Most of model is calibrated to broadly match UK empirical evidence

- interpret time period as 3 years to capture credit building up over a longer horizon and policy implementation lags
Without macroprudential policy, monetary policy must trade off two goals.
Introducing macroprudential policy leads to welfare gains (1)
Introducing macroprudential policy leads to welfare gains (2)
Credit growth shocks: policies as substitutes

- In benchmark case, macroprudential tightening leads to monetary policy loosening, e.g., as credit growth increases.
Credit growth shocks (2)
Policies as substitutes or complements

**Table 5:** *Optimal policy in response to a credit boom (Shock to: $\xi_{1}^{B}$)*

<table>
<thead>
<tr>
<th>Case</th>
<th>$\Delta k_1$</th>
<th>$\Delta i_1$</th>
<th>Parameter restriction</th>
<th>Intuition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument complements</td>
<td>+</td>
<td>+</td>
<td>$\frac{\kappa^2}{\kappa^2+\lambda} &lt; \sigma \omega \psi$</td>
<td>The impact of the CCyB on potential output sufficiently exceeds its impact on demand</td>
</tr>
<tr>
<td>Instrument substitutes</td>
<td>+</td>
<td>-</td>
<td>$\frac{\nu \psi}{\kappa} &lt; \sigma \omega \psi$, $\frac{\partial \gamma_1}{\partial i_1} &gt; 1$</td>
<td>The impact of the CCyB on potential output does not sufficiently exceed its impact on demand, and the CCyB has a comparative advantage for reducing crisis probability</td>
</tr>
<tr>
<td>Instrument substitutes and sign switches</td>
<td>-</td>
<td>+</td>
<td>$\frac{\partial \gamma_1}{\partial i_1} &gt; 1$</td>
<td>The impact of the CCyB on potential output does not sufficiently exceed its impact on demand, and monetary policy has a comparative advantage for managing the crisis probability</td>
</tr>
</tbody>
</table>

- Monetary and macroprudential policies are strategic substitutes in the benchmark case, though instrument assignment can switch.
- Might be strategic complements if macroprudential policies have large supply effects, and the policymaker places a fairly high weight on inflation, or if they boost aggregate demand.
Optimal policy conditions

Intratemporal condition:

\[ \overline{\lambda} y_1 + \kappa \pi_1 = 0 \]

where \( \overline{\lambda} < \lambda \)

Intertemporal condition:

\[ \lambda y_1 \left( -\frac{v \psi}{\kappa} \right) = \left( \frac{\partial \gamma_1}{\partial k_1} + \frac{\partial \gamma_1}{\partial i_1} \left( \frac{v \psi}{\kappa \sigma} - \omega \psi \right) \right) \left( -\frac{\partial L}{\partial \gamma_1} \right) \]

where \( \frac{\partial L}{\partial \gamma_1} \) is the expected discounted cost of a crisis
Optimal response to different shocks (1)
Optimal response to different shocks (2)

- **CCyB**
- **Policy rate**

- Optimal policy change (pp)

<table>
<thead>
<tr>
<th>Credit and demand increase</th>
<th>Credit increases, spreads compress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Extensions to the model – summary outcomes

<table>
<thead>
<tr>
<th>Case</th>
<th>SD($y_1$)</th>
<th>SD($\pi_1$)</th>
<th>SD($B_1$)</th>
<th>median($\gamma_1$)</th>
<th>SD($i_1$)</th>
<th>SD($k_1$)</th>
<th>$E(L)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\zeta = 0$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Benchmark results under CCyB regime</td>
<td>0.11</td>
<td>0.005</td>
<td>5.3</td>
<td>0.77</td>
<td>0.11</td>
<td>1.45</td>
<td>1.37</td>
</tr>
<tr>
<td>(ii) Nash policies</td>
<td>0.10</td>
<td>0.005</td>
<td>5.3</td>
<td>0.94</td>
<td>0.10</td>
<td>1.33</td>
<td>1.41</td>
</tr>
<tr>
<td>(iii) ELB</td>
<td>0.09</td>
<td>0.030</td>
<td>5.5</td>
<td>1.73</td>
<td>0</td>
<td>0.76</td>
<td>2.61</td>
</tr>
<tr>
<td>(iv) Market-based finance</td>
<td>0.09</td>
<td>0.004</td>
<td>5.6</td>
<td>1.46</td>
<td>0.08</td>
<td>1.13</td>
<td>2.32</td>
</tr>
<tr>
<td>(v) Risk-taking channel</td>
<td>0.11</td>
<td>0.003</td>
<td>5.8</td>
<td>0.87</td>
<td>0.10</td>
<td>1.45</td>
<td>1.51</td>
</tr>
<tr>
<td>(vi) Endogenous crisis severity</td>
<td>0.22</td>
<td>0.010</td>
<td>4.8</td>
<td>0.73</td>
<td>0.21</td>
<td>2.85</td>
<td>1.87</td>
</tr>
</tbody>
</table>

- Table shows model simulations in response to a *credit shock*
- Several extensions make outcomes significantly worse
- In all variants, the CCyB remains the key financial-stability tool
If monetary policy is constrained by the effective lower bound, use the CCB less or later as greater consideration is needed for its effects on aggregate demand.
Implications of the effective lower bound (2)
Introducing market-based finance

- Assume $\gamma_1 = b\gamma_1^B + (1 - b)\gamma_1^M$,
  - $\gamma_1^B = \frac{\exp(h_0 + h_B B_1^B + h_k k_1)}{1 + \exp(h_0 + h_B B_1^B + h_k k_1)}$ - probability of banking crisis
  - $\gamma_1^M = \frac{\exp(h_0 + h_B B_1^M)}{1 + \exp(h_0 + h_B B_1^M)}$ - probability of market-based crisis
  - $b$ - share of lending in banking sector

- CCyB $(k_1)$ cannot increase resilience in market-based sector

- Bank and market-based lending determined by:
  - $B_1^B = \phi_0^B + \phi_i i_1 + \phi_s^B s_1 + \xi_1^B$
  - $B_1^M = \phi_0^M + \phi_i i_1 + \phi_s^M s_1 + \xi_1^M$
  - $\phi_s^B < 0$, $\phi_s^M > 0$ - CCyB causes credit to leak to market based sector
Implications of market-based finance

- As macroprudential policies become less effective, there is a stronger role for monetary policy to ‘lean against the wind’
Implications of a large risk-taking channel of monetary policy

- Lower interest rates make the CCB less effective at reducing lending growth
- Potential role for monetary policy in some circumstances
Conclusion and next steps

• Developed simple framework for modelling monetary and macroprudential policy
  – encapsulates many hypotheses & trade-offs in a parsimonious manner
  – key role for macroprudential policy throughout; monetary policy often a strategic substitute but instruments can be complements
  – identify circumstances in which monetary policy may be needed

• Next steps / extensions
  – incorporating product-based macroprudential tools
  – open economy considerations
Reserve Slides
Some Related Literature

• Monetary-macroprudential policy interaction in DSGE model

• Our model

• Policy-oriented discussions of monetary-macroprudential policy interaction
Calibration and estimated crisis probability

• Interpret time period as 3 years to capture credit building up over a longer horizon and policy implementation lags
• Most of the model is calibrated to broadly match UK empirical evidence
• Crisis probability equation based on estimation on cross-country dataset

![Graph showing the relationship between annual probability of a crisis and annual real credit growth, with lines for CCyB of 0%, CCyB of 1%, CCyB of 2.5%, and steady state credit growth.](image)
Implied UK crisis probability
# Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>Discount Factor</td>
<td>0.97</td>
<td>Matches $r^* = 1%$</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Interest-rate sensitivity of output</td>
<td>0.6</td>
<td>Burgess et al. (2013)</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>Slope of the Phillips Curve</td>
<td>1</td>
<td>Burgess et al. (2013)</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Weight on output stabilisation</td>
<td>0.05</td>
<td>Standard welfare-based</td>
</tr>
<tr>
<td>$i^*$</td>
<td>Long-run natural nominal rate of interest</td>
<td>3%</td>
<td>Rachel and Smith (2015)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\psi$</td>
<td>Effect of the CCyB on credit spreads</td>
</tr>
<tr>
<td>$\omega$</td>
<td>Effect of spreads on the IS curve</td>
</tr>
<tr>
<td>$\nu$</td>
<td>Effect of spreads on the Phillips Curve</td>
</tr>
</tbody>
</table>

## CCyB transmission mechanism

### Financial conditions equation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\phi_0$</td>
<td>Average real credit growth</td>
</tr>
<tr>
<td>$\phi_i$</td>
<td>Coefficient on interest rates</td>
</tr>
<tr>
<td>$\phi_s$</td>
<td>Coefficient on spreads</td>
</tr>
</tbody>
</table>

## Crisis probability equation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h_0$</td>
<td>Constant</td>
</tr>
<tr>
<td>$h_B$</td>
<td>Sensitivity of crisis probability wrt credit growth, $B$</td>
</tr>
<tr>
<td>$h_k$</td>
<td>Sensitivity of crisis probability wrt to CCyB, $k_1$</td>
</tr>
</tbody>
</table>

## Period 2 parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y_{2,c}$</td>
<td>Deviation of output from target in crisis state</td>
</tr>
<tr>
<td>$\pi_{2,c}$</td>
<td>Deviation of inflation from target in crisis state</td>
</tr>
<tr>
<td>$y_{2,nc}$</td>
<td>Deviation of output from target in non-crisis state</td>
</tr>
<tr>
<td>$\pi_{2,nc}$</td>
<td>Deviation of inflation from target in non-crisis state</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>Additional weight on E(crisis cost)</td>
</tr>
</tbody>
</table>

### Shocks

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SD(\zeta^y_{2})$</td>
<td>Standard deviation of demand shocks</td>
</tr>
<tr>
<td>$SD(\zeta^c_{2})$</td>
<td>Standard deviation of cost-push shocks</td>
</tr>
<tr>
<td>$SD(\zeta^k_{2})$</td>
<td>Standard deviation of credit quantity shocks</td>
</tr>
<tr>
<td>$SD(\zeta^s_{2})$</td>
<td>Standard deviation of credit spread shocks</td>
</tr>
</tbody>
</table>
Impulse responses

![Impulse response chart]

- 100bps increase in CCyB
- 100bps increase in policy rate

Axes:
- Impulse response (pp)
- $s_1$, $y_1$, $\pi_1$, $B_1$, $\gamma_1$