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 $\longrightarrow$ capital goods $\longrightarrow$ consumption goods
  - Storage

    endowments $\longrightarrow$ consumption goods

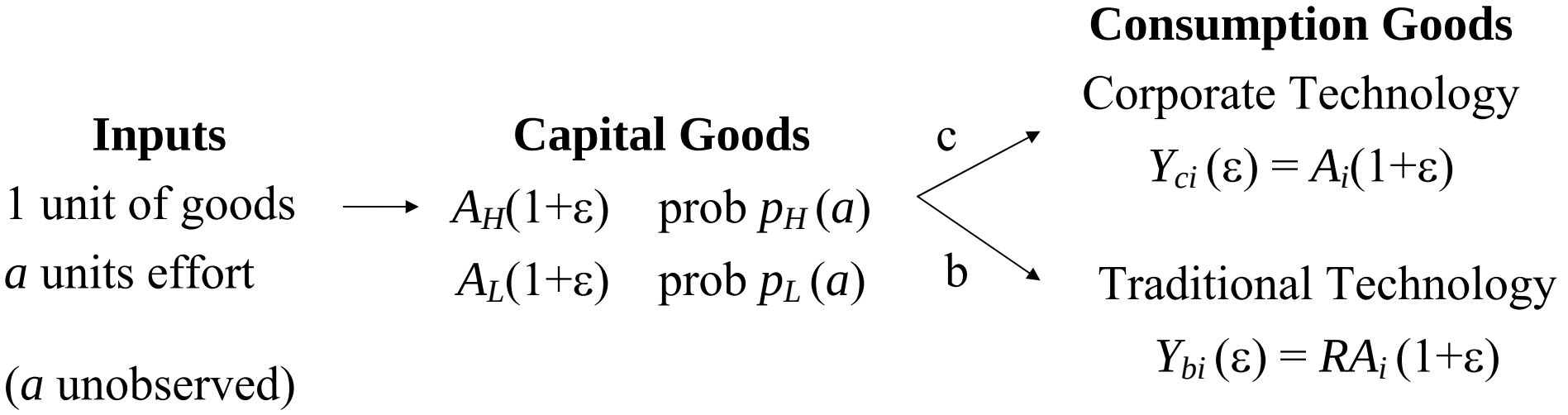
Corporate Technology

- 1 unit of goods, *a* units of manager effort produces capital goods

$$\begin{cases} A_H(1+\varepsilon) & \text{prob } p_H(a) \\ A_L(1+\varepsilon) & \text{prob } p_L(a) \end{cases} \quad \text{where } \varepsilon \sim H(\varepsilon) \text{ manager specific shock}$$

- Given capital goods, decide *continue* or *bankruptcy*
  - If continue, produce consumption goods 1:1 rate
  - If bankruptcy, two costs
    - manager suffers -*B*
    - use inferior technology called traditional technology

Corporate Technology



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 $\varepsilon \in [\underline{\varepsilon}, \varepsilon^*]$, 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) $$p_H c_H + 1 \le p_H A_H + p_L A_L \left[\int_{\varepsilon^*}^{\bar{\varepsilon}} (1+\varepsilon)dH(\varepsilon) + R \int_{\underline{\varepsilon}}^{\varepsilon^*} (1+\varepsilon)dH(\varepsilon) \right]$$

- 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

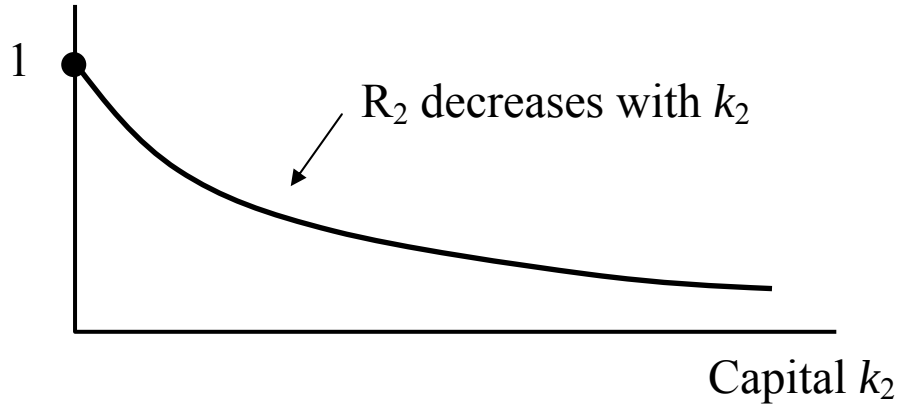
   – Investment k_c produces $A_i(1+\varepsilon)g(k_c)$ units of capital goods

   – Allows for inefficient level of k_c

Benchmark Economy: Four Alterations

3. Probability α_0 managers lose ability to turn capital goods into consumption goods
   - Gives supply of capital goods to traditional sector even if $\varepsilon^* = \underline{\varepsilon}$

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



Develop Private Sustainability Constraint

- If manager ever renegotiates, then believe always will
  - Benefit of renegotiation: lower costs today
  - Costs of renegotiation: worse outcomes tomorrow
    - Let U^N = utility when always renegotiate
    - Under U^N have no bankruptcy $\varepsilon^* = \underline{\varepsilon}$, but get low effort

Develop Private Sustainability Constraint

- *Private sustainability constraint*

$$U(a,k_c,\varepsilon^*)+\frac{\beta}{1-\beta}U(a,k_c,\varepsilon^*)\geq\widehat{U}(a,k_c,\underline{\varepsilon})+\frac{\beta}{1-\beta}U^N$$

- Best one shot deviation
  - Stop all bankruptcy
  - But evaluate change at original "firesale price" R_2

$$\widehat{U}=\alpha_1[p_H(a)A_H+p_L(a)A_L]g(k_c)+R_2\widehat{k_2}-a-k_c$$

$\widehat{k_2}=$ 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 ε^*

No Commitment by Bailout Authority

- Add *sustainability to bailouts* constraint

$$U(a,k_c,\varepsilon^*)+\frac{\beta}{1-\beta}U(x)\geq \widehat{U}^{G}(a,k_c,\underline{\varepsilon})+\frac{\beta}{1-\beta}U^{N}$$

- Best one shot deviation
  - Stop all bankruptcy
  - Evaluate change at new "non-firesale" price $\tilde{R}_2$

$$\widehat{U}^{G}=\alpha_1[p_H(a)A_H+p_L(a)A_L]g(k_c)+\tilde{R}_2\hat{k}_2-a-k_c$$

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

$$\hat{U}^G - \hat{U} = (\tilde{R}_2 - R_2)\hat{k}_2 > 0$$

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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

$$U(a, k_c, \varepsilon^*) + \frac{\beta}{1-\beta} U \;\geq\; \widehat{U}(a, k_c, \underline{\varepsilon}) + \frac{\beta}{1-\beta} U^N$$

and

  - Return in corporate technology = Return in traditional technology

Regulator's Problem is More Relaxed

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- Regulator has higher ε^*, lower k_c than bailout authority
- Intution: ε^* 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

$$\frac{debt}{value} \leq \left(\frac{debt}{value}\right)^r$$

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