

Renegotiation of Debt-Contracts under Endogenous Measurement Manipulation

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Long-standing Interests in Incomplete Debt-Contracting

- Control Right Allocation
- Renegotiation
- Measurement-based covenants

Long-standing Interests in Endogenous Accounting Measurement

- Managerial opportunism in accounting method choice
- Distortion in contracting

- We Study Debt-contract Design with Endogenous Measurement
- A Different Role of Renegotiation: a reduction in renegotiation cost may reduce firm value
- Joint Determination of both covenant design and accounting measurement
 - Distorted covenant design
 - Higher manipulation cost may not reduce manipulation

- Incomplete Contracting Literature
- Earnings Management in Complete Contracting Models
- Empirical Work

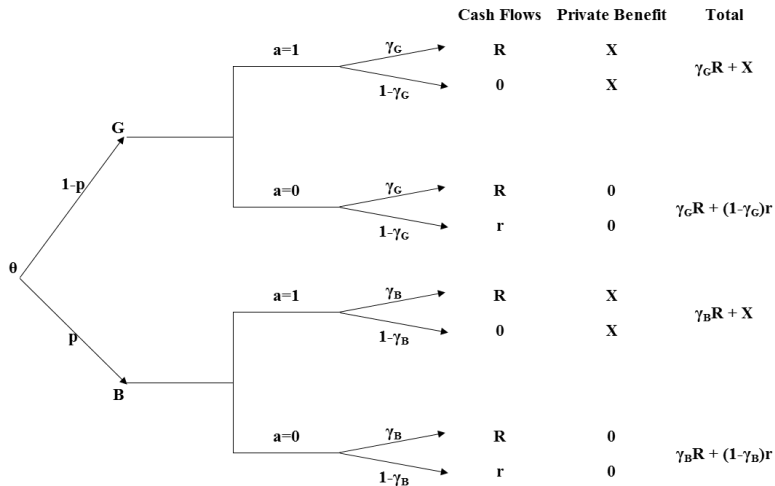
Basic Model

Timeline of the Model

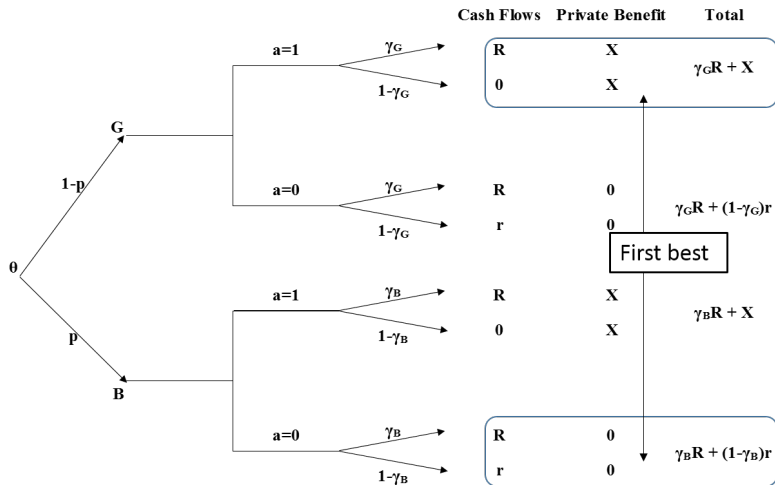
Date	0	1	2	3
	Manager offers a debt contract $\{d, \sigma_s\}$ in exchange for $K - A$; If lender accepts, investment takes place	Manager observes $\{\theta\}$ privately, chooses m to manipulate reporting of θ ; public signals s is realized	Initial control right σ_s ; State θ revealed to all; Renegotiation takes place, if necessary; Interim action a is chosen	Cash flow is realized.

Figure 1: The Time-line

Firm Project Payoffs

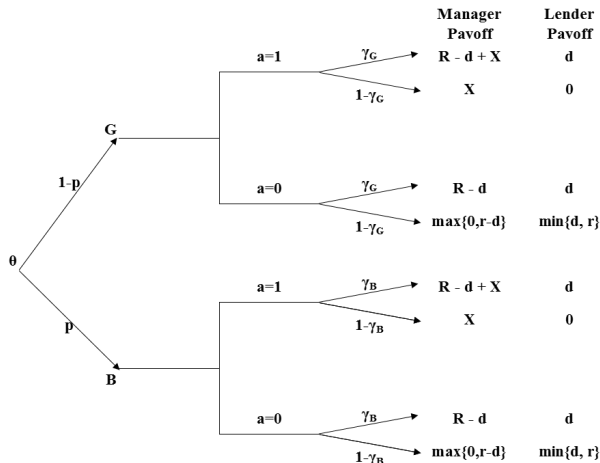


Firm Project Payoffs



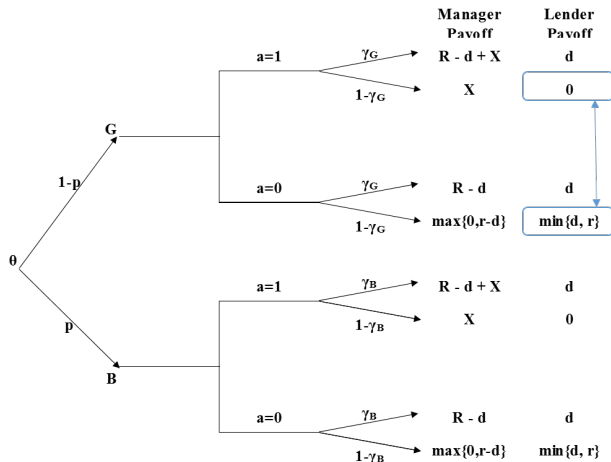
- Assumption (A1): $(1 - \gamma_B)r > X > (1 - \gamma_G)r > 0$

Conflict of Interests



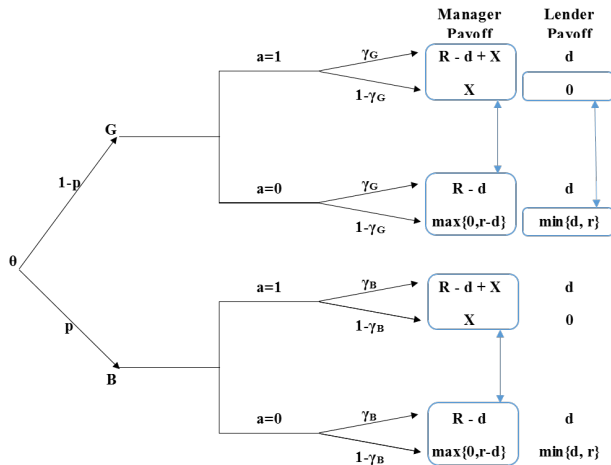
- Under debt-financing ($K - A$), the total payoff is split between the manager and the lender.

Conflict of Interests



- $\min\{r, d\} > 0$ leads to lender always preferring restructuring.

Conflict of Interests



- Assumption (A2): $X > (1 - \gamma_B) \max\{0, r - d\}$ leads to manager always preferring status quo;

Allocation of Control Right

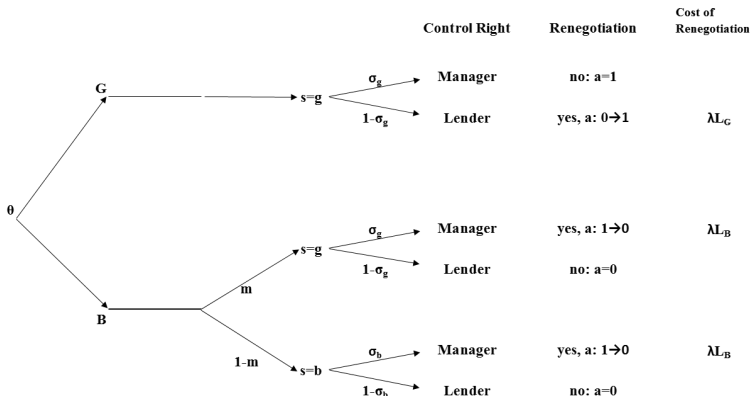
- Ex ante (Date-0) Covenant Design
 - Covenant: $\sigma(\cdot)$ denote the probability the right to make the interim decision is awarded to the manager $\tau = M$; [with $1 - \sigma(\cdot)$, $\tau = L$]
 - $\sigma(\cdot)$ cannot be based on the true state-of-the-world θ , only on an “accounting” signal s
- Ex Post (Date-2) Contract Renegotiation
 - After the initial control right determined via $\sigma(\cdot)$, the two parties can renegotiate
 - If they renegotiate, a new pair of face-value and control-right $\{d', \tau'\}$ is generated
 - the surplus from renegotiation is split: μ share to the manager and $(1 - \mu)$ share to the lender

- Manager observes θ and chooses m to influence measurement:

$$\Pr(s = g|\theta = G, m) = 1 \quad \text{and} \quad \Pr(s = 1|\theta = B, m) = m. \quad (1)$$

- The manipulation cost is $\frac{c}{2}m^2$
- Prior Incomplete Contracting Literature assumes an exogenous imperfection in s (i.e., $m \equiv \hat{m}$)

Accounting Measurement and Control Right Allocation



L_θ : renegotiation surplus:

$$L_G = X - (1 - \gamma_G)r, \text{ and } L_B = (1 - \gamma_B)r - X.$$

- Solves the post-renegotiation payoff for any $\{\theta, \tau\}$ pair;
- Solves the manager's manipulation decision m ;
- Solves lender's break-even condition for any given $\{d, \sigma_S\}$ pair;
- Solves the optimal contract design $\{d, \sigma_S\}$ choices;

Main Results

Lemma

With renegotiation, the value of control right to the manager is

$$\pi = X + \mu(1 - \lambda)L_B$$

The value is increasing in μ and decreasing in λ .

Lemma

Assuming $\sigma_g > \sigma_b$ in equilibrium, the optimal ex post manipulation for the manager is given by

$$m^* = \frac{\pi (\sigma_g - \sigma_b)}{c} \quad (2)$$

and the manipulation is

- 1 increasing in value of control right π
- 2 increasing in the covenant differential $(\sigma_g - \sigma_b)$
- 3 decreasing in manipulation cost c

Key Implication: Joint determination of Covenant Design and Measurement Manipulation

- m^* is a choice variable ex post
- $(\sigma_g - \sigma_b)$ are choice variables ex ante

Lemma

The equilibrium face value d^ of the debt-contact is feasible and satisfies*

$$K - A = d^* \gamma + p [(1 - \sigma_m) (1 - \gamma_B) r + \sigma_m (1 - \mu) (1 - \lambda) L_B] \\ + (1 - p) (1 - \sigma_g) [(1 - \gamma_G) r + (1 - \mu) (1 - \lambda) L_G]$$

where $\gamma \equiv (1 - p) \gamma_G + p \gamma_B$ and $\sigma_m \equiv \sigma_b + m (\sigma_g - \sigma_b)$.

The Covenant Design Optimization Problem:

$$V^* = \max_{\sigma_g, \sigma_b} V^{FB} - (1 - p)(1 - \sigma_g)\lambda L_G - p\sigma_{m^*}\lambda L_B - p\frac{c}{2}m^{*2}$$

$$\text{s.t. } 0 \leq \sigma_b \leq \sigma_g \leq 1$$

$$m^* = \frac{\pi(\sigma_g - \sigma_b)}{c}$$

$$\sigma_{m^*} \equiv \sigma_b + m^*(\sigma_g - \sigma_b)$$

Proposition

Let $\bar{c} \equiv \frac{\pi(\pi+2\lambda L_B)}{\lambda L_B}$, the optimal date-0 debt-contract is either

- 1 $\sigma_g^* = 1$ and $\sigma_b^* = 0$ if $c > \bar{c}$; or
- 2 $\sigma_g^* = 1$ and $\sigma_b^* = 1 - \frac{c}{\bar{c}}$ if $c \in (\pi, \bar{c}]$.

Main Intuition of Proposition 1

Proposition 1 illustrates the key trade-off in covenant design when accounting measurement is endogenous

- 1 When manipulation is not a significant concern (i.e., c is large), covenant design is used reduce renegotiation cost, not to discourage managerial opportunism;
- 2 When manipulation is a significant concern (i.e., c is small), covenant design is used balance both renegotiation cost and managerial opportunism;
- 3 Joint determination

Main Analysis

Proposition

Assume manipulation is exogenous: $m = \hat{m} \in (0, 1)$. In equilibrium,

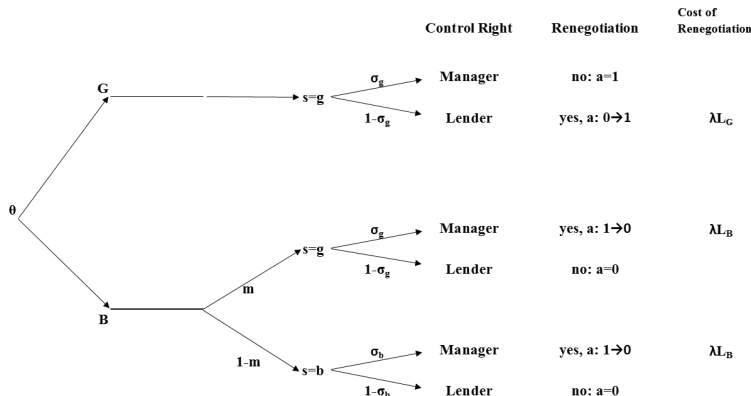
- 1 the optimal covenant design is independent of parameters:

$$\sigma_g^* = 1 \quad \text{and} \quad \sigma_b^* = 0;$$

- 2 a decrease in renegotiation cost always improves ex ante efficiency

$$\frac{\partial}{\partial \lambda} V|_{\sigma_g^*=1, \sigma_b^*=0, m^*=\hat{m}} < 0.$$

Accounting Measurement and Control Right Allocation



L_θ : renegotiation surplus:

$$L_G = X - (1 - \gamma_G)r, \text{ and } L_B = (1 - \gamma_B)r - X.$$

Proposition

Assume manipulation m is endogenous. In equilibrium,

- 1 an increase in manipulation cost improves the ex ante efficiency,

$$\frac{\partial}{\partial c} V^* > 0$$

- 2 a decrease in renegotiation cost doesn't necessarily improve ex ante efficiency:

$$\frac{\partial}{\partial \lambda} V^* > 0 \text{ if } c > \bar{c} \text{ and } \mu > \hat{\mu} \in (0, 1)$$

Main Intuition of Proposition 3

Proposition 3 illustrates the key implication of endogenous accounting measurement

- 1 When manipulation is not endogenous (i.e., $m = \hat{m}$), renegotiation cost is always welfare-reducing;
- 2 When manipulation endogenous (i.e., m responds covenant design), renegotiation cost is always welfare-enhancing;
- 3 Higher renegotiation costs reduces the manager's desire to manipulate.

Thanks!

Take-away