Cost Padding, Monitoring, and Regulation

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Objectives

- We analyze the model of a government's procurement of facilities from a firm that can do cost padding.
- To examine the optimal residual claimancy for the government. (Government versus Firm)
- To examine the optimal monitoring instruments for the government.

Related Literature

- Khalil and Lawarree (1995) explore the asymmetric information model in which a principal can determine residual claimancy (principal or agent) and a monitoring instrument (input or output).

- Laffont and Tirole (1992) analyze the procurement model with asymmetric information in which an agent exerts cost reduction effort (e) and does cost padding (a).

Model

- S : Social benefits
- R : Revenue
- C : Cost
- t and τ : Monetary transfers

  t : Gov. is a residual claimant

  τ : Firm is a residual claimant

Gov. Payoff $*\pi^{GI} > \pi^{GO} = \pi^{FO} > \pi^{FI}$

Khalil-Lawarree (1995)

$$C(\theta, e, a) = \theta - e + a$$

e: Firm's cost reduction effort

disutility $\dfrac{e^2}{2}$ for Firm

θ: Firm's productivity types with $\theta_1 < \theta_2$

w.p. p and $1 - p$

a: Firm's cost padding

Monitoring Instruments

$$C(\theta, e, a) = \theta - e + a$$

- Monitoring e & a
- Monitoring a & C
- Monitoring e & C

Gov. as Residual Claimant

(Case 1) Monitoring a & e

(Case 2) Monitoring e & C

(Case 3) Monitoring a & C

- Government 's Payoff : $\Pi = S + R - C - t$
- Firm's Payoff : $U = t + a - \frac{e^2}{2}$

Firm as Residual Claimant

(Case 4) Monitoring a & e

(Case 5) Monitoring e & C

(Case 6) Monitoring a & C

- Government's Payoff : $\Pi = S + \tau$

- Firm's Payoff : $U = R + a - C - \tau - \frac{e^2}{2}$

$$= R - (\theta - e) - \tau - \frac{e^2}{2}$$

Timing

Time

$t=0$ — G can decide on residual claimancy

monitoring instruments

$t=1$ — Nature chooses θ

$t=2$ — G offers a contract, F accepts or refuses it

$t=3$ — F makes e and a

$t=4$ — C is realized, monitoring is implemented

t or τ takes place

Benchmark: without cost padding

As a benchmark, we consider the cost function

$C = \theta - e$

residual claimant (government or firm)

and two monitoring instruments (cost reduction effort or cost)

- Gov. as R/C + monitoring e
- Gov. as R/C + monitoring C
- Firm as R/C + monitoring e
- Firm as R/C + monitoring C

without cost padding: Gov. as R/C + Monitoring *e*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$t_1 = \frac{e_1^2}{2} \qquad t_2 = \frac{e_2^2}{2}$$

$$\begin{cases} t_1 - \dfrac{e_1^2}{2} \geq 0 \\ t_2 - \dfrac{e_2^2}{2} \geq 0 \end{cases} \qquad \begin{cases} t_1 - \dfrac{e_1^2}{2} \geq t_2 - \dfrac{e_2^2}{2} \\ t_2 - \dfrac{e_2^2}{2} \geq t_1 - \dfrac{e_1^2}{2} \end{cases}$$

without cost padding: Gov. as R/C + Monitoring *C*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$t_1 = \frac{e_1^2}{2} + \frac{e_2^2 - \hat{e}_2^2}{2} \qquad t_2 = \frac{e_2^2}{2}$$

with $\hat{e}_2 = e_2 + \theta_1 - \theta_2$ and $\hat{e}_1 = e_1 + \theta_2 - \theta_1$

$$\begin{cases} t_1 - \dfrac{e_1^2}{2} \geq 0 \\ t_2 - \dfrac{e_2^2}{2} \geq 0 \end{cases} \qquad \begin{cases} t_1 - \dfrac{e_1^2}{2} \geq t_2 - \dfrac{\hat{e}_2^2}{2} \\ t_2 - \dfrac{e_2^2}{2} \geq t_1 - \dfrac{\hat{e}_1^2}{2} \end{cases}$$

without cost padding: Firm as R/C + Monitoring e

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$\tau_1 = R - (\theta_1 - e_1) - \frac{e_1^2}{2} - (\theta_2 - \theta_1) \qquad \tau_2 = R - (\theta_2 - e_2) - \frac{e_2^2}{2}$$

with $\hat{e}_2 = e_2 + \theta_1 - \theta_2$ and $\hat{e}_1 = e_1 + \theta_2 - \theta_1$

$$\begin{cases} R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq 0 \\ R - (\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq 0 \end{cases} \begin{cases} R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq R - (\theta_1 - e_2) - \frac{e_2^2}{2} - \tau_2 \\ R - (\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq R - (\theta_2 - e_1) - \frac{e_1^2}{2} - \tau_1 \end{cases}$$

without cost padding: Firm as R/C + Monitoring *C*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$\tau_1 = R-(\theta_1 - e_1) - \frac{e_1^2}{2} - \frac{e_2^2 - \hat{e}_2^2}{2} \qquad \tau_2 = R-(\theta_2 - e_2) - \frac{e_2^2}{2}$$

with $\hat{e}_2 = e_2 + \theta_1 - \theta_2$ and $\hat{e}_1 = e_1 + \theta_2 - \theta_1$

$$\begin{cases} R-(\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq 0 \\ R-(\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq 0 \end{cases} \quad \begin{cases} R-(\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq R-(\theta_1 - \hat{e}_2) - \frac{\hat{e}_2^2}{2} - \tau_2 \\ R-(\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq R-(\theta_2 - \hat{e}_1) - \frac{\hat{e}_1^2}{2} - \tau_1 \end{cases}$$

without cost padding: Cost reduction effort

A θ_1 type's effort level is at the first best.

A θ_2 type's effort level is at the first best under monitoring e and is distorted downward under monitoring C.

	Gov. as R/C	Firm as R/C
Monitoring e	$e_1 = e_2 = e^{fb} = 1$	
Monitoring C	$e_1 = e^{fb} = 1$ $e_2 = 1 - \frac{p}{1-p}(\theta_2 - \theta_1)$	

without cost padding: information rents

$$C = \theta - e$$

	Gov. as R/C	Firm as R/C
Monitoring e	0	$\theta_2 - \theta_1$
Monitoring C	**due to lower effort** $\frac{e_2^2 - \hat{e}_2^2}{2}$	

$$(\theta_2 - \theta_1) - \left(\frac{e_2^2 - \hat{e}_2^2}{2}\right) = (\theta_2 - \theta_1)(1 - e_2) + \frac{(\theta_2 - \theta_1)^2}{2} > 0$$

$$\Leftrightarrow \theta_2 - \theta_1 > \frac{e_2^2 - \hat{e}_2^2}{2}$$

without cost padding: Government's payoffs

$$C=\theta-e$$

	Gov. as R/C	Firm as R/C
Monitoring e	$\pi^{G\theta}=S+R-p\theta_1-(1-p)\theta_2+\frac{1}{2}$	$\pi^{F\theta}=S+R-\theta_2+\frac{1}{2}$
Monitoring C	$\pi^{GO}=\pi^{FO}=S+R-\theta_2+\frac{1}{2}+\frac{p}{2(1-p)}(\theta_2-\theta_1)^2$	

Analysis: with cost padding

We consider the cost function $C = \theta - e + a.$

residual claimant (government or firm)

and three cases of monitoring:

(Case 1) Gov. as R/C + monitoring e and a

(Case 2) Gov. as R/C + monitoring a and C

(Case 3) Gov. as R/C + monitoring e and C

(Case 4) Firm as R/C + monitoring e and a

(Case 5) Firm as R/C + monitoring a and C

(Case 6) Firm as R/C + monitoring e and C

Case 1: Gov. as R/C + Monitoring *e* and *a*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$t_1 = \frac{e_1^2}{2} \qquad t_2 = \frac{e_2^2}{2}$$

$$\begin{cases} t_1 - \dfrac{e_1^2}{2} \geq 0 \\ t_2 - \dfrac{e_2^2}{2} \geq 0 \end{cases} \qquad \begin{cases} t_1 - \dfrac{e_1^2}{2} \geq t_2 - \dfrac{e_2^2}{2} \\ t_2 - \dfrac{e_2^2}{2} \geq t_1 - \dfrac{e_1^2}{2} \end{cases}$$

Case 2: Gov. as R/C + Monitoring *a* and *C*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$t_1 = \frac{e_1^2}{2} + \frac{e_2^2 - \hat{e}_2^2}{2} \qquad t_2 = \frac{e_2^2}{2}$$

with $\hat{e}_2 = e_2 + \theta_1 - \theta_2$ and $\hat{e}_1 = e_1 + \theta_2 - \theta_1$

$$\begin{cases} t_1 - \dfrac{e_1^2}{2} \geq 0 \\ t_2 - \dfrac{e_2^2}{2} \geq 0 \end{cases} \qquad \begin{cases} t_1 - \dfrac{e_1^2}{2} \geq t_2 - \dfrac{\hat{e}_2^2}{2} \\ t_2 - \dfrac{e_2^2}{2} \geq t_1 - \dfrac{\hat{e}_1^2}{2} \end{cases}$$

Case 3: Gov. as R/C + Monitoring *e* and *C*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$t_1 = \frac{e_1^2}{2} - a_1 + \theta_2 - \theta_1 \qquad t_2 = \frac{e_2^2}{2} - a_2$$

with $\hat{a}_2 = a_2 + \theta_2 - \theta_1$ and $\hat{a}_1 = a_1 + \theta_1 - \theta_2$

$$\begin{cases} t_1 + a_1 - \dfrac{e_1^2}{2} \geq 0 \\ t_2 + a_2 - \dfrac{e_2^2}{2} \geq 0 \end{cases} \qquad \begin{cases} t_1 + a_1 - \dfrac{e_1^2}{2} \geq t_2 + \hat{a}_2 - \dfrac{e_2^2}{2} \\ t_2 + a_2 - \dfrac{e_2^2}{2} \geq t_1 + \hat{a}_1 - \dfrac{e_1^2}{2} \end{cases}$$

Case 4: Firm as R/C + Monitoring *e* and *a*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$\tau_1 = R - (\theta_1 - e_1) - \frac{e_1^2}{2} - (\theta_2 - \theta_1) \qquad \tau_2 = R - (\theta_2 - e_2) - \frac{e_2^2}{2}$$

$$\begin{cases} R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq 0 \\ R - (\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq 0 \end{cases} \begin{cases} R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq R - (\theta_1 - e_2) - \frac{e_2^2}{2} - \tau_2 \\ R - (\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq R - (\theta_2 - e_1) - \frac{e_1^2}{2} - \tau_1 \end{cases}$$

Case 5: Firm as R/C + Monitoring *a* and *C*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$\tau_1 = R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \frac{e_2^2 - \hat{e}_2^2}{2} \qquad \tau_2 = R - (\theta_2 - e_2) - \frac{e_2^2}{2}$$

with $\hat{e}_2 = e_2 + \theta_1 - \theta_2$ and $\hat{e}_1 = e_1 + \theta_2 - \theta_1$

$$\begin{cases} R - (\theta_1 - e_1) - \dfrac{e_1^2}{2} - \tau_1 \geq 0 \\ R - (\theta_2 - e_2) - \dfrac{e_2^2}{2} - \tau_2 \geq 0 \end{cases} \quad \begin{cases} R - (\theta_1 - e_1) - \dfrac{e_1^2}{2} - \tau_1 \geq R - (\theta_1 - \hat{e}_2) - \dfrac{\hat{e}_2^2}{2} - \tau_2 \\ R - (\theta_2 - e_2) - \dfrac{e_2^2}{2} - \tau_2 \geq R - (\theta_2 - \hat{e}_1) - \dfrac{\hat{e}_1^2}{2} - \tau_1 \end{cases}$$

Case 6: Firm as R/C + Monitoring *e* and *C*

The government's problem is to maximize its payoff subject to two IRCs and two ICCs. The optimal mechanism is given by

$$\tau_1 = R - (\theta_1 - e_1) - \frac{e_1^2}{2} - (\theta_2 - \theta_1) \qquad \tau_2 = R - (\theta_2 - e_2) - \frac{e_2^2}{2}$$

with $\hat{a}_2 = a_2 + \theta_2 - \theta_1$ and $\hat{a}_1 = a_1 + \theta_1 - \theta_2$

$$\begin{cases} R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq 0 \\ R - (\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq 0 \end{cases} \quad \begin{cases} R - (\theta_1 - e_1) - \frac{e_1^2}{2} - \tau_1 \geq R - (\theta_1 - \hat{e}_2) - \frac{\hat{e}_2^2}{2} - \tau_2 \\ R - (\theta_2 - e_2) - \frac{e_2^2}{2} - \tau_2 \geq R - (\theta_2 - \hat{e}_1) - \frac{\hat{e}_1^2}{2} - \tau_1 \end{cases}$$

Payoffs with cost padding

Case 1 Case 6	$\Pi^{GEA} = \Pi^{FEC} = S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2}$
Case 2 Case 5	$\Pi^{GAC} = \Pi^{FAC} = S + R - \theta_2 + \frac{1}{2} + \frac{p(a)}{2(1-p(a))}(\theta_2 - \theta_1)^2$
Case 3 Case 4	$\Pi^{GEC} = \Pi^{FEA} = S + R - \theta_2 + \frac{1}{2}$

Conclusion

$$\Pi^{GEC} = \Pi^{FEA} < \Pi^{GAC} = \Pi^{FAC} < \Pi^{GEA} = \Pi^{FEC}$$

- When the government is the residual claimant, it obtains the highest payoff by monitoring effort and cost padding, and the lowest payoff by monitoring effort and cost.
- When the firm is the residual claimant, the government obtains the highest payoff by monitoring effort and cost, and the lowest payoff by monitoring effort and cost padding.