Bailouts, Time Inconsistency, and Optimal Regulation

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Stern-Feldman Question

- Assume:
  - Government cannot credibly commit not to bail out firms

- Question:
  - How should ex ante regulation be designed taking into account government temptation to bail out ex post?

- Analysis motivated by ideas of Stern-Feldman *Too Big To Fail*
3 Points

• Optimal contracts often involve ex post inefficiency
  ○ Implies time inconsistency problem

• Gov’t faces more severe sustainability constraint than private agents
  ○ Ability to improve “firesale” prices for bankrupt assets

• Given government is tempted to bail out ex post
  ○ Optimal to regulate contracts ex ante to reduce temptation
Optimal contracts involve ex-post inefficiency
Simplified Version of Benchmark Model

- Agents: managers and lenders
  - Risk neutral, measure 1 of each
  - Lenders have $e$ units of endowment
  - Managers exert costly unobservable effort $a$

- Technologies
  - Corporate technology
    
    endowments $\rightarrow$ capital goods $\rightarrow$ consumption goods
  - Storage
    
    endowments $\rightarrow$ consumption goods
• 1 unit of goods, $a$ units of manager effort produces capital goods

$$\begin{cases} A_H (1 + \varepsilon) & \text{prob } p_H (a) \\ A_L (1 + \varepsilon) & \text{prob } p_L (a) \end{cases}$$

where $\varepsilon \sim H(\varepsilon)$ manager specific shock

• Given capital goods, decide \textit{continue} or \textit{bankruptcy}

  ○ If continue, produce consumption goods 1:1 rate

  ○ If bankruptcy, two costs

    – manager suffers -$B$

    – use inferior technology called traditional technology
Corporate Technology

Inputs
1 unit of goods
a units effort
(a unobserved)

→

Capital Goods

AH(1+ε) prob pH(a)
AL(1+ε) prob pL(a)

Consumption Goods

Corporate Technology

Y_{ci}(ε) = A_i(1+ε)

Traditional Technology

Y_{bi}(ε) = RA_i(1+ε)

R ≤ 1

Manager: -B
Optimal Contract

- Maximize utility of manager s.t. zero profit constraint
- Set $c_H(\varepsilon) = c_H$ and $c_L(\varepsilon) = 0$
- Bankruptcy has cutoff form:
  - In low state declare bankruptcy for $\varepsilon \in [\varepsilon, \varepsilon^*]$, continue otherwise
  - In high state no bankruptcy
Optimal Contract

\[
\max p_H(a)c_H - p_L(a)BH(\varepsilon^*) - a
\]

(MIC) \[ a \in \arg \max_a p_H(a)c_H - p_L(a)BH(\varepsilon^*) - a \]

(Budget) \[ p_Hc_H + 1 \leq p_H A_H + p_L A_L \left[ \int_{\varepsilon^*}^{\bar{\varepsilon}} (1 + \varepsilon)dH(\varepsilon) + R \int_{\varepsilon}^{\varepsilon^*} (1 + \varepsilon)dH(\varepsilon) \right] \]

- Equilibrium ex-ante efficient but ex-post inefficient
Recap

- Optimal contracts often involve ex post inefficiency
  - Implies time inconsistency problem
  - Incentive to renegotiate to avoid bankruptcy costs
Develop private sustainability constraint
Benchmark Economy: Four Alterations

- Four alterations

1. Infinite repetition of static model
   - Triggers can make renegotiation costly

2. Variable scale in corporate technology
   - Investment $k_c$ produces $A_i(1+\varepsilon)g(k_c)$ units of capital goods
   - Allows for inefficient level of $k_c$
3. Probability $\alpha_0$ managers lose ability to turn capital goods into consumption goods
   
   - Gives supply of capital goods to traditional sector even if $\varepsilon^* = \varepsilon$

4. Replace traditional technology $R < 1$ with CRS technology $F(k_1, k_2)$
   
   - Gives endogenous “firesale price” for bankrupt capital

![Diagram](attachment:image.png)
If manager ever renegotiates, then believe always will

- Benefit of renegotiation: lower costs today

- Costs of renegotiation: worse outcomes tomorrow
  - Let $U^N = \text{utility when always renegotiate}$
  - Under $U^N$ have no bankruptcy $\varepsilon^* = \underline{\varepsilon}$, but get low effort
Develop Private Sustainability Constraint

- Private sustainability constraint

\[ U(a, k_c, \varepsilon^*) + \frac{\beta}{1-\beta} U(a, k_c, \varepsilon^*) \geq \hat{U}(a, k_c, \varepsilon) + \frac{\beta}{1-\beta} U^N \]

- Best one shot deviation
  - Stop all bankruptcy
  - But evaluate change at original “firesale price” \( R_2 \)

\[ \hat{U} = \alpha_1 [p_H(a)A_H + p_L(a)A_L]g(k_c) + R_2 \hat{k}_2 - a - k_c \]

\( \hat{k}_2 = \) only exogenously liquidated capital
Develop government sustainability constraint
Bailout Authority

- Instruments: Lump sum transfers, $T_L(\varepsilon)$, to firms in low state, financed by lump sum taxes on firms in high state

- Chooses transfers/taxes after action $a$ chosen

- Can “bribe” firms to avoid bankruptcy
  - Effectively bailout authority can choose $\varepsilon^*$
No Commitment by Bailout Authority

- Add *sustainability to bailouts* constraint

\[
U(a, k_c, \varepsilon^*) + \frac{\beta}{1-\beta} U(x) \geq \hat{U}^G(a, k_c, \varepsilon) + \frac{\beta}{1-\beta} U^N
\]

- Best one shot deviation
  - Stop all bankruptcy
  - Evaluate change at new “non-firesale” price \( \tilde{R}_2 \)

\[
\hat{U}^G = \alpha_1 [p_H(a)A_H + p_L(a)A_L]g(k_c) + \tilde{R}_2 k_2 - a - k_c
\]
No Commitment by Bailout Authority

- **Proposition:** Equilibrium with bailouts worse than private equilibrium

- Key idea: Sustainability with bailouts **tighter** than private sustainability
  
  - Government temptation
    \[
    \hat{U}^G = \alpha_1[p_H(a)A_H + p_L(a)A_L]g(k_c) + \tilde{R}_2\hat{k}_2 - a - k_c
    \]
  
  - Private temptation
    \[
    \hat{U} = \alpha_1[p_H(a)A_H + p_L(a)A_L]g(k_c) + R_2\hat{k}_2 - a - k_c
    \]
  
  - Tighter for government since \(\tilde{R}_2 > R_2\) so
    \[
    \hat{U}^G - \hat{U} = (\tilde{R}_2 - R_2)\hat{k}_2 > 0
    \]
Recap

- Optimal contracts often involve ex post inefficiency
  - Implies time inconsistency problem

- Gov’t faces more severe sustainability constraints than private agents
  - Ability to improve “firesale” prices for bankrupt assets
Can ex ante regulator improve welfare?
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Yes

Why: Regulation reduces temptation to bailout
Ex Ante Regulator

- Instruments: Lump sum transfers, $T_L(\varepsilon)$, to firms in low state, financed by lump sum taxes on firms in high state, and a tax on $k_c$

- Proposition: Regulator improves welfare relative to equilibrium with bailouts
Best Bailout Equilibrium

- Maximize manager’s utility subject to
  - Manager’s incentive constraint
  - Resource constraint
  - \( F_1(k_1, k_2) = 1 \) and
  - Sustainability constraint
    \[
    U(a, k_c, \varepsilon^*) + \frac{\beta}{1 - \beta} U \geq \hat{U}(a, k_c, \varepsilon) + \frac{\beta}{1 - \beta} U^N
    \]
    and
  - Return in corporate technology = Return in traditional technology
Regulator’s Problem is More Relaxed

- Maximize manager’s utility subject to
  - Manager’s incentive constraint
  - Resource constraint
  - \( F_1(k_1, k_2) = 1 \) and
  - Sustainability constraint

\[
U(a, k_c, \varepsilon^*) + \frac{\beta}{1-\beta} U \geq \hat{U}(a, k_c, \varepsilon) + \frac{\beta}{1-\beta} U^N
\]
Regulator’s Problem is More Relaxed

• Maximize manager’s utility subject to
  ○ Manager’s incentive constraint
  ○ Resource constraint
  ○ $F_1(k_1, k_2) = 1$ and
  ○ Sustainability constraint

\[
U(a, k_c, \varepsilon^\ast) + \frac{\beta}{1 - \beta} U \geq \widehat{U}(a, k_c, \varepsilon) + \frac{\beta}{1 - \beta} U^N
\]

• Regulator has higher $\varepsilon^\ast$, lower $k_c$ than bailout authority

• Intuition: $\varepsilon^\ast$ more important than $k_c$ for incentives
Can Have Symmetric Instruments ______________________________

- Add tax on $k_c$ to bailout authority instrument
  - No incentive to alter $k_c$ ex post
  - With tiny tax distortions, strict incentive not to alter $k_c$

- Key to our results
  - Time inconsistency problem, not difference in instruments
Interpreting equilibrium with debt and equity

• Face value of debt = $A_L(1 + \varepsilon^*)(g(k_c))$

• Equity is residual claimant

• In bankruptcy: debt gets liquidation value, equity 0

• Regulatory equilibrium implemented with
  ○ Tax on returns to corporate technology
  ○ cap on debt to value

\[ \frac{\text{debt}}{\text{value}} \leq \left( \frac{\text{debt}}{\text{value}} \right)^r \]
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