Lecture 3: Insurance, Liquidity, and Crises

Alp Simsek

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Future borrowing constraints and demand for insurance

- So far: Investment with borrowing constraints.
- Future BC generates **demand for insurance**.
- If insurance imperfect, then precautionary behavior, crises...
- But when/why is insurance imperfect?
  - A reason: Asymmetric information (moral hazard/adverse selection).
  - Less plausible for aggregate shocks. Why?
- Relatedly: Active government lending/support during crisis. Why?

Holmstrom-Tirole: Private and public liquidity

This lecture: Brief discussion of Holmstrom-Tirole (JPE, 1998):

- Link between **insurance and liquid assets (pledgeable income).**
- Role for **government provision of liquidity**.

Key insight: Government can convert nonpledgeable income into pledgeable assets, thanks to its taxation power.

Holmstrom-Tirole: Key ingredients

Assumption 1: Limited pledgeable income and **asset shortages**.

- Inside liquidity: Es' income partially pledgeable (e.g., stocks/bonds).
- Fs' income (e.g., wages) not pledgeable. **But pledgeable to G**.
- **Outside liquidity:** Durable goods (e.g., mortgages), treasuries, bubbles...

Assumption 2: All promises, e.g., insurance, backed by pledgeable income.

- Collateral constraints with liquid assets serving as collateral.
- Complete markets **but only on** pledgeable income.

Holmstrom-Tirole: Liquidity shortages and crises

- Implication: Es both produce and use liquid assets (for insurance).
- HT characterize conditions under which inside liquidity is self-sufficient.
- When insufficient, demand for outside liquidity. **Liquidity premium.**
- If liquidity is scarce: Underinsurance, crises, government provision.

- We will illustrate subset of insights in a simple version of the model.

Holmstrom-Tirole: Environment

- An economy with three dates $t \in \{0, 1, 2\}$, and a single good (dollar).
- Agents: Es and Fs with preferences: $c_0 + c_1 + c_2$.
- Fs have large endowment in all periods. **Not pledgeable** (except to G).
- Unit mass of Es with net worth N at date 0, and investment technology...

E has investment opportunities now and in the future

Investment technology:

- Date 0: Investment I made (flexible scale).
- Date 1: Liquidity shock s realized. Each unit of investment requires injection of s more dollars to continue.
- Date 1: Continuation decision, a fraction $i(s) \in [0, I]$ of investment continued.
- Date 2: Project returns $Ri(s)$.

- Exact structure not important. E invests today and in the future.
- Question: How to plan for future needs **with limited pledgebility**...

Key assumption: Limited pledgeability

- Pledgeable output is $\rho i(s)$, where $\rho < R$ (moral hazard at date 1.5).
- Liquidity shock s has some distribution dF with mean $\bar{s}$.
- Assume: $\rho < 1 + \bar{s} < R$. Why?

Next: A simple case without uncertainty, i.e., $s = \bar{s}$ is constant.

- Think of date 1 as financial crisis state in full-fledged version.
- **Note:** All firms are in the same situation. **Aggregate shock** is important for insufficiency of inside liquidity.

Consider the case with no shocks

- At first look, this case seems equivalent to the static setting:

$$I = \frac{1}{1 + \overline{s} - \rho} N.$$

- Digging deeper into timing, there are two sub-cases:
  1. If $\overline{s} < \rho$, then E has slack borrowing capacity at date 1.
     Can implement the contract without ex-ante arrangements.
  2. If $\overline{s} > \rho$, then E needs additional liquidity inflows at date 1.
     Need ex-ante arrangements. Saving or insurance (uncertainty).
- But assets/insurance must be backed by liquidity (pledegable income).
- Given all Es need liquidity, there is **aggregate liquidity shortage**...

Implications of aggregate liquidity shortage

- **Ideal contract features saving/liquidity insurance:**
  E would like to give Fs $N - I > 0$ and receive this back at date 1.
- **Fs' pledgeability constraint breaks down the ideal contract...**
  No asset to back Fs promise. Project cannot continue since $\overline{s} > \rho$.
- **... and leads to an "inefficient" level of investment/liquidations:**
  E would invest $I = 0$ at date 0, since any investment is liquidated.
  With uncertainty, more generally: $I > i > 0$ due to liquidity shortage.

Two partial solutions: (i) Outside liquidity (ii) Government provision.

Outside liquidity facilitates insurance

- Consider an outside liquid asset at fixed supply, L_S.
- One unit is worth one dollar at date 1 (e.g., pays 1 dollar at date 1).
- E can purchase z units of the pledgeable asset at date 0.
- E can now choose i subject to **liquidity constraint**:

$$i\left(\overline{s}-\rho\right)\leq z.$$

(Equivalently, E could arrange insurance with F, requiring F to hold z units of asset as collateral).

Demand for outside liquidity

- Let q denote the price of the liquid asset. E's problem:

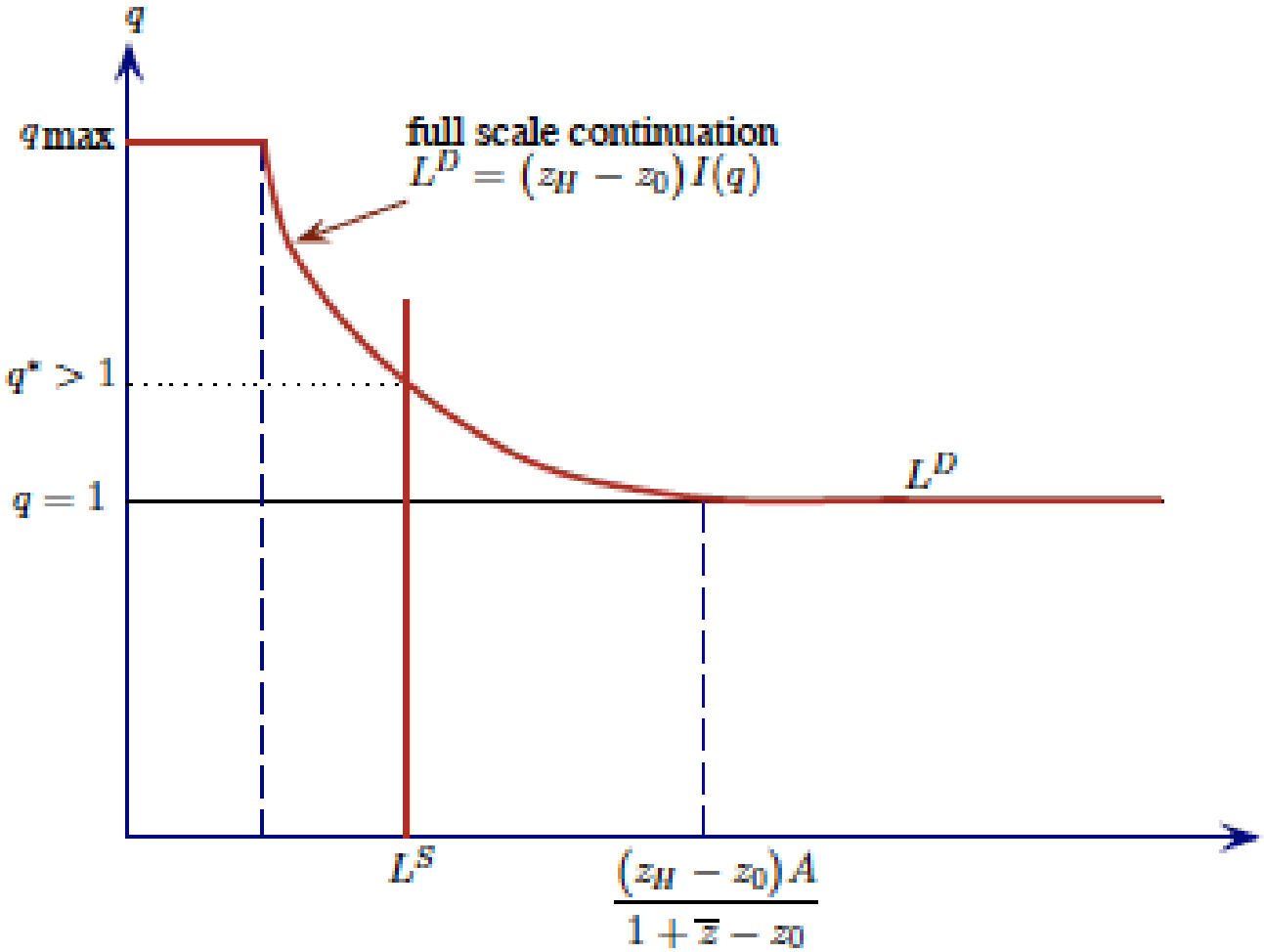
$$\begin{aligned} & \max_{I, i \leq I, z} (R - \rho) i \\ \text{s.t.} \quad & (\rho - \overline{s}) I + z \geq I - N + zq \\ & i (\overline{s} - \rho) \leq z. \end{aligned}$$

- Optimal contract when $q > 1$ and not too large:

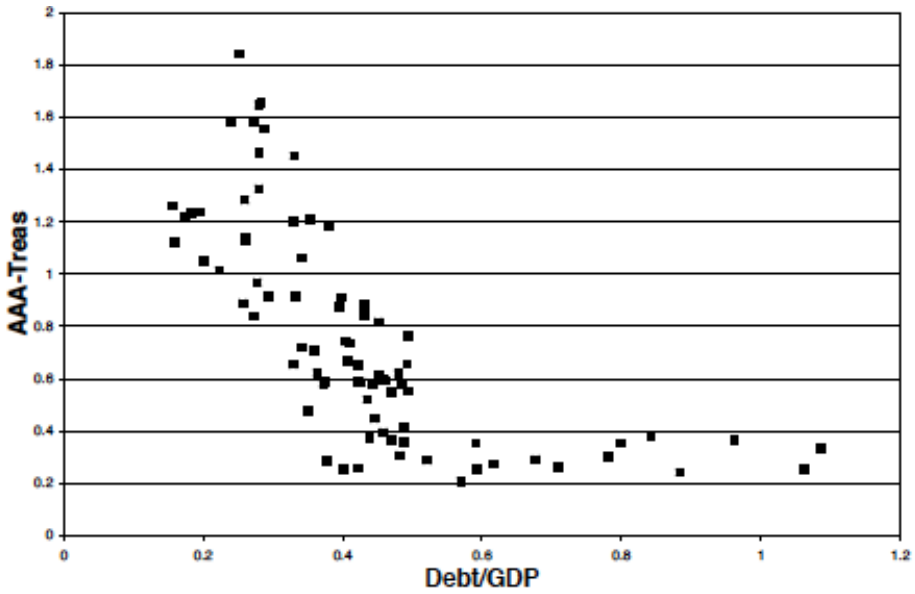
$$i = I(q) = \frac{N}{1 + \overline{s} - \rho + (\overline{s} - \rho)(q - 1)}.$$

Liquidity premium, $q - 1$, increases costs, reduces investment.

Liquidity premium in equilibrium



Treasury premium (Krishnamurthy/Vissing-Jorgensen)



The corporate bond spread (y-axis) is graphed versus the $Debt/GDP$ ratio (x-axis) based on annual observations from 1925 to 2005. The bond spread is the difference between the percentage yield on Moody's AAA long maturity bond index and the percentage yield on long maturity Treasury bonds.

- H-T interpretation: Cost of insurance for severe crises.

Government provision of liquidity: Public debt

- Consider above setting with $q > 1$. Suppose government increases L_S: It issuing bonds at date 0 and pays by **taxing Fs at date 1.**
- Suppose revenues are rebated to Fs at date 0, so Fs break even.
- Is this a Pareto improvement?

Key: Taxation turns nonpledgeable income into pledgeable assets!

Public debt as private liquidity

Older view: Public debt as a solution to asset shortages.

- Diamond (1965): Shortage of assets, with dynamic inefficiency (OLG).
- Government debt raises interest rates. Crowds investment out.

Newer version: Shortage of assets from limited pledgeability.

- Government debt still raises interest rates (see Woodford, 1990).
- But it can **crowd investment in**, as above, unlike the older view.
- Benefits do not require dynamic inefficiency unlike the older view.

Government liquidity provision: Ex-post interventions

- Back to the H-T model. Key feature of public debt arrangement: Transfers income from Fs to Es at times of distress.
- Can also implement without bonds, but **ex-post intervention**.
- Metaphor for active government policy during crises.
- Interpretations: Bailouts, lender of last resort, liquidity facilities...

Taking stock: Insurance, liquidity, and crises

- Future borrowing constraints generates demand for saving/insurance.
- H-T: Insurance supply depends on liquidity supply (liquid assets).
- Outside liquidity might be useful and might command a premium.
- Government liquidity might be useful thanks to its taxation power.
- One rationale for public debt premium and interventions during crises.

Next time: Crises and amplification mechanisms.