Cost Padding, Monitoring, and Regulation*

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Abstract

This paper examines the relationship between monitoring and residual claimancy in a model in which a firm constructing facilities can do cost padding. The firm's cost depends on a cost parameter, its effort for cost reduction and its cost padding level. We suppose that the government has the following monitoring instruments: (1) monitoring cost reduction effort and cost padding, (2) monitoring cost padding and cost, and (3) monitoring cost reduction effort and cost. We show that if the government is the residual claimant, then monitoring cost reduction effort and cost padding yields the highest payoff for the government whereas monitoring cost reduction effort and cost gives the lowest payoff. On the other hand, if the firm is the residual claimant, then monitoring cost reduction effort and cost yields the highest payoff for the government.

JEL: D82, L33, L51.
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1 Introduction

In this paper, we examine the relationship between monitoring and residual claimancy in a model in which a firm constructing and operating facilities such as toll express ways can do cost padding. The firm's cost depends on a cost parameter, its effort for cost reduction and its cost padding level.

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Suppose that the government has the following monitoring instruments: monitoring (1) effort for cost reduction and cost padding level, (2) cost padding level and cost, and (3) effort for cost reduction and cost. We show that if the government is the residual claimant, then monitoring effort for cost reduction and cost padding level yields the highest payoff for the government whereas monitoring effort for cost reduction and cost brings about the lowest. On the other hand, if the firm is the residual claimant, then monitoring effort for cost reduction and cost yields the highest payoff for the government.

The problem of input versus output monitoring has been examined in several papers. Among them, Maskin and Riley (1985) show that output monitoring is superior to input monitoring. Khalil and Lawaree (1995) demonstrate that input monitoring gives the highest payoff to the principal when he is the residual claimant.

The issue of cost padding has been studied in Laffont and Tirole (1992). They show that without auditing the firm's cost padding, fixed price contract is optimal. Our paper extends these papers to the setting in which the possibility of cost padding and the choice of residual claimancy are considered.

The paper is organized as follows. In Section 2 we set up the model. In Section 3, we analyze the case in which the government is the residual claimant. In Section 4, we analyze the case in which the firm is the residual claimant. In Section 5, we compare the government's payoff under the two cases of residual claimancy. Section6 concludes.

2 The Model

A government delegates a firm to construct and operate facilities such as toll express ways. The firm's cost function is given by

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

where θ is a cost parameter, either θ_1 or θ_2 $(0 < \theta_1 < \theta_2)$ with probabilities p and $1-p$ $(0 < p < 1)$ respectively, e is the firm's effort level for cost reduction with $e \geq 0$, and a is the level of cost padding by the firm with $a \geq 0$. The disutility of cost reduction effort for the firm is assumed to be $\varphi(e) = \dfrac{e^2}{2}$. The level of cost padding a gives monetary benefit a to the firm. Without monitoring, the government cannot observe θ, e, a, or C.

2.1 Payoffs

2.1.1 When the government is the residual claimant

The government's payoff is given by

$$\Pi = S + R - C - t,$$

where S is social benefit, R is revenue from the facilities, and t is a monetary transfer to the firm. The firm's payoff is given by

$$U = t + a - \frac{e^2}{2}.$$

2.1.2 When the firm is the residual claimant

The government's payoff is given by

$$\Pi = S + \tau,$$

where τ is a monetary transfer to the government. The firm's payoff is given by

$$U = R - C - \tau + a - \frac{e^2}{2}.$$

3 When the Government is the Residual Claimant

When the government is the residual claimant, the government's problem is

$$\max_{e,\, a,\, t} \; S + R - p[(\theta_1 - e_1 + a_1) + t_1] - (1-p)[(\theta_2 - e_2 + a_2) + t_2].$$

3.1 Case 1 (Monitoring e and a)

Suppose that the government can monitor cost reduction effort e and cost padding level a. In this case, the individual rationality constraints and incentive compatibility constraints are given by

$$\begin{aligned} t_1 - \frac{e_1^2}{2} &\geq 0, \\ t_2 - \frac{e_2^2}{2} &\geq 0, \\ t_1 - \frac{e_1^2}{2} &\geq t_2 - \frac{e_2^2}{2}, \\ t_2 - \frac{e_2^2}{2} &\geq t_1 - \frac{e_1^2}{2}. \end{aligned}$$

Then the binding conditions are

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

Thus the government's problem can be rewritten as

$$\max_{e,\, a,\, t} \; S + R - p\left(\theta_1 - e_1 + \frac{e_1^2}{2}\right) - (1-p)\left(\theta_2 - e_2 + \frac{e_2^2}{2}\right).$$

The first order conditions with respect to e yield

$$e_1 = e_2 = e^{FB} = 1.$$

Thus we obtain

$$t_1 = t_2 = \frac{1}{2}.$$

Hence the government's payoff Π^{GEA} is

$$\Pi^{GEA} = S + R - p\theta_1 - (1-p)\theta_2 - \frac{1}{2}.$$

The firm's payoff U^{GEA} is

$$U_1^{GEA} = U_2^{GEA} = 0.$$

Hence the optimal contract $\{a_i, e_i, t_i\}$ is $\left\{0, 1, \frac{1}{2}\right\}$ for the both types.

3.2 Case 2 (Monitoring a and C)

Suppose that the government can monitor cost padding level a and cost C. In this case, the individual rationality constraints and incentive compatibility constraints are given by

$$t_1 - \frac{e_1^2}{2} \geq 0,$$
$$t_2 - \frac{e_2^2}{2} \geq 0,$$
$$t_1 - \frac{e_1^2}{2} \geq t_2 - \frac{\hat{e}_2^2}{2},$$
$$t_2 - \frac{e_2^2}{2} \geq t_1 - \frac{\hat{e}_1^2}{2},$$

where we have

$$\hat{e}_2 = e_2 + \theta_1 - \theta_2,$$
$$\hat{e}_1 = e_1 + \theta_2 - \theta_2.$$

The binding conditions are given by

$$t_1 = \frac{e_1^2 + (\theta_2 - \theta_1)(2e_2 + \theta_1 - \theta_2)}{2},$$
$$t_2 = \frac{e_2^2}{2}.$$

The government's problem can be rewritten as

$$\max_{e,\, a,\, t}\ S - p\left[\theta_1 - e_1 + \frac{e_1^2 + 2(\theta_2 - \theta_1)e_2 + (\theta_2 - \theta_1)^2}{2}\right] - (1-p)[\theta_2 - e_2 + \frac{e_2^2}{2}].$$

The first order conditions with respect to e yield

$$e_1 = 1,$$
$$e_2 = 1 - \frac{p}{1-p}(\theta_2 - \theta_1).$$

Thus the transfers can be written as

$$t_1 = \frac{1}{2} + (\theta_2 - \theta_1) - \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2,$$
$$t_2 = \frac{1}{2} - \frac{p}{1-p}(\theta_2 - \theta_1) + \frac{p^2}{2(1-p)^2}(\theta_2 - \theta_1)^2.$$

Then the government's payoff Π^{GAC} is

$$\Pi^{GAC} = S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2.$$

The firm's payoff U^{GAC} is

$$U_1^{GAC} = (\theta_2 - \theta_1) - \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2,$$
$$U_2^{GAC} = 0.$$

The contract $\{a_i, e_i, t_i\}$ is $\left\{0, 1, \frac{1}{2} + (\theta_2 - \theta_1) - \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2\right\}$ for type θ_1 and $\left\{0, 1 - \frac{p}{1-p}(\theta_2 - \theta_1), \frac{1}{2} - \frac{p}{1-p}(\theta_2 - \theta_1) + \frac{p^2}{2(1-p)^2}(\theta_2 - \theta_1)^2\right\}$ for type θ_2.

3.3 Case 3 (Monitoring e and C)

Suppose that the government can monitor cost reduction effort e and cost C. In this case, the individual rationality constraints and incentive compatibility constraints are given by

$$\begin{aligned} t_1 + a_1 - \frac{e_1^2}{2} &\geq 0, \\ t_2 + a_2 - \frac{e_2^2}{2} &\geq 0, \\ t_1 + a_1 - \frac{e_1^2}{2} &\geq t_2 + \hat{a}_2 - \frac{e_2^2}{2}, \\ t_2 + a_2 - \frac{e_2^2}{2} &\geq t_1 + \hat{a}_1 - \frac{e_1^2}{2}, \end{aligned}$$

where we have

$$\begin{aligned} \theta_2 - e_2 + a_2 &= \theta_1 - e_2 + \hat{a}_2 \\ &\iff \hat{a}_2 = a_2 + \theta_2 - \theta_1 \\ \theta_1 - e_1 + a_1 &= \theta_2 - e_1 + \hat{a}_1 \\ &\iff \hat{a}_1 = a_1 - \theta_2 + \theta_1 \end{aligned}$$

The binding conditions are

$$\begin{aligned} t_1 &= \frac{e_1^2}{2} - a_1 + \hat{a}_2 - a_2 \\ &= \frac{e_1^2}{2} - a_1 + \theta_2 - \theta_1, \\ t_2 &= \frac{e_2^2}{2} - a_2. \end{aligned}$$

Then the government's problem can be rewritten as

$$\begin{aligned} &\max\ S + R - p\left[\theta_1 - e_1 + a_1 + \left(\frac{e_1^2}{2} - a_1 + \theta_2 - \theta_1\right)\right] - (1-p)\left(\theta_2 - e_2 + a_2 + \frac{e_2^2}{2} - a_2\right) \\ &= S + R - p\left(\theta_2 - e_1 + \frac{e_1^2}{2}\right) - (1-p)\left(\theta_2 - e_2 + \frac{e_2^2}{2}\right) \end{aligned}$$

The first order conditions with respect to e yield

$$e_1 = e_2 = e^{fb} = 1.$$

Thus we obtain

$$t_1 = \frac{1}{2} + \theta_2 - \theta_1,$$
$$t_2 = \frac{1}{2}.$$

The government's payoff Π^{GEC} is

$$\begin{aligned}\Pi^{GEC} &= S + R - p\left(\theta_2 - \frac{1}{2}\right) - (1-p)\left(\theta_2 - \frac{1}{2}\right) \\ &= S + R - \theta_2 + \frac{1}{2}.\end{aligned}$$

The firm's payoff U^{GEC} is

$$\begin{aligned}U_1^{GEC} &= \theta_2 - \theta_1, \\ U_2^{GEC} &= 0.\end{aligned}$$

Thus the optimal contract $\{e_i, C_i, t_i\}$ is $\left\{1, \theta_1 - 1, \frac{1}{2} + \theta_2 - \theta_1\right\}$ for type θ_1 and $\left\{1, \theta_2 - 1, \frac{1}{2}\right\}$ for type θ_2.

4 When the Firm is the Residual Claimant

In this section, we analyze the cases in which the firm is the residual claimant.

The government's payoff is

$$S + p\tau_1 + (1-p)\tau_2.$$

The firm's payoff is

$$\begin{aligned}&R - p\left[(\theta_1 - e_1 + a_1) + \tau_1 - a_1 + \frac{e_1^2}{2}\right] - (1-p)\left[(\theta_2 - e_2 + a_2) + \tau_2 - a_2 + \frac{e_2^2}{2}\right] \\ &= R - p\left(\theta_1 - e_1 + \tau_1 + \frac{e_1^2}{2}\right) - (1-p)\left(\theta_2 - e_2 + \tau_2 + \frac{e_2^2}{2}\right).\end{aligned}$$

4.1 Case 4 (Monitoring e and a)

Suppose that the government can monitor cost reduction effort e and cost padding level a. In this case, the individual rationality constraints and incentive compatibility constraints are given by

$$\begin{aligned}
&R-\theta_1+e_1-\tau_1-\frac{e_1^2}{2}\geq 0,\\
&R-\theta_2+e_2-\tau_2-\frac{e_2^2}{2}\geq 0,\\
&R-\theta_1+e_1-\tau_1-\frac{e_1^2}{2}\geq R-\theta_1+e_2-\tau_2-\frac{e_2^2}{2},\\
&R-\theta_2+e_2-\tau_2-\frac{e_2^2}{2}\geq R-\theta_2+e_1-\tau_1-\frac{e_1^2}{2}.
\end{aligned}$$

The binding conditions are

$$\begin{aligned}
\tau_1&=R-\theta_2+e_1-\frac{e_1^2}{2},\\
\tau_2&=R-\theta_2+e_2-\frac{e_2^2}{2}.
\end{aligned}$$

The government's problem can be written as

$$\max_{e,\,a,\,\tau}\ S+p\left(R-\theta_2+e_1-\frac{e_1^2}{2}\right)+(1-p)\left(R-\theta_2+e_2-\frac{e_2^2}{2}\right).$$

The first order conditions with respect to e yield

$$e_1=e_2=e^{fb}=1.$$

Thus the transfers are

$$\tau_1=\tau_2=R-\theta_2+\frac{1}{2}.$$

The government's payoff Π^{FEA} is

$$\Pi^{FEA}=S+R-\theta_2+\frac{1}{2}.$$

The firm's payoff U^{FEA} is

$$\begin{aligned}
U_1^{FEA}&=\theta_2-\theta_1,\\
U_2^{FEA}&=0.
\end{aligned}$$

Thus the optimal contract $\{e_i,a_i,\tau_i\}$ is $\left\{1,0,R-\theta_2+\frac{1}{2}\right\}$ for type θ_1 or $\left\{1,0,R-\theta_2+\frac{1}{2}\right\}$ for type θ_2.

4.2 Case 5 (Monitoring a and C)

Suppose that the government can monitor cost padding level a and cost C. In this case, the individual rationality constraints and incentive compatibility constraints are given by

$$\begin{aligned} R - \theta_1 + e_1 - \tau_1 - \frac{e_1^2}{2} &\geq 0, \\ R - \theta_2 + e_2 - \tau_2 - \frac{e_2^2}{2} &\geq 0, \\ R - \theta_1 + e_1 - \tau_1 - \frac{e_1^2}{2} &\geq R - \theta_1 + \hat{e}_2 - \tau_2 - \frac{\hat{e}_2^2}{2}, \\ R - \theta_2 + e_2 - \tau_2 - \frac{e_2^2}{2} &\geq R - \theta_2 + \hat{e}_1 - \tau_1 - \frac{\hat{e}_1^2}{2}, \end{aligned}$$

where we have

$$\begin{aligned} \hat{e}_2 &= e_2 + \theta_1 - \theta_2, \\ \hat{e}_1 &= \hat{e}_1 + \theta_2 - \theta_1. \end{aligned}$$

The binding conditions are

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

and

$$\tau_2 = R - \theta_2 + e_2 - \frac{e_2^2}{2}.$$

The government's problem can be rewritten as

$$\max_{e,\, a,\, \tau} \; S + p \left(R - \theta_1 + e_1 - \frac{e_1^2 + (\theta_2 - \theta_1)(2e_2 + \theta_1 - \theta_2)}{2} \right) + (1-p) \left(R - \theta_2 + e_2 - \frac{e_2^2}{2} \right).$$

The first order conditions with respect to e yield

$$\begin{aligned} e_1 &= 1, \\ e_2 &= 1 - \frac{p}{1-p}(\theta_2 - \theta_1). \end{aligned}$$

Then the transfers are

$$\begin{aligned} \tau_1 &= R - \theta_2 + \frac{1}{2} + \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2, \\ \tau_2 &= R - \theta_2 + \frac{1}{2} - \frac{p^2}{2(1-p)^2}(\theta_2 - \theta_1)^2. \end{aligned}$$

Thus the government's payoff Π^{FAC} is

$$\Pi^{FAC} = S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2.$$

The firm's payoff U^{FAC} is

$$\begin{aligned} U_1^{FAC} &= R - \theta_1 + 1 - \left(R - \theta_2 + \frac{1}{2} + \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2\right) - \frac{1}{2} \\ &= (\theta_2 - \theta_1) - \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2. \\ U_2^{FAC} &= 0. \end{aligned}$$

Thus the optimal contract $\{a_i, C_i, \tau_i\}$ is $\left\{a_1, \theta_1, R - \theta_2 + \frac{1}{2} + \frac{1+p}{2(1-p)}(\theta_2 - \theta_1)^2\right\}$ for type θ_1 and $\left\{a_2, \theta_2, R - \theta_2 + \frac{1}{2} - \frac{p^2}{2(1-p)^2}(\theta_2 - \theta_1)^2\right\}$ for type θ_2.

4.3 Case 6 (Monitoring e and C)

Suppose that the government can monitor cost reduction effort e and cost C. In this case, the individual rationality constraints and incentive compatibility constraints are given by

$$\begin{aligned} &R - \theta_1 + e_1 - \tau_1 - \frac{e_1^2}{2} \geq 0, \\ &R - \theta_2 + e_2 - \tau_2 - \frac{e_2^2}{2} \geq 0, \\ &R - \theta_1 + e_1 - \tau_1 - \frac{e_1^2}{2} \geq R - \theta_1 + e_2 - a_2 - \tau_2 + a_2 - \frac{e_2^2}{2}, \\ &R - \theta_2 + e_2 - \tau_2 - \frac{e_2^2}{2} \geq R - \theta_2 + e_1 - a_1 - \tau_1 + a_1 - \frac{e_1^2}{2}. \end{aligned}$$

The binding conditions are

$$\begin{aligned} \tau_1 &= R - \theta_1 + e_1 - \frac{e_1^2}{2}, \\ \tau_2 &= R - \theta_2 + e_2 - \frac{e_2^2}{2}. \end{aligned}$$

The government's problem is written as

$$\max_{e,\, a,\, \tau} \; S + p\left(R - \theta_1 + e_1 - \frac{e_1^2}{2}\right) + (1-p)\left(R - \theta_2 + e_2 - \frac{e_2^2}{2}\right).$$

The first order conditions with respect to e yield

$$e_1 = e_2 = e^{fb} = 1.$$

Then the transfers are

$$\tau_1 = R - \theta_1 + \frac{1}{2},$$
$$\tau_2 = R - \theta_2 + \frac{1}{2}.$$

Thus the government's payoff Π^{FEC} is

$$\Pi^{FEC} = S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2}.$$

The firm's payoff is

$$U_1^{FEC} = U_2^{FEC} = 0.$$

Thus the optimal contract $\{e_i, C_i, \tau_i\}$ is $\left\{1, \theta_1 - 1, R - \theta_1 + \frac{1}{2}\right\}$ for type θ_1 and $\left\{1, \theta_2 - 1, R - \theta_2 + \frac{1}{2}\right\}$ for a type θ_2.

5 Comparisons

In the previous sections, we have derived the optimal contracts for the six cases depending on monitoring instruments and residual claimancy. We compare the government's payoff in those six cases in this section.

The government's payoff in the six cases are summarized in Table 1.

Table 1: With Cost Padding (a)

Case	Residual claimant	Monitoring	Government's payoff
1	Govern.	e and a	$\Pi^{GEA} = S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2}$
2		a and C	$\Pi^{GAC} = S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2$
3		e and C	$\Pi^{GEC} = S + R - \theta_2 + \frac{1}{2}$
4	Firm	e and a	$\Pi^{FEA} = S + R - \theta_2 + \frac{1}{2}$
5		a and C	$\Pi^{FAC} = S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2$
6		e and C	$\Pi^{FEC} = S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2}$

First we have the following relationships:

$$\Pi^{GEA} = \Pi^{FEC} = \Pi^{FB},$$
$$\Pi^{GAC} = \Pi^{FAC},$$
$$\Pi^{GEC} = \Pi^{FEA}.$$

Since $\theta_2 - \theta_1 \leq 1 - p$, we have

$$\begin{aligned}
&\Pi^{GEA} - \Pi^{GAC} \\
&= \left[S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2} \right] - \left[S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2 \right] \\
&= S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2} - S - R + \theta_2 - \frac{1}{2} - \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2 \\
&= (\theta_2 - \theta_1)\left[p - \frac{p}{2(1-p)}(\theta_2 - \theta_1) \right] \\
&\geq (\theta_2 - \theta_1)\left[p - \frac{p}{2(1-p)}(1-p) \right] \\
&= \frac{p(\theta_2 - \theta_1)}{2} > 0.
\end{aligned}$$

Hence we obtain the result that $\Pi^{GEA} = \Pi^{FEC} > \Pi^{GAC} = \Pi^{FAC}$.

It also holds that

$$\begin{aligned}
&\Pi^{GAC} - \Pi^{GEC} \\
&= \left[S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2 \right] - \left[S + R - \theta_2 + \frac{1}{2} \right] \\
&= \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2 > 0.
\end{aligned}$$

Thus we can conclude that $\Pi^{GAC} = \Pi^{FAC} > \Pi^{GEC} = \Pi^{FEA}$.

Therefore the government's payoff under the six cases can be ordered as

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

The main conclusion can be stated in the following proposition.

Proposition 1 *If the government is the residual claimant, then monitoring cost reduction effort and cost padding yields the highest payoff for the government whereas monitoring cost reduction effort and cost gives the lowest payoff.*

We have shown that if the government is the residual claimant, then monitoring cost reduction effort and cost padding yields the highest payoff for the government whereas monitoring cost reduction effort and cost gives the lowest payoff. On the other hand, if the firm is the residual claimant, then monitoring cost reduction effort and cost yields the highest payoff for the government.

Finally we note that in a model without considering firm's cost padding activities, we obtain the following results regarding the government payoff shown in Table 2. Thus we can summarize the government payoffs and the relationship between the models with and without cost padding in Table 3.

Table 2: Without Cost Padding (a)

Residual claimant	Monitoring	Government's payoff
Govern.	e	$\pi^{GE} = S + R - p\theta_1 - (1-p)\theta_2 + \frac{1}{2}$
	C	$\pi^{GC} = S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2$
Firm	e	$\pi^{FE} = S + R - \theta_2 + \frac{1}{2}$
	C	$\pi^{FC} = S + R - \theta_2 + \frac{1}{2} + \frac{p}{2(1-p)}(\theta_2 - \theta_1)^2$

Table 3: Comparisons

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

6 Conclusion

In this paper we have examined the relationship between monitoring and residual claimancy in a model in which a firm constructing public facilities can do cost padding. We have considered the setting that the government has the following monitoring instruments: (1) monitoring cost reduction effort and cost padding, (2) monitoring cost padding and cost, and (3) monitoring cost reduction effort and cost. We have shown that if the government is the residual claimant, then monitoring cost reduction effort and cost padding yields the highest payoff for the government whereas monitoring cost reduction effort and cost gives the lowest payoff. On the other hand, if the firm is the residual claimant, then monitoring cost reduction effort and cost yields the highest payoff for the government.

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