Liquidity Risk and Financial Stability Regulation

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Introduction

- Empirical evidence shows that banks borrow and lend (issue money-like liabilities and invest in risky assets) a lot during booms, and less so during downturns
- Predominant view among policy-makers: too much during booms, too little during downturns

  $\rightarrow$ excessive fluctuations in credit, asset prices and output
- Normative interpretation supported by growing academic literature on overborrowing in presence of pecuniary externailities

  Lorenzoni (2008), Mendoza (2010), Bianchi (2011), Jeanne and Korinek (2010,2013), Stein (2012), Gersbach and Rochet (2012), Kara and Ozsoy (2016), Korinek and Simsek (2016), Korinek and Davila (2017), etc.

Introduction

- Overborrowing literature
  - Agents (banks, households) do not take into account the incremental impact of their asset sales on asset prices during crises
  - Systemic risks due to fire sales (borrowing/collateral constraints)
  - Macroprudential regulation must curb excessive borrowing in booms
    - Pigouvian taxes on debt
    - Bank capital regulation
  - Focus on purely aggregate risk
    - In crisis state, *all* agents hit by adverse shock simultaneously
    - No (systemic) role for liquidity
- Contribution of this paper
  - Allow risk to have both **aggregate** and **idiosyncratic** component
    - In crisis state, only fraction of agents (banks) is hit by adverse shock
    - Brings liquidity regulation into the picture

Main Results

Fundamental effects

- Social inefficiencies
  - Whenever idiosyncratic risk is somewhat relevant, key inefficiency is that unregulated banks hold insufficient liquidity reserves
  - Underinsurance leads to *underborrowing* and *underinvestment* in risky assets
  - Overborrowing and overinvestment in risky assets only when idiosyncratic risk component is very small
- Optimal macroprudential regulation
  - No longer should focus on curbing excessive borrowing and investment (via taxes or capital regulation) ...
  - ... but should ensure sufficient liquidity in banking system (e.g., liquidity ratios or macroprudential minimum reserve requirements)

Literature

Closely related contributions

- **Stein (2012, QJE)**.
  Model where commercial banks can finance investment via private money creation, but subject to liquidity risk. Absent regulation, excessive money creation and vulnerability to financial crises.
- **Gersbach and Rochet (2012, JMCB)**.
  Model with aggregate investment externalities and free capital reallocation across traditional and financial sector. Banks exacerbate economic fluctuations by excessively reallocating capital in response to productivity shocks.
- **Kara and Ozsoy (2016, WP)**.
  Interaction of capital and liquidity regulation in model with fire-sales. Banks overinvest in risky assets and underinvest in liquid assets, calling for both macroprudential capital and liquidity regulation.

Literature

Related strands

- **Financial amplification**. Fisher (1933), Bernanke and Gertler (1989), Shleifer and Vishny (1993), Kiyotaki and Moore (1997)
- **Macroprudential policy under pecuniary externalities**. Lorenzoni (2008), Mendoza (2010), Bianchi (2011), Jeanne and Korinek (2010,2013), Stein (2012), Gersbach and Rochet (2012), Kara and Ozsoy (2016), Korinek and Davila (2017)
- **Strategic liquidity hoarding by banks**. Allen and Gale (2004), Gorton and Huang (2004), Acharya, Shin and Yorulmazer (2011)
- **Bank liquidity regulation**. Farhi et al. (2009), Perotti and Suarez (2011), Calomiris et al. (2015).

The model

Overview

Builds on Stein (2012) and Gersbach and Rochet (2012)

- Three time periods, $t = 0, 1, 2$
- Five types of agents
  - households
  - firms
  - banks
  - outside investors
  - international lenders
- Two states of the world
  - good state: all banks have high return on their investment projects
  - bad state: only fraction q of banks with high RoI, $1 - q$ with low RoI

The model

Households

- Endowed with
  - X consumption goods in period $t = 0$
  - $\bar{H} = 1$ units of labor in $t = 2$
- Linear preferences over consumption in periods 0 and 2,

$$u(C_0, C_2) = C_0 + \delta \mathbb{E}(C_2).$$

- Can use X to consume in $t = 0$ or purchase unsecured long-term bonds issued by banks, B^l
  - Bonds promise expected return R^l in $t = 2$
  - Households wiling to purchase bonds if $R^l \geq 1/\delta$.
- Supply labor inelastically to firms in $t = 2$ at wage rate w

The model

Firms

- Operate under perfect competition in $t = 2$
- Have access to Cobb-Douglas production technology,

$$Y = AK^{\alpha}H^{1-\alpha}$$

- Hire capital K from outside investors at rental rate R^k
- Hire labor H from housholds at wage rate W
- Maximize profits

$$\Pi^f = Y - R^k K - WH$$

The model

Banks

$t = 0$

- Raise external funds for investment by issuing
  - unsecured long-term debt B^l to households at interest rate R^l
  - secured short-term debt to international creditors at interest rate $R^s \in (1, R^l)$
- Have access to risky banking technology (project) and can store liquid funds as non-renumerated reserves L
- Bank budget constraint: $I + L = B^s + B^l$

$t = 1$

- State of the world realizes
  - good (p): all banks are *sound*
  - bad ($1 - p$): only a fraction q of banks are sound, $1 - q$ are *distressed*

The model

Banks

$t = 1$ (continued)

- Types / expected project returns in $t = 2$ revealed
  - $f(I) > I$ with certainty if bank is sound
  - $\lambda I \leq I$ in expectation if bank is distressed
    - $\frac{\lambda I}{1-\epsilon} < I$ with probability $1 - \epsilon$, 0 with probability ϵ
- **Sound banks** roll over secured short-term debt and possibly purchase shares in projects of distressed banks at price $k \leq 1$
- **Distressed banks** cannot roll over secured short-term debt
  - need to use reserves and sell project shares to sound banks and outside investors to repay short-term creditors

$t = 2$

- Return on bank projects realized; debts repaid

The model

Outside investors

- Endowed with W consumption goods in period $t = 1$
- Can transform consumption goods into capital goods at no cost
- Can use funds W to
  - purchase bank projects in $t = 1$
  - rent out capital K to firms in $t = 2$
- Choose activity with higher expected return; indifferent if

$$\frac{1}{k} = R^k.$$

- In end of $t = 2$, investors transfer earnings back to household sector

The model

International lenders

- Deep pockets
- Provide short-term funding for banks at rate R^s provided investment is entirely risk-free (secured by reserves and market value of bank projects in worst scenario)
- In $t = 0$, banks must satisfy collateral constraint

$$L + \lambda I k \geq R^s B^s$$

- In $t = 1$, only sound banks can roll-over short-term debt

The model

Key ingredients

- Collateral constraint binding for large enough spreads, $R^l >> R^s$,

$$L + \lambda I k = R^s B^s$$

- Real and financial sector of economy linked by no-arbitrage condition

$$1/k = R^k = \alpha A K^{\alpha - 1}$$

- Pecuniary externalities:

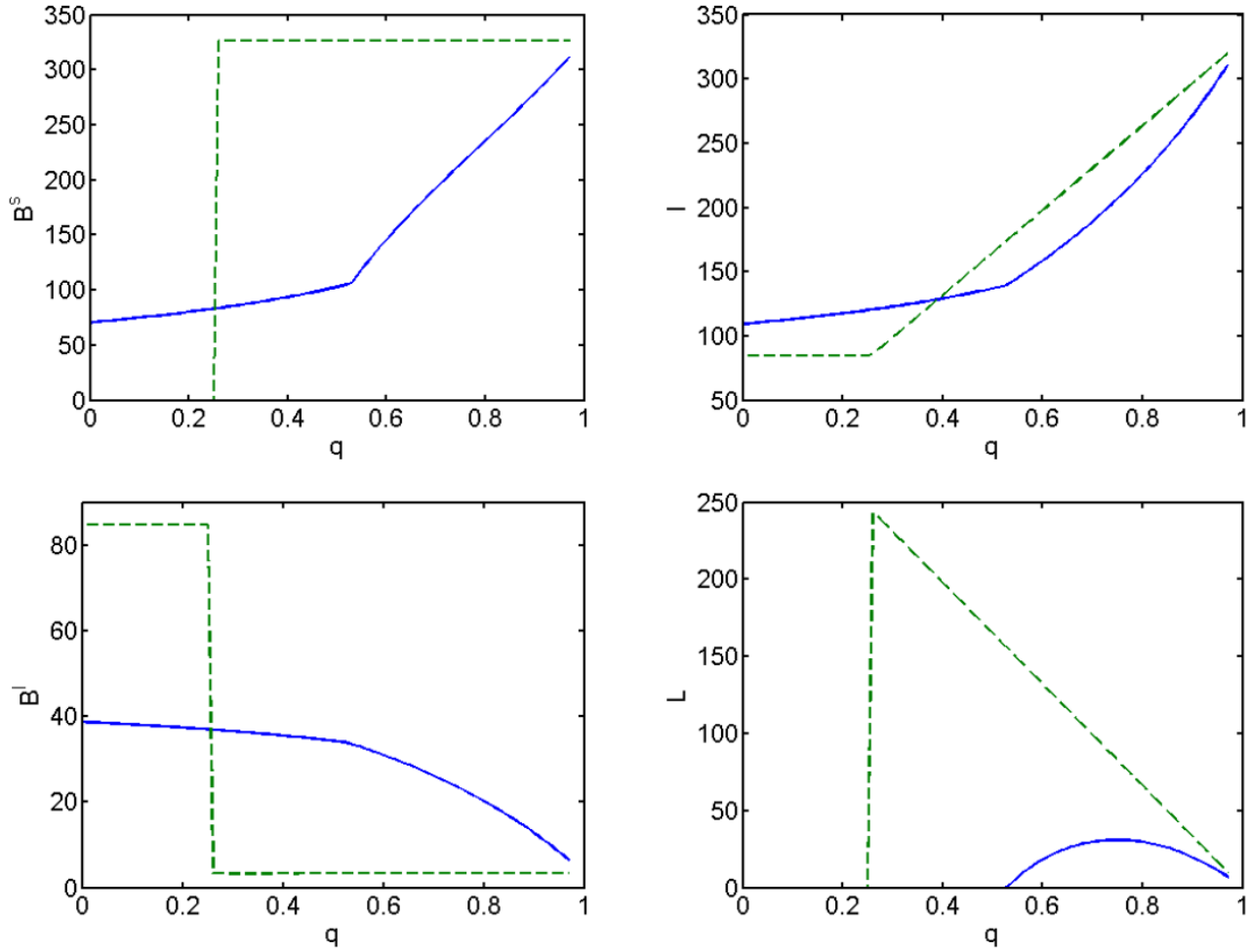
$$\begin{aligned} I \uparrow \quad &\Rightarrow \quad K \downarrow, R^k \uparrow, k \downarrow \\ L \uparrow \quad &\Rightarrow \quad K \uparrow, R^k \downarrow, k \uparrow \end{aligned}$$

- Social inefficiencies: competitive equilibrum differs from constrained-efficient allocation

Results

Numerical example

Parameters: $R^l = 1.04$, $R^s = 1.01$, $W = 140$, ...

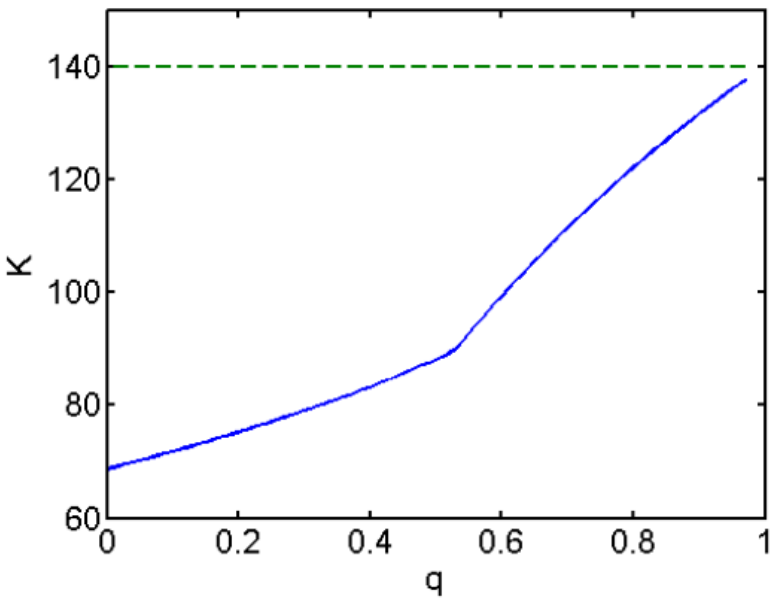


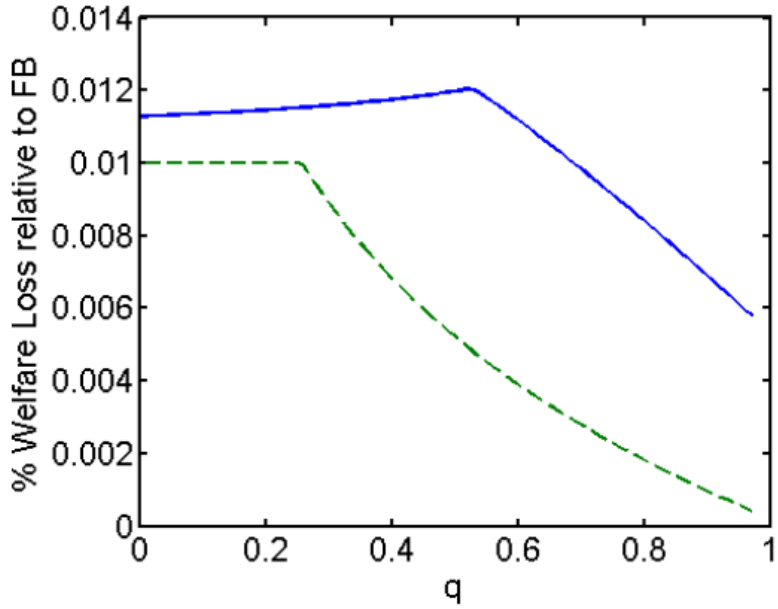
Note: Blue line = competitive equilibrium, green dashed line = constrained-efficient allocation.

The crisis probability p is adjusted with q such that $(1-q)(1-p) = 0.03$.

Results

Numerical example





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Macroprudential policy

Minimum reserve requirement

Proposition (Macroprudential minimum reserves)

A macroprudential regulator can implement the constrained-efficient allocation as a competitive equilibrium by imposing a minimum reserve requirement of $1 - q$ *units for each unit of short-term liabilities* $R^s B^s$ *in* $t = 0$*, and reducing this requirement to zero in* $t = 1$ *if the bad state is realized.*

Macroprudential policy

Pigouvian taxes and interest on reserves

Proposition (Price-based macroprudential measures)

A macroprudential regulator can implement the constrained-efficient allocation as a competitive equilibrium by imposing a Pigouvian tax τ on short-term borrowing and paying interest r on banks' liquidity reserves. However, this is costly for the regulator because tax revenues fall short of interest-on-reserves expenses,

$$\tau B^{s**} < rL^{**}.$$

Conclusion

- We have studied macroprudential policy in a model where liquidity risk has both an aggregate and an idiosyncratic component
- Idiosyncratic risk has important consequences
  - underborrowing due to insufficient liquidity reserves
- If fire-sale externalities are deemed important, macroprudential policy should focus on liquidity management by banks
  - Bank liquidity regulation (e.g., Liquidity Coverage Ratio) should respond to (macro-)economic shocks
  - Macroprudential revival of old monetary instrument: minimum reserve requirements