Motivation and Goals

- Financial deepening and inclusion much needed in LICs
- Periods of credit expansion often (but not always) end in crisis
  - Why do ‘bad booms’ happen?
  - Recognize a bad boom *as it is happening*?
  - Turn a bad boom into a good boom?
  - => Role for macroprudential (or micro-) policy?

- Our focus is exclusively on **private, intermediated** credit
- LICs face larger obstacles to policy implementation:
  - Informational requirements
  - Institutional hurdles
- Goal: build a model that is tailored to analysis of LIC credit markets and macroprudential policy
- Think about implementability of macroprudential policy in LIC context
Motivation: Credit Markets in LICs

- One size does NOT fit all
- Pathologies are not unique to LICs - but more severe
- Some common features:
  - Information scarce and asymmetrically distributed
  - Uncompetitive funding and loan markets
  - Large exogenous shocks
    - Real economy
    - Liquidity/financial shocks
  - Limited enforcement of contracts
  - Frictional spot markets, limited price discovery
  - Low proportion of economy’s wealth held in liquid form
  - Limited lending capacity
  - Dollarization
  - Role of foreign banks
Motivation: Empirics of Credit Booms in LICs

  - *Surges in capital inflows are associated with credit booms*
  - *Domestic and external factors play a role in driving credit booms*
- Gorton and Ordoñez (2015)
  - *Booms start with an increase of total factor productivity (TFP) and labor productivity (LP), such growth falls much faster subsequently for bad booms*
- Credit standards: countercyclical (IMF staff reports)


Credit standards, bank competition, business cycle: Ruckes (2004), Dell’Ariccia and Marquez (2006)


Good and bad booms: Mendoza and Terrones (2008), Gorton and Ordoñez (2015)

Micro empirics: Beaman, Karlan, Thuysbaert, Udry (2015)

The Model

- A simple static model of frictional financial intermediation
- *Extensive margin of credit* - new projects/plants/firms
- Profit maximizing entrepreneurs and bankers
- Entrepreneurs:
  - Have idea and wealth - but not enough to start project
  - Can choose to apply for loans and if successful, start a firm
  - Alternatively, invest their wealth in best possible alternative
  - Some are intrinsically better (ideas have higher expected NPV), but they all look the same
  - Entrepreneurs know which type they are
- Bankers:
  - Hold wealth in liquid form
  - Have lending technology
- Contracts:
  - Bankers make loans (size, rate) to entrepreneurs
  - Borrower fails to pay: banker seizes firm
  - No recourse to entrepreneurs outside wealth
Model: Entrepreneurs

- Entrepreneurs:
  - Endowed with wealth $w$
  - Technology: invest $k > w$ to yield $R^s$ w.p. $p^i$, $R^f$ w.p. $1 - p^i$
  - $i \in \{b, g\}; p^g > p^b$
  - $p^g R^s + (1 - p^g) R^f > \rho^b k > p^b R^s + (1 - p^b) R^f$
  - Mass $\theta$ of good entrepreneurs and $1 - \theta$ bad
  - Entrepreneurs can store wealth at rate $\rho^e$
Model: Bankers

Banks:
- Mass $B$ of bankers
- Each banker can originate one loan per period
- Bankers’ opportunity cost of funds: $\rho^b$

Baseline model:
- $B < \theta$ - there are fewer loans available than good projects
- Bankers endowed with liquidity $L$ at cost $\rho^e$
- Liquidity not lent out stored at $\rho^b$
Model: Alternative Interpretations

- Setup accommodates range of macro contexts
- \( \rho^b (\rho^e) \) is bankers’ (entrepreneurs’) opportunity cost of funds
  1. Bank has \( L \) units of domestic currency liquidity. Entrepreneurs earn \( \rho^e \) on bank deposits, government bonds yield \( \rho^b \).
  2. \( L \) is in USD, \( \rho^e \) is onshore USD depo rate and \( \rho^b \) is offshore USD depo rate
  3. Dollarized economy, bank can borrow abroad at \( \rho^b \)
  4. Parent bank funds domestic subsidiary at \( \rho^b \)
Model: Loan Contract

- Loan contract is a pair \((r, y)\), where \(y\) is entrepreneurs contribution to project (equity)
- \(l = k - y; \, w \leq y \leq w\)
- Limited liability for entrepreneurs:
  \[
  \max(R^i - r(k - y), 0), \quad i \in \{s, f\}
  \]
- With \(R^f < r(k - w)\), entrepreneur expected profit:
  \[
  \pi^{e,i} = p^i(R^s - r(k - y)) + \rho^e(w - y), \quad i \in \{b, g\}
  \]
- Participation constraint:
  \[
  \pi^{e,i} \geq \rho^e w
  \]
- Entrepreneurs’ surplus:
  \[
  S^{e,i}(r, y) = \pi^{e,i} - \rho^e w = p^i(R^s - r(k - y)) - \rho^e y
  \]
Limited liability for entrepreneurs $\Rightarrow$ bank payoff:

$$\min(r(k - y), R^i), \ i \in \{s, f\}$$

Expected profit from a loan $(r, y)$

$$\pi^b = p^j r(k - y) + (1 - p^j)R^f + \rho^b(L - (k - y))$$

$j \in \{b, g, p\}; \ p^p = \theta p^g + (1 - \theta)p^b$

Participation constraint:

$$\pi^b \geq \rho^b L$$

Banks’ surplus:

$$S^{b,j}(r, y) = \pi^b - \rho^b L = p^j r(k - y) + (1 - p^j)R^f - \rho^b(k - y)$$
Credit market is a sequential game

First stage: entrepreneurs decide whether to apply for loans or not
- Applying for a loan costs $\epsilon$ (non-pecuniary cost)

Second stage: bankers are randomly matched with applicants
- Bank offers a contract $(r, y)$ to its potential borrower

Third stage: entrepreneurs accept or reject contract
- If reject, entrepreneur (bank) stores her wealth (liquidity)
- If accept, project is activated, entrepreneur stores $w - y$ and bank stores $L - (k - y)$
Model: Surplus sharing

- How is \((r, y)\) determined in a match?
- Interested in studying effect that surplus distribution has on equilibrium
- Intuitively: more competitive credit market, lower share of surplus bankers keep
- Surplus sharing rule: banker sets \(r\) such that it gets \(\eta \in (0, 1)\) of expected surplus from a match
- In equilibrium, \(y\) will be set to either maximize match surplus or screen bad entrepreneurs
Equilibrium: Efficiency

- Three possible equilibria (from best to worst):
  1. Only good projects funded ("good" boom - separating)
  2. Both types of projects funded on same terms ("bad" boom - pooling)
  3. No credit

- Bad projects are negative NPV so no separating equilibrium where both types borrow
Equilibrium: Joint Surplus

- Surplus at a screening equilibrium:
  \[ S^g(y) \equiv S^{b,g} + S^{e,g} = p^g R^s + (1 - p^g)R^f - \rho^b k + (\rho^b - \rho^e)y \]

- Surplus at a pooling equilibrium:
  \[ S^p(y) \equiv S^{b,p} + \theta S^{e,g} + (1 - \theta)S^{b,g} = p^p R^s + (1 - p^p)R^f - \rho^b k + (\rho^b - \rho^e)y \]

- Assume:
  \[ p^p R^s + (1 - p^p)R^f > \rho^b k \]

- \( p^p < p^g \) so surplus at pooling is lower than at separating \( \forall y \)

- \( \rho^b > \rho^e \Rightarrow \) joint surplus maximized at \( y = w \)

- \( \rho^b < \rho^e \Rightarrow y = 0 \)
Max and min interest rates as function of $y$ implied by participation constraints

$S^{e,i} = 0, \ i \in \{b, g\}$:

$$\bar{r}^i(y) = \frac{R^s}{k - y} - \frac{\rho^e y}{p^i(k - y)}$$

$S^{b,j} = 0, \ j \in \{g, p\}$:

$$r^j(y) = \frac{\rho^b}{p^j} - \frac{1 - p^j}{p^j} \frac{R^f}{k - y}$$

Equilibrium interest rate:

$$r^j(y, \eta) = (1 - \eta)r^j(y) + \eta \bar{r}^j(y)$$
Equilibrium: Interest Rate

Graph showing the relationship between interest rates and a variable y. The graph includes lines for different rates labeled as $r^g$, $r^b$, $r'^g$, and $r'^p$.
Equilibrium: Interest Rate

Separating

Pooling

$r^g$, $r^g$, $r^p$
Solve the credit market game by backward induction

Look for symmetric, pure strategy Bayesian Nash equilibria

Final stage is straightforward: entrepreneur type $i$ accepts $(r, y)$ if it satisfies participation constraint:

$$p^i (R^s - r(k - y)) - \rho^e y \geq 0$$

<table>
<thead>
<tr>
<th>(Good Applies, Bad Applies)</th>
<th>$(r^s, y^s)$</th>
<th>$(r^p, y^p)$</th>
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<tbody>
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<td>(Yes, No)</td>
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**Equilibrium: Contracting Stage**

- Assume that both a screening and pooling equilibrium are feasible (necessary conditions hold).
- If both types apply for loan, when do bankers offer pooling contract?
  - Bad entrepreneur rejects the screening contract by definition => if borrower is bad, banker stores and earns zero surplus.
  - If all apply, matched entrepreneur is good w.p. $\theta$.
  - If both apply, pooling contract $(r^p, y^p)$ offered if:
    $$S_{b,p}^p(r^p, y^p) > \theta S_{b,g}^g(r^s, y^s)$$
- If the condition is satisfied, both types apply and $(r^p, y^p)$ is equilibrium contract.
- If violated, only good apply and $(r^s, y^s)$ is equilibrium contract.
- Why? Applying is costly, so bad only apply if probability of getting a loan is $> 0$. 

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*Credit Booms and Macroprudential Policies in LICs*

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No credit equilibrium:

\[ r^g(y) \geq \bar{r}^g(y) \quad \forall \ y \in [\underline{w}, \overline{w}] \iff NPV^G < 0 \text{ and } \underline{w} < \overline{w} \]

1. If \( \rho^b > \rho^e \), equilibrium is always separating with \( y = \overline{w} \)
2. \( y = \underline{w} \) at all pooling equilibria
3. If \( \rho^b < \rho^e \), equilibrium may be pooling or separating.
4. Pooling less likely as:
   1. \( \eta \) increases
   2. \( \rho^e \) decreases
   3. \( \underline{w} \) increases
   4. \( \rho^b \) ambiguous
Results

- Bad booms in the yellow area, good booms in the blue
- From left to right: bankers keep more of the surplus
- Finding: lower competition lowers the probability of a bad boom
Macroprudential Policy

- Relationship between opportunity cost of funds for bankers and entrepreneurs determines existence of inefficient credit boom
- How do these vary with:
  - The business cycle
  - Global financial cycles
  - Domestic liquidity conditions
  - Monetary policy
- Exact answers will depend on macro context in which micro model is embedded
Macroprudential Policy: General Findings

- **Micro-prudential:**
  - Loan-level leverage limits very effective in turning a bad boom into a good boom
  - High informational requirement for implementation?

- **Capital requirements:**
  - Capital requirements work similarly to increasing $\eta$
  - Higher capital requirements can reduce probability of bad booms

- **Limits on loan growth (caps on banking licenses or loans)**
  - Will prevent bad booms - but at the cost of any credit growth

- **Monetary policy**
  - Interest rate targets dominate quantity targets from financial stability perspective
  - Control over opportunity cost of funds to banking sector effective tool for financial stability
  - Comes at cost of reducing volume of loans