Sources of Liquidity and Liquidity Shortages

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Motivation

- traditional banking models (e.g., Diamond and Dybvig, 1983): in a crisis resources flow from the banking sector to the non-bank sector (e.g., bank run)
- in reality flow of resources of goes in the other way in a crisis, for example:
  - during crisis of 2007-2009 banks raised substantial amounts of equity
  - balance sheet of commercial banks lengthened during crisis (He, Khang, Krishnamurthy, 2010)
  - often inflows of deposits in stress times (Gatev and Strahan, 2006)

To understand reverse flow we need to think about:

- provision of liquidity by non-bank sector in crises times
- initial allocation of resources between bank and other sectors
- difference between non-bank sector liquidity and bank liquidity in crisis times
model with banking and non-bank sector
- non-bank sector: uninformed investors (such as households) or informed investors (such as hedge funds)

banks can raise liquidity from other banks but also from non-banks in order to meet random liquidity needs

difference between bank and non-bank liquidity: banks can purchase assets from other banks, while non-banks cannot
Focus of Talk: Efficiency of Ex-Ante Allocation of Resources

Key results:

- familiar overinvestment in risky assets within banking sector
- new dimension of inefficiency arising from inefficient ex-ante resource allocation between banking and non-bank sector
- direction of the bias depends on
  1. elasticity of liquidity supply by non-banks
  2. the relative cost of raising liquidity ex-ante versus ex-post
Role of supply of liquidity from outside the banking sector (Allen and Gale 2004, Acharya and Yorulmazer 2008, Acharya et al 2009, ...)
- typically exogenous supply of outside liquidity in times of crises
- no ex-ante problem of holding liquidity inside or outside banking system

Bolton et. al. (2010): focus on informational advantages of raising liquidity ex-ante versus ex-post
- here: focus on potentially limited outside liquidity

Holmström and Tirole (1996): liquidity demands arise from asset side
there are three dates: 0, 1, 2

non-bank sector: each agent endowed with liquid assets

bankers (project owner): endowed with access to projects

projects: require input at date 0, may require additional inputs at date 1, possibly return R at date 2

**Date 0:**

- a banker \(i\) decides on funds \(y_i\) to raise from non-banks
  
  - doing so incurs proportional costs \(\delta_0\) (e.g., agency problem in bank)
  
  - decides how much of the funds to invest in projects \((x_i)\)
  
  - remaining part \((y_i - x_i)\) held as liquidity
  
  - focus on choice of \(y_i\) (keeping \(x_i\) fixed): allocation of (liquid) resources between non-bank and banking sector

- non-banks decide whether to invest in banks or to store endowments
Date 1:

- the projects of some of the banks need a liquidity injection of $l$
- if liquidity injection not provided, projects cannot be continued and become worthless
- deficit banks have two ways to generate liquidity using projects
  - borrowing against project: limited, because fraction $\alpha$ of projects is not attachable
  - asset sales to other banks (transfer of ownership): value shrinks by factor $\beta$
- raising liquidity by borrowing from non-banks incurs deadweight loss $\delta_1$ (eg, adverse selection)

Model endogenously generates sequence for generating liquidity at $t=1$: i) borrow from other banks, ii) borrow from households, iii) asset sales to other banks
continued projects return $R$ or $(1 - \beta)R$, depending on whether they have been continued at originating bank or not

project returns and stored liquidity are used to pay bank owners and creditors
Central Question: Is the equilibrium amount of liquidity \((y)\) held in banking sector at \(t = 0\) socially efficient?

- To answer this question, study whether externalities are present

There are two types of constraints at \(t=1\): *individual* and *aggregate*

- individual constraint: borrowing capacity of a deficit bank may exceed its liquidity shortage
- aggregate constraint: liquidity that can be raised by entire banking sector exceeds its liquidity shortage

- aggregate constraint can become binding for two reasons:
  1. insufficient borrowing capacity of banking sector
  2. insufficient liquidity supply by non-banks
First Case: Elastic Liquidity Supply by Outsiders

- Suppose non-bank sector large relative to banking sector: liquidity supply by outsiders is then elastic at \( t = 1 \).
- In this case the first aggregate constraint is the one that matters.

**Proposition**

*The equilibrium amount of liquidity held in the banking sector at \( t = 0 \) is less than the efficient one (bank liquidity is underprovided).*
there is a positive externality from holding liquidity in the banking system which runs through the first aggregate borrowing constraint:

- if a bank raises more liquidity at $t = 0$ from non-banks, liquidity needs in the banking sector are lowered at $t = 1$
- this tends to relax the aggregate constraint
- price of assets in the interbank market rises (price of liquidity falls)
- benefits deficit banks as they have to sell fewer assets to generate liquidity

due to positive externality, there is a tendency for the banking system to raise insufficient liquidity at $t=0$

Note: reminiscent of results from traditional banking models (e.g., Bhattacharya and Gale, 1987)
Suppose non-banks are relatively small: liquidity supply at \( t = 1 \) is then inelastic.

In this case, supply of liquidity from outside the banking sector can be the constraining factor at \( t = 1 \) (second aggregate constraint becomes binding).

**Proposition**

*Inside liquidity is (i) underprovided if \( \delta_0 < \delta_1 \) and (ii) overprovided if \( \delta_0 > \delta_1 \).*

Recall that there are costs of raising liquidity from non-banks ex-ante at date 0 (\( \delta_0 \)) and ex-post at date 1 (\( \delta_1 \)).
when an individual bank raises more liquidity from households at date 0, this increases inside liquidity at date 1 but now it also reduces supply of liquidity from outside the banking system

net impact on aggregate constraint depends on the relative ability of inside and outside liquidity to generate liquidity at t=1:

- **Inside liquidity**: raise liquidity at t=0 and store for t=1: one unit of endowment generates $1 - \delta_0$ liquidity at t=1

- **Outside liquidity**: store liquidity at non-banks at t=0 and raise at t=1 (if needed): one unit of endowment generates $1 - \delta_1$ liquidity at t=1

Thus, if $\delta_0 > \delta_1$ holding liquidity inside the banking system reduces the capacity of the banking system to deal with liquidity problems at t=1

In this case inside liquidity tightens the aggregate constraint and causes a negative externality, resulting in inside liquidity to be overprovided
When Can We Expect Liquidity to be Oversupplied?

The model shows that liquidity may be oversupplied if two conditions are met:

1. outside liquidity is scarce
2. the relative cost of raising liquidity ex-post is low

These conditions do not apply to liquidity supply by uninformed investors (households). However, they arguably apply to informed investors (hedge funds, sophisticated private investors) because:

- their resources are small relative to banking sector ⇒ inelastic supply
- raising liquidity from them ex-post is relatively less costly since they are informed (can more easily value assets in crisis times)

⇒ suggests that banks raise ex-ante too much liquidity from informed investors (but too little from uninformed investors)
The traditional focus of ex-ante policies is to influence the allocation of resources within banking sector. For example, capital requirements aim at correction the mix of risky and safe investments at banks.

This paper suggests that we also have to be concerned about the allocation across sectors.

In addition, we also have to differentiate according to where banks are raising liquidity from.
We have developed a model in which banks can raise liquidity from outside the banking system when they have liquidity problems.

In this model, aggregate shortages of liquidity may arise for two reasons:

1. insufficient borrowing capacity of the banking system
2. insufficient liquidity supply by non-banks in a crisis

The model suggests a new allocation problem: ex-ante allocation of resources between bank and non-bank sector.

We highlight two factors in determining whether ex-ante allocation is efficient:

1. elasticity of non-bank liquidity supply
2. costs of raising liquidity ex-ante versus ex-post