

COLLECTIVE MORAL HAZARD, MATURITY MISMATCH, AND SYSTEMIC BAILOUTS

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I. INTRODUCTION

Two facts

- (1) *Overall macroeconomic fragility: wide-scale maturity mismatch*

[subprime borrowers; commercial and investment banks; other players]

- (2) *Unprecedented bailouts (monetary and fiscal)*

This paper:

- proposes theory of why these two facts are related
- derives implications for regulation.

(1): Overall macroeconomic fragility

- ✓ *Subprime borrowers have been exposed to interest rate risk*
 - monthly repayment for ARMs.
 - ability to refinance

- ✓ *Commercial banks have pledged substantial liquidity support to the conduits.*

- ✓ *Investment banks have gained market share.*

Investment banks rely on Repo and CP funding much more than commercial banks do.

- ✓ *Primary dealers's ratio of overnight to term borrowing has grown.*

- ✓ *Others: LBOs*

(2) Unprecedented interventions

Example: Fed's balance sheet has tripled since 2007.

Bailouts:

- ✓ *monetary* (nominal interest rate close to 0)
- ✓ *fiscal*:
 - support to institutions
[recapitalizations, purchase of CP, underpriced deposit insurance]
 - support to asset prices
[as planned in TARP I and II; Geithner plan]

- Private leverage/capital insurance choices depend on anticipated reaction to overall maturity mismatch.
- Policy instruments are imperfectly targeted to the institutions they try to rescue



balance-sheet-risk choices are strategic complements.

- When everybody engages in maturity transformation,
 - authorities have little choice but intervening
 - refusing to adopt a risky balance sheet lowers ROE

“As long as the music is playing, you have to get up and dance”

Charles Prince, CEO Citigroup, summer 2007.

- Possibility of multiple equilibria
- Perverse comparative statics:
risk of distress increase may imply more risk-taking by banks.
- *Endogenous macroeconomic uncertainty*
In contrast with CAPM, banks, if confronted with choice of sensitivity of their risk to the market risk, will choose to correlate their position.
- Strategic complementarities in the choice of liquid assets *quality*, if amount of liquidity regulated.

Comparison of policy instruments

Analyze optimal bailout mix using Mechanism Design

✓ *monetary policy*

- archetypal non-targeted policy \implies SC

Costs: (1) Wedge between MRS and MRT (fixed cost).

(2) Implicit subsidy from consumers to borrowers

(3) [Extension] Sowing the seeds of the next crisis

(4) [Not done in paper] Inflation, distortion in relative prices

- but market-based: benefits those institutions with refinancing needs.

- ✓ *recapitalization/liquidity support*
 - better focus on strategic actors
 - but authorities, facing asymmetric information, may refinance firms that do not need refinancing.

- ✓ *toxic assets repurchases.*

✓ *Macro-prudential regulation*

- efficient for state to provide liquidity in bad times

[as in Holmström-Tirole 1998]

- but supplies too much of it in time-consistent outcome.

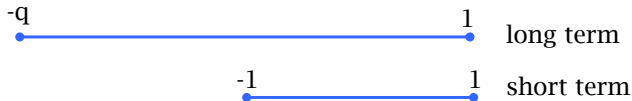
Regulator should oversee overall, and not only individual, maturity transformation.

Banks' decisions have externalities on others \implies pecking order: regulate big banks, large probability of distress in crisis, large weight in objective function.

- Time inconsistency
- Shortages of liquidity
- Soft-budget constraint, banking bailouts
- Macro-literature on SC
- ...

II. MODEL

- ✓ Three periods: $t = 0, 1, 2$.
- ✓ Two groups of mass 1: banking entrepreneurs and consumers.
- ✓ *Consumers*:
 - preferences: $V = c_0 + u(c_1) + c_2$ with $c_0, c_1, c_2 \geq 0$.
 - large endowments e_t
 - cannot pledge their future income.
- ✓ *Two storage technologies*:



where $q \geq 1$.

✓ *Banking entrepreneurs:*

- preferences: $U = c_0 + c_1 + c_2$ with $c_0, c_1, c_2 \geq 0$.
- endowment: A at date 0.

Investment and outcomes:

- banks invest i at $t = 0$
- intact (probability α), or distressed (probability $1 - \alpha$) at date 1
- if distressed, 1-for-1 reinvestment need. Can downsize to $j \in [0, i]$.
- perfect correlation
[later: choice of correlation]

Value and pledgeable income:

$$\rho_1 > 1 > \rho_0 \text{ per unit of investment.}$$

- *Objective function*: $W = V + \beta U$ with $\beta \leq 1$.
 - β reflects
 - (a) how strategic sector is (credit, payment system),
 - (b) how politically powerful sector is.
 - discussion: investment banks (or AIG).

- *Instrument*:

tax date-1 investment in storage technology and rebate proceeds lump-sum to consumers

\implies sets real interest rate R between $t = 1$ and $t = 2$ ($R = 1$ without intervention).

- Rule out other forms of policy intervention (direct bailouts) for the time being.

III. BANK'S BEHAVIOR

The representative bank hoards xi at date 0.

Continuation at scale j ($j \leq i$):

$$j = \frac{xi + \rho_0 j}{R}$$

- ✓ Borrowing capacity when bank anticipates R , and assuming that it hoards enough to continue when in distress

$$i - A + q(R - \rho_0)i = \alpha[\rho_0 i + (R - \rho_0)i]$$

$$\implies i = \frac{A}{1 + (q - \alpha)R - q\rho_0} \quad \text{decreasing in } R, (1 - \alpha), \text{ and } q.$$

$$\text{Let } m(R) \equiv \frac{1}{1 + (q - \alpha)R - q\rho_0} \quad (\text{multiplier})$$

Assumption:

Banks want to withstand shock even for $R = 1$

$$\frac{(1 - \alpha)^2}{\alpha} \geq (q - 1)(1 - \rho_0)$$

- ✓ never satisfied for α close to 1
- ✓ always satisfied for q close to 1.

IV. COMMITMENT SOLUTION

Distortion from monetary policy ($s =$ savings) measured by utility:

$$\widehat{V}(R) \equiv u(e_1 - s) + s \text{ with } u'(e_1 - s) = R.$$

Maximized at $R = 1$.

✓ If continuation in case of a shock,

$$u(e_1 - s) + Rs + \underbrace{(1 - R)}_{\substack{\text{tax on} \\ \text{storage} \\ \text{rebated to} \\ \text{consumers}}} = \underbrace{\widehat{V}(R)}_{\text{DWL}} - \underbrace{(1 - R)i}_{\text{implicit subsidy}}$$

\implies ex ante welfare:

$$\alpha \widehat{V}(1) + (1 - \alpha) \left[\widehat{V}(R) - (1 - R)i(R) \right] + \beta(\rho_1 - \rho_0)i(R)$$

$$\alpha \widehat{V}(1) + (1 - \alpha) \left[\widehat{V}(R) - (1 - R)i(R) \right] + \beta(\rho_1 - \rho_0)i(R)$$

Loose monetary policy:

- creates DWL
- involves implicit subsidy
- boosts investment capacity (less liquidity to be hoarded)

NSC for $R^c = 1$.

V. TIME CONSISTENT SOLUTION

- ✓ R^* = equilibrium interest rate in case of a macro-shock.

$$\implies x^* = R^* - \rho_0.$$

Continuation scale for $R \geq R^*$

$$j = \frac{\rho_0 j + x^* i(R^*)}{R} \implies j = \frac{R^* - \rho_0}{R - \rho_0} i(R^*)$$

- ✓ Ex post welfare (in case of a shock) for $R \geq R^*$:

$$W^{\text{ex post}} = \widehat{V}(R) - (1 - R)j + \beta(\rho_1 - \rho_0)j$$

$$\implies W^{\text{ex post}} = \widehat{V}(R) + \left[\beta(\rho_1 - \rho_0) - (1 - R) \right] \frac{R^* - \rho_0}{R - \rho_0} i(R^*)$$

Result #1: Necessary and sufficient condition for $R^* = 1$:

$$w \equiv \beta(\rho_1 - \rho_0) - (1 - \rho_0) \leq 0$$

more demanding than NSC for $R^c = 1$.

Result #2: When $w > 0$, equilibria satisfy

$$\widehat{V}'(R^*) - \frac{w}{R^* - \rho_0} [m(R^*)A] \leq 0.$$

- ✓ Strategic complementarities. Multiple equilibria, Pareto-ranked: lower R^* better for banks.

Pareto-dominant equilibrium for banks.

$$x^* = 0 \iff R^* = \rho_0,$$

exists iff

$$\widehat{V}(1) - \widehat{V}(\rho_0) \leq \frac{wA}{1 - \alpha\rho_0}$$

- ✓ Equilibrium set $\{R^{\text{nc}}\}$ monotone in weight β and size A .

[Set monotonicity with respect to inclusion order.]

(1) *Heterogeneity*

If regulation is costly, regulate high β banks (and high A banks if IRS in regulation). Note that β and A highly correlated in practice.

(2) *Other illustration of same phenomenon*

If given the choice, banks want to correlate their shocks:

Suppose

- continuum of states of nature

- banks choose probability of distress in each state, subject to overall probability of distress being equal to $1 - \alpha$:

$$\alpha = \int \alpha_{\theta} d\theta.$$

Only strict equilibria: **maximal correlation**

Intuition: prefer to be in distress when refinancing is easy, i.e., when others are in distress.

(3) *Comparative statics.*

Suppose only a fraction γ are in distress in the bad state of nature:

- range of equilibria increases with γ
- leverage i/A can increase, and x decrease with γ :
opposite of standard corporate finance results (R constant).

(4) *Macroprudential regulation:*

focus on overall exposure to aggregate risk, not only on risk of failure of individual institution.

(a) *Liquidity requirement*

- mandatory minimum capital insurance $x \geq 1 - \rho_0$

[similar to mandatory capital insurance (Kashyap, Rajan, Stein 2008)]

(b) *Subsidizing liquidity is a bad idea*

Subsidize liquidity hoarding (q smaller) $\implies i/A$ increases, x decreases, subsidy turned into bigger investment, less liquidity or capital insurance and a more generous bailout.

VI. MONETARY AND FISCAL BAILOUTS

- ✓ Different kind of inefficiency. Can be targeted. But (due to informational limitations) consumer money may end up subsidizing firms that don't need it.
- ✓ *Modeling*
 - When adverse shock, fraction $\gamma \in [0, 1]$ of firms face liquidity need.
 - Proportion ν of false positives: A fraction $(1 - \gamma)\nu$ are mistaken by the state for banks that need liquidity. These banks know that they belong to the false-positives group.

- ✓ Banks and their investors form perfect coalitions. Banks have full bargaining power.
 - ✓ Policy instruments. Government
 - sets rate R
 - (wlog) gives $j \leq i$ in exchange of shares, valued ρ_{0j} , to banks in distress
 - (wlog) lets intact banks continue at scale i , and gives them $T \geq 0$.
- Government must satisfy:
- incentive constraints
 - participation constraints.

- Either intact bank cannot compensate its investors

$$j < \frac{(\rho_0 + x)i}{R} \quad (IC_1)$$

or coalition does not gain:

$$(\rho_1 - \rho_0)i + T \geq (\rho_1 - \rho_0)j + \left[j - \frac{(\rho_0 + x)i}{R} \right] \quad (IC_2)$$

- Participation:

$$T \geq 0 \quad (PC_1)$$

$$j \geq \min \left\{ \frac{x}{R - \rho_0}, 1 \right\} i \quad (PC_2)$$

- Note that only (IC_2) and (PC_1) are relevant: Optimum under (IC_1) : $j = (\rho_0 + x)i/R$. Then (IC_2) satisfied (even with $T = 0$).

Bottom line

- Always use monetary policy.
- Region in which bailouts are purely monetary, as in previous analysis.
- Fiscal bailouts are not perfectly targeted because informational rents have to be distributed.
- The form of bailout depends on the severity of the crisis.
- Screening when liquidity support takes the form of *downsizing* for minor crises, *monetary transfers* for severe ones.

bailout with downsizing:

$$j < i, T = 0,$$

$$R = \underline{R}_L(\gamma), x = 0$$

purely monetary bailout,
multiple equilibria:

$$j = i, T = 0,$$

$$R \in [\max\{\underline{R}_L(\gamma), \rho_0\}, \bar{R}(\gamma)]$$

$$x = R - \rho_0$$

high rents bailout:

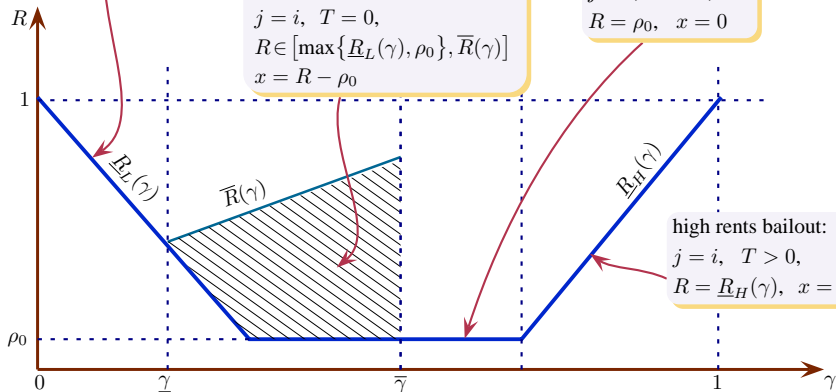
$$j = i, T = 0,$$

$$R = \rho_0, x = 0$$

high rents bailout:

$$j = i, T > 0,$$

$$R = \underline{R}_H(\gamma), x = 0$$



VII. REGULATORY ARBITRAGE AND ASSET PURCHASES

Banks can

- a) acquire at date 0 potentially toxic assets and
- b) count on selling these (securitization) at date 1 to conform with liquidity requirements.

Bailout = maintaining price of assets.

✓ Avoid signaling by scale:

- investment i fixed
- self-financing: $i - A + q(1 - \rho_0)i \leq 0$

✓ Two assets/stores of value:

- non-toxic \longrightarrow always yields 1, price $q \geq 1$
- toxic \longrightarrow yields one in good state, 0 in bad state, price $q_0 \leq q$

- ✓ Choice of liquid asset:
 - made by banking entrepreneur
 - ex-ante not observable (moral hazard)

- ✓ Bank hoards $(1 - \rho_0)i$ in liquid assets:
 - regulation (regulator observes amount, although not quality) or optimal
 - focus on allocation.

✓ Let

- γ = endogenous fraction of banks choosing toxic asset
- ν = fraction of banks with clean assets mistaken for banks with liquidity needs.

At date 1, model is exactly that of mixed bailout section!

- ✓ Choices of toxic/non-toxic assets may exhibit strategic complementarities.
- ✓ Comparative statics and sudden shifts.
- ✓ Importance of monitoring quality of capital insurance.

✓ *Strategic complementarities:*

- untargeted bailouts
- time inconsistency
- endogenous correlation.

✓ *Sensitivity to conditions + comparative statics.*

✓ *Macro-prudential regulation:*

- focus on overall exposure to aggregate risk, not only on risk of failure of individual institution
- bigger externality \implies bigger benefits
- mandatory capital insurance.

Sowing the seeds of the next crisis

- ✓ Suppose $u(c_0) + u(c_1) + c_2$

Cost of capital effect

$$i - A + xi = \frac{\alpha(\rho_0 + x)}{R_0 R} i$$

R_0 lower \implies higher investment.

Maturity effect

Low R_0 discourages hoarding of liquidity

[more ST debt if there exists date-1 income]

- ✓ Embody this reasoning in OLG version of model.