Cost Allocation in Agency Paradigm

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CONTENTS

Ⅰ. Introduction

Although there has been a significant number of researches on cost allocation, the impact of the researches on the cost allocation practice has been limited. Without capturing the essential aspects of settings in which demands for allocation arises, previous researches are varied and sometimes conflicting in results, as well as their assumptions, definitions, and methodologies.[1] This paper explores and clarifies the fundamental issue in a simple principal-agent setting, such as the need for the cost allocation as an optimal incentive scheme, and its implication on topics such as joint cost allocation and noncontrollable cost allocation is discussed.

When the agent use some input(e.g., raw material) as well as his own effort to produce output, there are two possible cases ; one case in which the principal provides fixed amount of input, and the other case in which principal delegates the input choice decision to the agent. Hence the allocation issue of how firms should allocate must be preceded by the centralization issue of whether to delegate or not. In other words, for the practice of cost allocation to be justified, in the first place, we have to be in the

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1) For the review of pervious researches on this topic, see Biddle and Steinberg(1984).

situation where the delegation of input choice gives better solution than centralizing the input decision. It is well-known from the previous researches(See Demski and Sappington(1986), Magee(1988), among others) that decentralization with an appropriate incentive scheme gives better solution when there exists an information asymmetry. Hence information asymmetry is introduced in this paper to a simple principal-agent setting, and later we will consider the multiple-agent case.

It should be noted that in cost allocation analysis under the agency framework the cost objective is the agent to whom different payoffs according to different level of input use will be applied through incentive scheme. Considering that significant number of papers have focused on the allocation among products or projects for the price decision, the agency framework seems to be limited for such kind of application. It does provide, however, more fundamental implication since the ultimate cost objective of allocation would be the agent.

With the organizational design of single-period principal-agent setting with the information asymmetry, the results of this paper support the cost allocation practice by showing that the optimal incentive scheme reflects some cost allocation property of input costs. Under the multiple-agent setting with an independent production possibility assumption, the results of this paper support the traditional idea of responsibility accounting. Also, through the characterization of an optimal incentive scheme developed, discussion on the controversial topics such as non-controllable cost allocation and product cost allocation is also provided.

In the following section, the model and results of the analysis is provided. In section III, the results of the previous section are verified with the numerical example. In section IV, consideration on multiple-agent case for possible implication on non-controllable cost allocation, and summarizing conclusion is provided.

II. The Model

Suppose that the principle hires an agent for the production of output(or profit) x.

Assume that there are two factors for the production of x, which are agent's effort a, and another input r (e.g., raw material) provided by the principle. While the effort a causes some disutility to the agent through the function $V(a)$, r brings some costs to the principal through the input cost function $J(r,\xi)$, where ξ is a random parameter. It is assumed that the agent has a private information on ξ, by observing ξ after the contract and before starting the production, and r doesn't provide any non-pecuniary benefit to the agent. The decisions on a and r are delegated to the agent because of the unobservability of a and agent's superior information on ξ.

The factors of production, a and r, have non-trivial effects on the output x, i.e., production possibility is characterized by the probability measure $P(x|a, r)$, which has the monotone likelihood ratio(MLRC) property, such that $P(x|a', r)/P(x|a, r)$ is non-increasing in x when $a' \geq a$, also $P(x|a, r')/P(x|a, r)$ is non-increasing in x when $r' \geq r$. The agent is assumed to have additively separable utility function $U(\omega) - V(a)$, with $U'>0$, $U'' < 0$ and $V'> 0$, where ω=monetary wealth and a=agent 's effort. The function $P(x|a,\mathrm{r})$, $U(\cdot)$, $V(\cdot)$, and $J(\cdot)$, and the set $X=(x_1, x_2 \cdots x_n)$,, $A=(a_1, a_2 \cdots a_l)$, $\Xi=(\xi_1, \xi_2 \cdots \xi_k)$, and $R=(r_1,, r_2 \cdots r_m)$are assumed to be common knowledge.

Then the problem can formally be written as follows ;

$$\max \sum_{j=1}^{j=k} P(\xi_j) \left\{ \sum_{i=1}^{i=n} P(x_i|\hat{a}, \hat{r}(\xi_j))\, G(x_i - \hat{I_i^r} - J(r, \xi_j)) \right\} \tag{1}$$

s.t.

$$\sum_{j=1}^{j=k} P(\xi_j) \left\{ \sum_{i=1}^{i=n} P(x_i|\hat{a}, \hat{r}(\xi_j))\, U(I_i^r) - V(\hat{a}) \right\} \geq \overline{U}$$

(Reservation Utility Constraint)

$$\sum_{i=1}^{i=n} P(x_i|\hat{a}, \hat{r}(\xi_j))\, U(\hat{I_i^r}) - V(\hat{a}) \geq \sum_{i=1}^{i=n} P(x_i|a, r(\xi_j))\, U(I_i^r) - V(\mathrm{a})$$

for all $\xi_j \in \Xi$, $a \in A$, and $r \in R$

(Self-sellection constraint of a and r)

To work out for the solution, we can simplify the program by assuming that principal wishes to obtain the optimal solution with a particular $\hat{\xi}$ which might be observed by the agent. Then the program can be reduced as follows, and the reduced program should be repeated for all possible. ξ, $\hat{\xi} \in \Xi$

$$\max \sum_{i=1}^{i=n} P(x \mid \hat{a}, r\, G(x - \hat{I}_i^r - J(r, \hat{\xi})) \tag{2}$$

s.t.

$$\sum_{i=1}^{i=n} P(x \mid \hat{a}, \hat{r}\, U(\hat{I}_i^r) - V(\hat{a}) \geq \overline{U}$$

$$\sum_{i=1}^{i=n} P(x \mid \hat{a}, r)\, U(\hat{I}_i^r) - V(\hat{a}) \geq \sum_{i=1}^{i=n} P(x \mid a, r)\, U(I_i^r) - V(a)$$

for all $a \in A$, and $r \in R$

Note that the solution for the reduced model is also a feasible solution to the original program. The incentive scheme $\hat{I}_i^r = (\hat{I}_1^r, \hat{I}_2^r, \cdots\cdots, \hat{I}_n^r)$ represents the payment of $\hat{I}_i^r$ with the output observation of x and input use of $\hat{r}$. With any other input choice of r, $r \neq \hat{r}$, the agent will be paid $\underline{I}$. Also, in this reduced model, since r is observable by the principal the incentive problem is solely raised by the unobservable effort a. So it may be looked that there is no need for the delegation of the input choice decision on r. However, due to the information asymmetry on ξ in the original problem, centralization of input decision would not lead to a better solution.

The difference between the reduced model and the basic agency model(Holmstrom (1979), Grossman and Hart(1983)) is that there is another factor r associated with the production possibility, which also brings some costs to the principal. Hence, if we go further and fix r and set aside input cost term $J(\overline{r}, \overline{a})$ for a moment, then the program becomes the traditional basic agency model as follows, and we can use the results from the previous researches.

$$\max \sum_{i=1}^{i=n} P(x|a, \bar{r})\, G(x-\bar{I}_i^r) \tag{3}$$

s.t.

$$\sum_i P(x|\hat{a}, \bar{r})\, U(\bar{I}_i^r)-V(\hat{a}) \geq \bar{U}$$

$$\sum_i P(x|\hat{a}, \bar{r})\, U(\bar{I}_i^r)-V(\hat{a}) \geq \sum_i P(x|a, \bar{r})\, U(\bar{I}_i^r)-V(a)$$

for all $a \in A$.

The program will be repeated for all $\bar{r} \in R$. According to Grossman and Hart (1983), the analysis can be done in two stages. First assuming that the principal wishes the agent to choose a particular action $a \in A$, the least costly way of achieving this, $C(a, \bar{r})$, is obtained by solving a converted convex program. And then choose which a should be implemented by choosing a which maximizes $B(a, \bar{r}) - C(a, \bar{r})$, whre $B(a, \bar{r}) \equiv \sum_{i=1}^{i=n} P(x_i|a, \bar{r})x_i$ (expected output). The solution of $\hat{a}$ to the basic agency model (3) is the optimal action under given fixed input cost $J(\bar{r}, \bar{\xi})$, and repeating the process for all $\bar{r} \in R$ gives a set $F = ((\dot{\bar{a}}, r_1), (\ddot{\bar{a}}, r_2), \cdots\cdots, (\bar{\bar{a}}, r_m))$, where $\ddot{a}$ represents the optimal action under the production possibility with r_i.

Hence, to solve the program (2), where r is allowed to vary, we have to find an optimal pair from the set F by solving

$$\max_F ((B'(\dot{\bar{a}}, r_i)-J(r_i, \bar{\xi})),$$

$$\text{where } B'(\dot{\bar{a}}, r_i) \equiv \max_A (B(a, r_i)-C(a, r_i)).$$

Note that, at this stage, the solution, a^*, r^*, I^{r^*}, is the optimal solution under a particular $\bar{\xi}$.

Proposition 1

Assuming $P(x_i|a, r)>0$, for all $a \in A$, $r \in R$, then there exits a exits a second-best optimal action a^*, and second best optimal incentive scheme I^{r^*}.

⟨proof⟩

See Proposition 1 of Grossman and Hart(1983).

Proposition 2

Let a^* be the second best optimal action and I^{r^*} is the second best optimal incentive scheme with the optimal input use of r^*, then

$$\sum_{i=1}^{i=n} P(x_i|a^*, r^*)\, U(I_i^{r^*}) - V(\mathrm{a}) = \overline{U}$$

⟨Proof⟩

See Proposition 2 of Grossman and Hart(1983).

Proposition 3

If it is not the case that $\mathrm{B}'(\hat{a}, r) - J(r, \bar{\xi})$ is constant over all $a \in R$, and any $\bar{\xi} \in \Xi$, one can obtain Pareto improvement by incorporating the agent's input choice as an argument into his payoff scheme, i.e., the optimal incentive scheme is such that $I^{r_i} \neq I^{r_j}$, $r_i \neq r_j$.

⟨Proof⟩

Assume, on the contrary, that

$$I_i^{ri} = (I_1^{ri}\, I_2^{ri}, \cdots\cdots, I_n^{ri}) = (I_1^{rj}\, I_2^{rj}, \cdots\cdots, I_n^{rj}) = I_i^{rj}$$

Let $r_i < r_j$, then it is true that

$$\sum_{k=1}^{k=n} P(x_k|\hat{a}, r_j)\, U(I_k^{ri}) - V(\hat{\mathrm{a}}) > \sum_{k=1}^{k=n} P(x_k|\hat{a}, r_i)\, U(I_k^{ri}) - V\,(\hat{\mathrm{a}}) \geq \overline{U}$$

where the first inequality follows by the MLRC(stochastic dominance) assumption in r, and the second one follows from reservation utility constraint. Then it contradicts the Proposition 2, which says $\sum_{k=1}^{k=n} P(x_k|\hat{a}, r)\, U(I_k^{ri}) - V\,(\hat{\mathrm{a}}) = \overline{U}$. Therefore, I^{ri} is not an optimal solution, which contradicts. Q.E.D.

The above proposition says, when the input choice r is delegated to the agent, the optimal incentive scheme should reflect some allocation scheme, such that different input choice leads to different payoffs even with same observation of the output. Since the agents is paid for their effort and not by his input choice, he should be paid accordingly to the different production possibilities caused by the different use of r.

Though agent's are paid for his effort he exert in production and not by his input choice, the different production possibility which involves different degree of uncertainty causes different cost to the principal. This is shown by the following proposition.

Proposition 4

In general, when a is not the least cost action $C(a, r_i) \neq C(a, r_j)$, where $r_i \neq r_j$.

⟨Proof⟩

Note that, of a is the least cost cation, we can always implement the a with first best cost $C_{FB}(a)$, where $C_{FB} \equiv U^{-1}\,\overline{U} + V(a))$. In this case there is no need for the allocation, since $C_{FB}(a, r_i) = C_{FB}(a. r_j)$.

If a is not the first best action, then from the proposition 2

$$\sum_{k=1}^{k=n} P(x_k | a, r_i) u_k^{ri} = \sum_k P(x_k | a, r_j) u_k^{rj} = \overline{U}$$

$$\text{where } u_k^{ri} = U(I_k^{ri})$$

Then $\sum_k P(x_k | a, r_i) h(u_k^{ri}) = \sum_k P(x_k | a, r_j) h(u_k^{rj})$ can hold when h is linear function.

Since strictly convex, however, the above cannot hold. Q.E.D.

Proposition 4 gives some meaningful insight to prevailing cost allocation practice. As a control measure to prevent the agent from wa ting the central resource, many of cost allocation schemes are designed to let the agent(s) bear the input cost burden such that the principal is indifferent to the agent's input use level. According to the proposition 4, this would not be an optimal solution.

Finally, we go back to the original program (1) and consider the case where the random parameter ξ plays a role associated with the input cost function $J(\xi, r)$. Assuming that ξ has non-trivial effect on $J(\xi, r)$ such that different ξ brings different r as an optimal input choice. And, at this time, the corresponding optimal action choice will be the corresponding a in the set F.

Note that the different ξ does not affect agent's utility function, and the optimal incentive schemes are designed such that agent's reservation utility is binding under any choice of r. Therefore, the principal doesn't have to worry about ξ and just having an array of incentive schemes

$$I^r = (I^{r1}, I^{r2}, \cdots\cdots, I^{rn}) = \begin{pmatrix} I_1^{r1} & I_1^{r2} & \cdot & \cdot & \cdot & \cdot & I_1^{rm} \\ I_2^{r1} & I_2^{r2} & \cdot & \cdot & \cdot & \cdot & I_2^{rm} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ I_n^{r1} & I_n^{r2} & \cdot & \cdot & \cdot & \cdot & I_n^{rm} \end{pmatrix}$$

will ensure the agent to pick up the best r for the principle, since the agent is indifferent to any choice of r. Also with the incentive scheme bold I^r, the agent's second best action will be implemented.

Proposition 5

If the solution to $\max_F ((B'(\dot{a}, r_i) - J(r_i, \xi))$, does not give same solution of $(a, r) \in F$, for all $\xi \in \Xi$, then the decentralization with incentive scheme I^r gives Pareto superior solution to centralization case.

⟨proof⟩

To the agent, in either case, same reservation utility will be provided by Proposition 2. To the principal, the optimal incentive scheme in centralized case, $I = I^{r*}$, will be obtained by $\max_F \sum_{j=1}^{j=k} P(\xi_j)(B'(\dot{a}, r_i) - J(r_i, \xi))$, which is less than $\max_F (B'(\dot{a}, r_i) - J(r_i, \xi))$ of decentralized case. Q. E. D.

From this perspective, the cost allocation practice could be interpreted as an incentive scheme which make the agent indifferent to the different level of the principal's resource use. This incentive scheme not only prevent agent for wasting principal's resource, but also enables the agent to use his information to the principal's benefit. The results of this section will be illustrated by using the numerical example in the next section.

Ⅲ. Numerical Example

Assume that the utility functions of the principal and the agent can be represented as $G(w)=w$, $U(w, a)= \sqrt{w}-V(a)$ respectively, where w represents monetary wealth. Let $X=(x_1=10,\ x_2=10.3,\ x_3=42)$, $A=(a_1, a_2, a_3)$, and $\Xi=(\xi_1, \xi_2)$. The disutility function is assumed as $V(a_1)=0.05$, $V(a_2)=1.0$, $V(a_3)=1.252$ and input cost function as $J(r_1, \xi_1)=5.0$, $J(r_2, \xi_1)=5.5$, $J(r_1, \xi_2)=5.6$, and $J(r_2, \xi_2)=5.9$. Finally, production possibilities under the input use of r_1 is given as follows:

	x_1	x_2	x_3
a_1	0.3	0.5	0.2
a_2	0.2	0.4	0.4
a_3	0.2	0.4	0.5

Note that the MLRC condition in a is satisfied here.

To solve the problem, first, we need to compute $C(a_1)$, $C(a_2)$, and $C(a_3)$ are are computed by solving following program for each $\hat{a} \in A$.

$$\min \sum_i P(x_i|\hat{a}, r_1)\ (u_i^{r1})^2$$

s. t.

$$\sum_j P(x_i|\hat{a}, r_1)\ u_i^{r1} - V(\hat{a}) \geq \overline{U}$$

$$\sum_i P(x|\hat{a}, r_1)\, u_i^{r1} - V(\hat{a}) \geq \sum_i P(x|\hat{a}, r_1)\, u_i^{r1} - V(a)$$

$a \in A$, where $u_i^{r1} = U(I_i^{r1})$

To apply Kuhn-Tucker condition

$$2u_1^{r1} = \lambda - \frac{1}{2}\mu_1 + \frac{1}{2}\mu_2$$

$$2u_2^{r1} = \lambda - \frac{1}{4}\mu_1$$

$$2u_3^{r1} = \lambda - \frac{1}{2}\mu_1 + \frac{1}{4}\mu_2$$

From the above equation, we obtain $u_1^{r1} = 0.5, u_2^{r1} = 1.5$, and $u_3^{r1} = 5.75$, by setting the multipliers as $\lambda = 6$, $\mu_1 = 12$, and $\mu_2 = 2$. With the incentive scheme, the agent is different between a_1, a_2, and a_3, since the $E(U(I, a_i))=2.0$ for any a_i, where $i=1, 2, 3$, and E denotes the expectational operation.

To the principal,
$E(G(w|a_i))=(B(a_i)-C(a_i))=(8.835770, 8.745000, 8.663750)$, so a_2 is the second-best optimal action, and it will be implemented by incentive scheme $I^{r1}=(0.25, 2.25, 33.0625)$.

Now, consider another production possibilities with the input choice r_2, which given as follows :

	x_1	x_2	x_3
a_1	0.2619048	0.5	0.2380952
a_2	0.1696649	0.4	0.4303351
a_3	0.0707229	0.3	0.5229277

Note that MLRC conditions in r as well as a are satisfied comparing with the previous production possibilities.

The optimal incentive scheme should be solved again with the new production possibilities. The Kuhn-Tucker condition here is as follows:

$$2u_1^{r2} = \lambda - 0.543659\mu_1 + 0.5457382\mu_2$$

$$2u_2^{r2} = \lambda - 0.25\mu_2$$

$$2u_3^{r2} = \lambda - 0.4467123\mu_1 - 0.2151639\mu_2$$

Form the condition, we obtain optimal solution $u_1^{r2} = 0$, $u_2^{r2} = 1.4$, and $u_3^{r2} = 5.67$, with the multipliers $\lambda = 6.0$, $\mu_1 = 12.8$, and $\mu_2 = 1.75690$. This gives the expected utility to both parties

$E(G(w|a_i)) = (9.13458, 9.271924, 9.258137)$, and

$E(U(I, a_i)) = (2.0, 2.0, 2.0)$. Again, note that the agent have the same utility such that he feels indifferent to any choice of input level. Hence, under the input use of r_2, new incentive scheme should be $I_1^{r2} = 0$, $I_2^{r2} = 1.96$, and $I_3^{r2} = 32.14890$, and it will implement optimal action a_2. Here we can verify the allocation demand with the different choice of r.

It is worth noting that if there had not been any allocation scheme, and used same incentive scheme as under the input choice of r_1. Under the old incentive scheme of I^{r1} the expected utilities to both parties are $E(G(w|a_i)) = (8.706548, 8.720353, 8.650858)$, and $E(U(I^{r1}, a_i)) = (2.2, 2.159252, 2.120371)$. Therefore, the agent will shirk to choose a_1, with the increased input use of r_2. This is not optimal solution to the principal even without considering the input cost.

Now, we consider the delegation issue by introducing random parameter ξ. Having an incentive scheme $I^r = (I^{r1}, I^{r2})$ will ensure the agent to choose optimal a corresponding to a particular input choice of r, further the incentive scheme is designed to give same reservation utility of 2.0 with any choice of r. Then, by the assumption that the agent chooses the best one for the principal when he is indifferent, the choice of r will be the best one for the principal utilizing his observation of ξ. In the example, the expected utilities when r, and ξ are to vary are summarized as follows;

ξ	r	$(B(\hat{a})-C(\hat{a}r))-J(r,\xi)$	$E(U(\cdot))$
ξ_1	r_1	$(22.92-14.175)-5.0=3.754$	2.0
	r_2	$(23.890724-14.6188)-5.6=3.67192$	2.0
ξ_2	r_1	$(22.92-14.175)-5.5=3.245$	2.0
	r_2	$(23.890724-14.6188)-5.9=3.371924$	2.0

From the table, we can see that when the state is ξ_1 it is optimal to choose r_1, and r_2 is the optimal choice when the state is ξ_2. To the agent, since he is indifferent to any choice of r, he will choose best one according to his observation of ξ. Also note that $C(\hat{a}, r_i)$ are different with different r_i as proposition 4.

Ⅳ. Further Extension and Conclusion

In this section, extension to the multiple agent setting is considered to seek for an implication for non-direct cost allocation such as common cost allocation, non-controllable cost allocation, and joint cost allocation.

Assuming there are two agents who use (a^1, r^1), (a^2, r^2) respectively for their outputs which are considered to be independent of other agent's input pair of (a, r), i.e., their production possibilities are independent such that

$$P(x_i^1, x_j^2|a^1, a^2, r^1, r^2)=P(x_i^1|a^1, r^1)\cdot P(x_j^2|a^2, r^2).$$

Here we allow that the input cost function $J(r_1, r_2, \xi)$ is non-separable in r_1 and r_2 Then whatever the optimal solution of $(\hat{a}^1, \hat{a}^2, \hat{r}^1, \hat{r}^2)$ from following program

$$\max \sum_j P(\xi_j)\Big\{ \sum_l P(x^1_l|\hat{a}, \hat{r})\,(x^1_l - I_l^{\hat{r}1\ \hat{r}2})$$

$$+ \sum_m P(x^2_m|\hat{a}, \hat{r})\,(x^2_m - I_m^{\hat{r}1\ \hat{r}2}) - J(r_1, r_2, \xi)\Big\} \qquad (4)$$

s. t.

$$\sum_l P(x^1_l|\hat{a}, \hat{r})\, I_l^{\hat{r}1\ \hat{r}2}) - V(\hat{a}) \geq \overline{U}^1$$

$$\sum_m P(x^2_m|\hat{a}, \hat{r})\, W_m^{\hat{r}1\ \hat{r}2}) - V(\hat{a}) \geq \overline{U}^2$$

$$\sum_l P(x^1_l|\hat{a}, \hat{r})\, I_l^{\hat{r}1\ \hat{r}2} - V(\hat{a}) \geq \sum_l P(x^1_l|a^1, r^1)\, I_l^{r1\ r2} - V(a^1)$$

$$\text{for all } a^1 \in A^1,\ r^1 \in R^1.$$

$$\sum_m P(x^2_m|\hat{a}, \hat{r})\, W_m^{\hat{r}1\ \hat{r}2}) - V(\hat{a}) \geq \sum_m P(x^2_m|a^2, r^2)\, W_m^{r1\ r2} - V(a^2)$$

$$\text{for all } a^2 \in A^2,\ r^2 \in R^2.$$

can be implemented I^{r1}, W^{r2}.[2)] Therefore the model supports the traditional concept of responsibility accounting, and does not support the non-controllable cost allocation or joint cost allocation.

In summery, when the agent has superior information on cost function, delegation of input choice with the appropriate incentive scheme which has allocation feature leads to better solution to the principal. The allocation is designed to make the agent's payoff such that the agent can not be better off by the improved production possibilities due to the higher input use. By making him indifferent to any level of input use, he can choose the best input level for the principal. This seems to be the fundamental and plausible argument to explain the prevailing cost allocation practice.

For a possible application, consider the one of the issue in controversy; when a product produced by department A is used as an input for the department B, which costs,

2) For the proof, see Mookherjee(1984)

marginal cost or average cost, should be allocated to the department B? According to the results we obtained, this seems to be inappropriate question. In stead, we have to look for an allocation scheme which make the department not better off with the increased profit by each additional input use in expected sense.

A couple of recent researches to explain the prevailing non-controllable cost allocation practice have been done by extending the model of this paper. Baiman and Noel(1985) extended the model to multi-period situation where the run capacity decision by the principal is introduced. Suh(1987) has released the assumption that one agent's input choice are independent to the other agent's output level, by assuming the structural interdependency of the organization.

It is suggested, however, that those extension would be too restricted to explain such widely use of non-controllable cost allocation. It seems that, in many cases, the observation of r used by each agent involves significant cost. In such case, some satisfying solution may be used by the principal. The principal set up the payoff scheme such that he can be indifferent to the input costs incurred by the group of agents' use, instead of making each agent indifferent. Also, instead of r, the principal choses some surrogate(e.g., labor hour, production unit, e.t.c.) to split the burden of costs among the agents. By doing this, the principal may have to pay more because of the uncertainty involved with the allocation scheme to the agent since his payoff may be influenced by the other agents. However it may be justified under some given range of production possibilities, and activity and input level, due to the high cost involved with the observation of input choice r.

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국 문 요 약

대리인 모형에서의 원가배분

본 연구는 대리인 모형을 이용하여 원가회계의 원가배분 문제와 관련된 점들을 살펴 보았다. 대리인이 대리인의 노력과 위임자의 자원을 사용하여 생산 활동을 할 때, 대리인이 원가발생에 대한 우월한 정보를 갖는 경우, 자원의 사용 정도가 대리인의 보상 계획에 반영되는 것이 최적해라는 것을 보임으로써 원가회계에서의 원가배분이 합리적인 것임을 보여 주었다. 대리인 모형에 의한 이러한 결과는, 단순히 위임자의 원가부담을 대리인에게 전가시키기 위함에서가 아니라 자원의 사용 정도에 따라 생산가능영역이 변하며, 각 생산가능영역하에서 대리인의 최적 노력을 유인하기 위함에서 나타나는 결과라고 하겠다.

또한 본 연구 결과는 결합원가의 배분이나 공동원가의 배분 문제와 관련하여서도 유용한 시사점을 주고 있다. 대리인의 자원 사용과 관련하여, 대리인이 통제가능한 원가만이 최적 보상계획에 반영된다는 것을 보임으로써, 원가회계의 전통적인 입장이라고 할 수 있는 책임회계가 본 연구 결과에 의해서도 지지되는 것임을 보여 주었다.