노트 제목 2013-06-15

1960년대 말

↳ Univ of Chicago: Data Base (← Ball & Brown ⋮) — Empirical

Information Economics 의 응용 — Analytical

↳ Demski (Stanford) + Feltham (UBC)

1960년대

Normative ← | → Positive

↓ Value of Information ?

회계 ⇒ information

$\Phi = \{\theta_1, \theta_2, \dots \theta_n\}$

Q: More Disclosure ⇒ Better ?

- 어떤 정보가 Valuable ??

Blackwell Theorem → "single-person" decision setting

$x = f(a, \theta)$

(x: outcome, a: 의사결정, θ: Random state)

↳ "finer 하면 Valuable 하다"

Fix Φ. Then.

"Fineness" ⟺ "subpartitioning"

1970년대 말:

Q. ↳ Multiperson setting에서 Blackwell Theorem이 적용될까?

A: No.

↳ S. Baiman 박사학위 논문..

↳ product mkt

↳ 2 players

Finer info.

⇓

worse off.

Accounting Information의 role

- Investment role ← single-person
  ↳ 투자자에게 투자의사결정 관련 정보제공
- (재산관리) Stewardship role : 주주 vs. CEO
  (principal) (agent)

1970년대 말: Economists

↳ Holmstrom (from Stanford): "Moral Hazard and Unobservability" → 1979 Bell Journal of Economics

↳ Informative ⟺ (iff) Valuable

M. Harris & A. Raviv.

↳ "Journal of Economic Theory" (1979)

↳ principal-agent model

Loser

결론: 만약 계약변수(KPI)가 noisy 해서 확률적, 그리고 agent가 매우 riskaverse 하면, 그 계약변수는 계약에 사용되면 안됨..

"However noisy it is, it's valuable iff it's informative"

Winner

$a^* - \varepsilon$

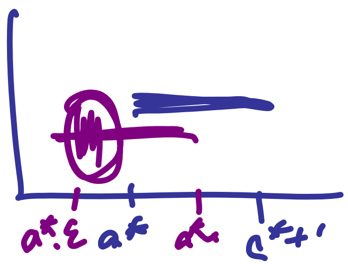
↳ Harris & Raviv의 가정

$X = a + \theta$ $\theta \sim Unif[0, 1]$

$X \sim Unif[a^*, a^* + 1]$

⇓

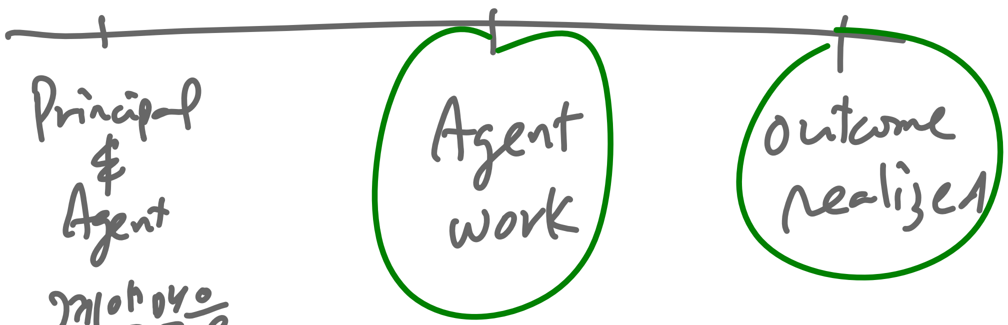
moving support ⇒ FB



(1) Basic Agency Model :

Principal → Eπ 극주

Agent → Ex/c(e)



(principal은
번역할 때 나빠짐)

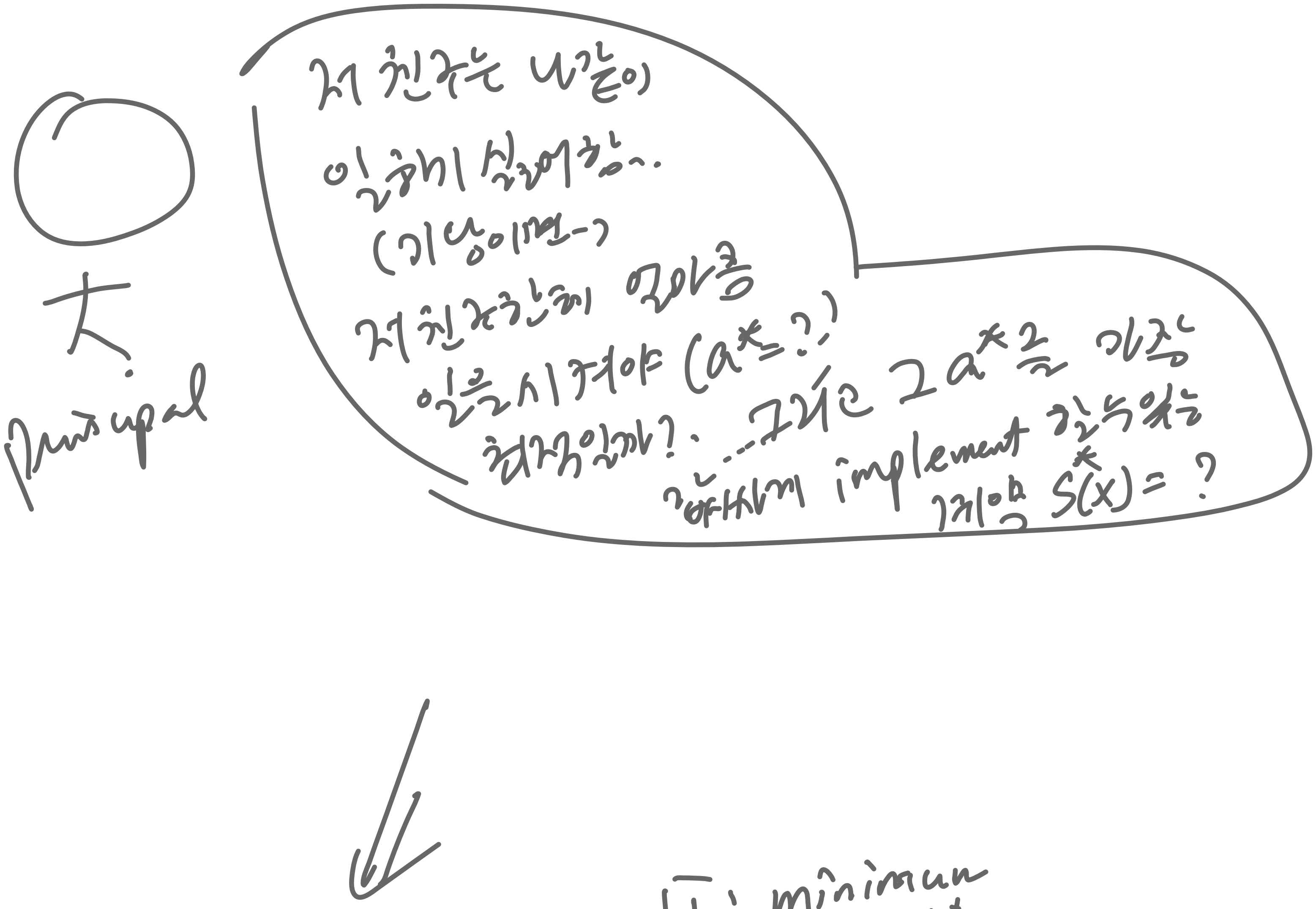
Principal's
precommitment
to contract

$$X = f(a, \theta)$$

X: outcome

a: agent's effort

θ: random state of nature



$\bar{H}$: minimum utility

Principal의 고민 :

$$\max_{s(\cdot),\, a} \; E[\underset{\sim}{X} - s(\underset{\sim}{x})]$$

s.t.

- $EH(s, a) \geq \bar{H}$
- a maximizes EH

$s(x)$: agent의 보수

x : outcome

$H(s, a)$ agent의 효용함수

$= \underset{\sim}{U(s)} - V(a)$

$U(s)$ ↓ (utility of wealth)

$V(a)$ ↓ Disutility of effort

$u' > 0$

$u'' < 0$: riskaversion

$f(x|a)$: x의 density given a

Holmstrom Model:

$$\max \int G[x - s(x)]\, f(x|a)\, dx$$

s.t

$$(\lambda) \rightarrow \int u[s(x)]\, f(x|a)\, dx - V(a) \geq \bar{H}$$

$$(\mu) \rightarrow \int u[s(x)]\, f_a(x|a)\, dx - V'(a) = 0$$

$$\Longleftrightarrow \quad \frac{G'[x - s(x)]}{u'[s(x)]} = \lambda + \mu \frac{f_a(x|a)}{f(x|a)}$$

(i) agent's action이 관찰된다면.. $\mu = 0$

↪ First-Best Solution

$$\frac{G'[x - s(x)]}{u'[s(x)]} = \lambda$$

Q: First Best (Risk sharing 측면만 고려된 ...).

Contract의 모양은?

A: (?)

↓

$$\frac{G'[x - s(x)]}{u'[s(x)]} = \lambda$$

x로 미분 ...

$$s' \left(= \frac{\partial s}{\partial x} \right) = \frac{R_P}{R_A + R_P}$$

R_A : Agent's Risk aversion $\left(= -\frac{u''}{u'} \right)$

R_P : Principal " $\left(= -\frac{G''}{G'} \right)$

Ex) ① $R_P = 0$; $s' = 0$ 즉 고정급

② $R_A = 0$; $s' = 1$ ⇒ $S = x - (k)$ ↳ principal의 몫

↓ selling the firm to the agent..

③ $\left.\begin{matrix} R_A = 1 \\ R_P = 1 \end{matrix}\right\} \rightarrow s' = \frac{1}{2}$

Q: SB contract의 모양은?

A: 예를 들어 Risk-neutral principal의 경우..

$$\frac{1}{u'[s(x)]} = \lambda + \mu \frac{f_a(x|a)}{f(x|a)}$$

"Likelihood Ratio"

Ex) $X = a + \theta$ $\quad \theta \sim N(0,1)$

$(\theta = x - a)$

$\hookrightarrow f(\theta) = \frac{1}{\sqrt{2\pi}} e^{-\frac{\theta^2}{2}}$

$$f(x|a) = \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-a)^2}{2}}$$

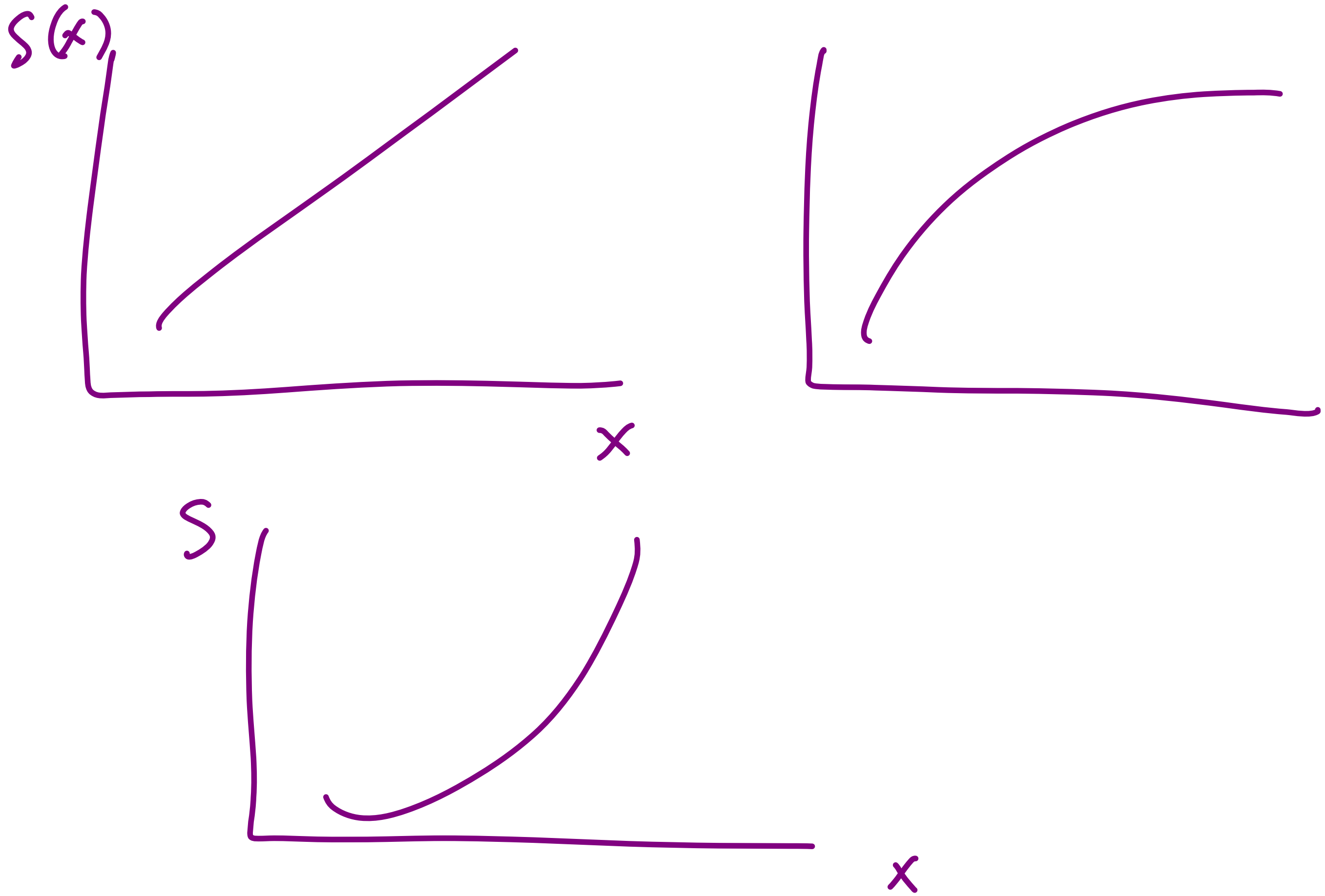
$$f_a(x|a) = f \cdot (x-a)$$

$$\therefore \frac{f_a}{f} = x - a$$

$$\therefore \frac{1}{u'} = \lambda + \mu(x-a)$$

$\vdots$

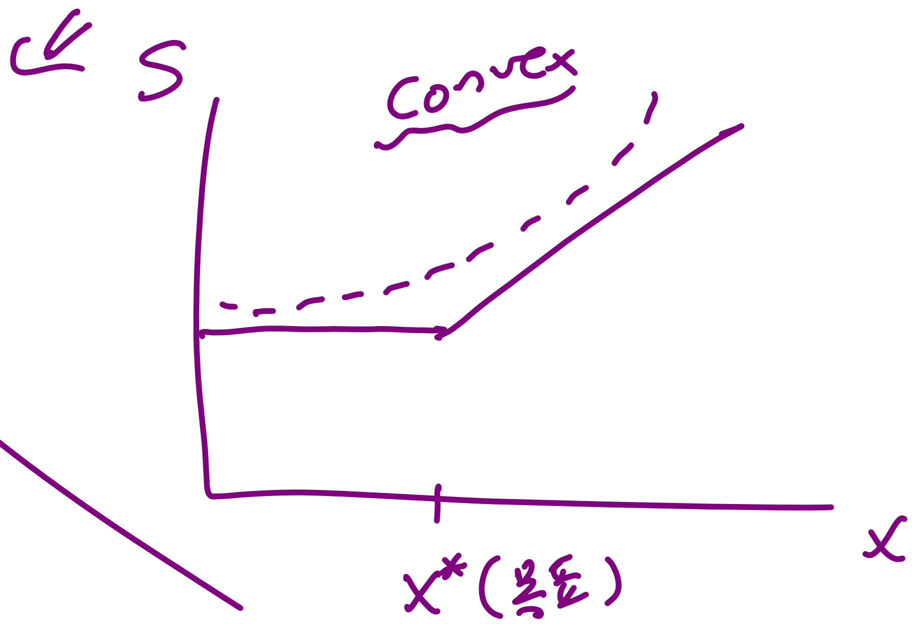
Q: SB contract의 shape는?



cf) 현실에서 관찰되는 CEO Contract:

$$S = \begin{cases} \alpha & \text{if } x \le x^* \\ \alpha + \beta x & \text{if } x \ge x^* \end{cases}$$

x^* → 목표



α

Holmstrom Model; $X = a + \theta \quad \theta \sim N(0,1)$

$$\frac{1}{u'} = \lambda + \mu(x-a)$$

Ex) $u = s^{\alpha}, \quad 0 < \alpha < 1$ (Ex) $u = s^{\frac{1}{2}} = \sqrt{s}$)

$$u' = \alpha s^{\alpha-1}$$

$$\frac{1}{u'} = \frac{1}{\alpha s^{\alpha-1}} = \frac{1}{\alpha} s^{1-\alpha}$$

$$\therefore s = \left(\lambda + \mu(x-a)\right)^{\frac{1}{1-\alpha}}$$

$\Rightarrow$ More informative $\Rightarrow$ more Valuable

(cf) Single-person setting;
Finer $\Rightarrow$ Valuable

↓

(i) y라는 평가지표가 있는데~. 그 지표가 더 informative 하면 경영사용목적으로 더 Valuable 하므로 y지표의 가중치가 올라가야 함.

ex) 평가지표
- y_1 : 매출액
- y_2 : 주가
- y_3 : 영업이익

Q: y_1, y_2, y_3 의 가중치 = ?

총점수 = $\beta_1 y_1 + \beta_2 y_2 + \beta_3 y_3$

(β_1: 가중치, β_2: 가중치, β_3: 가중치)

가중치 = f(informativeness)

Q: Informativeness 를 무엇으로 측정할 것인가?

A: "sensitivity", "precision" (+ "congruity")

$$\frac{1}{u'} = \lambda + \mu \frac{f_a}{f}$$

$\frac{f_a}{f}$ = Likelihood ratio

(X를 관찰함으로서 agent가 약속한 effort를 취했는가에 대한 믿음.)

$Var\left(\frac{f_a}{f}\right)$: Informativeness의 크기

(Banker + Datar) = Sensitivity, Precision

↪ Kim & Suh (JAR)

$X = Ka + \theta$ $\quad\quad$ $\theta \sim N(0, \sigma^2)$

$E(X) = Ka$

$V(X) = \sigma^2$

$K \uparrow$: X is more sensitive regarding "a"

$\sigma^2 \downarrow$: X is more precise.

$K\uparrow, \sigma^2 \downarrow \iff Var\left(\frac{f_a}{f}\right)\uparrow \iff$ more weight (즉, more valuable)

※ Good News :

↳ Holmstrom & Milgrom (1981) Econometrica

↳ Linear Contract : $S = \alpha + \beta x$

Exponential Utility : $u = -e^{-rS}$

Normal Distribution : $x = a + \theta$

$\theta \sim N(0, \sigma^2)$

즉 linear contract를 multiperiod continuous action choice 모델을 single period snapshot으로 represent 할 수 있다

✓ agent's utility

r : risk aversion $\left(-\frac{u''}{u'}\right)$

$$U(s) = -e^{-rs}$$

$$= -e^{-r(\alpha+\beta x)}$$

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-a)^2}{2\sigma^2}}$$

$$EU(s) = -\int -e^{-r(\alpha+\beta x)} f(x)\, dx$$

Maximize EU

$\Leftrightarrow$ Maximize CE

CE : Certainty Equivalent

CE = Expected Compensation − Risk Premium

$x = a + \theta$

$E(x) = a$

$S = \alpha + \beta x$

$E(S) = \alpha + \beta E(x) = \alpha + \beta a$

$$= [\alpha + \beta a] - \frac{1}{2} r \beta^2 \sigma^2$$

r: risk aversion

$\beta^2 \sigma^2 = Var[S(x)]$

$$= E(S) - \frac{1}{2} r \, Var(S)$$

Principal's EG

$X = a + \theta$

$E(X) = a$

$= E[X - S(X)]$

$= a - (\alpha + \beta a)$

$= (1-\beta) a - \alpha$

Maximize$_{\alpha, \beta, a}$: $(1-\beta) a - \alpha$

s.t.

: $\left(\alpha + \beta a - \frac{1}{2} r \beta^2 \sigma^2\right) - C(a) \geq \bar{H}$

: $\beta - C'(a) = 0$

Research Implications:

(i) Risk Sharing -- + α

↳ Owner-Manager firms
vs.
Dispersed ownership (Ex) POSCO, KT --)

① CEO Contract?

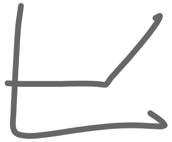
② Investment Behavior

↳ Short-term perspective vs. long-term perspective

③ CEO of Dispersed Ownership firm

↳ PM은 convex contract가 주어짐

주주 with limited liab.



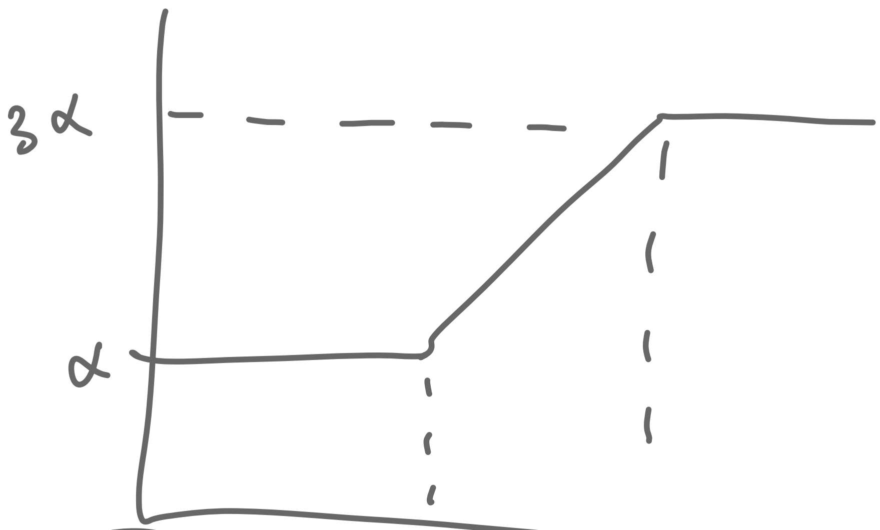
④ (i) CEO turnover 가 과연 performance 와 related?

(ii) CEO의 long-term perspective를 어떻게 고려?? - -

⑤ Puzzle

↳ Hedgefund 등의 Short-term shareholder activism ⇒ 주식시장의 주주들의 turnover 가 매우 rapid - - ⇒ 주가는 과연 long-term performance (going concern : $n \to \infty$) 을 반영하는 것인가?

⑥ Contract Shape



$S = \alpha + \beta x$

⇒ 어떤 Behavior

?

⑦ Transfer Pricing

↳ 회사내의 두 부서간의 거래에 대한 대가

⑧ CSR

⇒ Corporate Shared Value

"좋은 기업" ← 협동조합 등이 새로운 조직..

⇓

Ownership Structure