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## MANAGER'S INCENTIVES AND INDIVIDUAL WEALTH

by

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**MANAGER'S INCENTIVES AND INDIVIDUAL WEALTH**

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## **ABSTRACT**

Le modèle vise à montrer que le patrimoine détenu par les cadres dirigeants influe sur leur allocation d'effort divisée entre le travail consacré à l'entreprise et celui fourni en gestion de leurs actifs propres. La modélisation est réalisée sous la forme d'un jeu de type Stackelberg en dynamique entre une entreprise et un agent. La richesse détenue par ce dernier est intégrée dans la fonction d'utilité. Pour résoudre le problème nous introduisons un nouveau concept d'effort.

This paper shows that the patrimony of the top level executive has an influence on his effort allocation, which is divided between the work devoted to the firm and the work allocated to the management of his own portfolio. The model is a dynamic Stackelberg game between a firm and an agent. The agent's wealth is integrated inside the utility function. To find the solution of this kind of problem we use a new effort concept.

**KEY WORDS : MANAGER, INCENTIVES, EFFICIENCY WAGE, WEALTH, DYNAMICS.**

## INTRODUCTION

The purpose of this paper is to study the influence of the personal wealth of a manager in the agency relationship between the firm's manager and the owners.

Under asymmetric information, the separation of ownership and control explains that the manager may have preferences that differ from those of the stockholders. The solution to this moral hazard's problem is the use of incentives. The literature on managers' incentives is very vast and follows the main theoretical directions :

The incentive process may consist of a manager's remuneration with respect to his absolute performance. The latter is evaluated by the profits of the firm or by the increase of its stock value at the present or at the last periods as in **MURPHY** (1986). However **HOLMSTROM-MILGROM** (1991) emphasize that the firms' results may be correlated to external factors of the managers' action. **LAWLER** (1981) demonstrates after an empirical study, that the remuneration is not necessarily correlated to the absolute manager's performance. This explains why the manager's remuneration related to the relative performance seems to give a more relevant incentive rather than the absolute performance, see **GIBBONS-MURPHY** (1990). The relative performance remuneration consists of taking into account the industry or the market performance. This provides the advantages to obtain low cost levels, to consider shocks on the market and to avoid the possibility of managers' collusion.

The incentive process also may consist of tournaments inside the firm between managers. This kind of incentive constitutes an optimal remuneration system so that the return is ordinarily set with respect to the rank and to the absolute performance as detailed by **LAZEAR-ROSEN** (1981), and **GREEN-STOCKEY** (1983). Promotions are another kind of

incentive which explain an important part of the increase in wages, as described by **BACKER-JENSEN-MURPHY** (1988). It is principally relevant in firms with a large internal labor market since the existence of different high hierarchical levels motivate managers. The wage function is increasing with respect to the hierarchical position of the agent inside the firm, see **SIMON** (1957).

Another incentive contract consists of giving a share of profit to the managers since it ties the managers' effort to the firm's performance. Nevertheless, for **BAKER-JENSEN-MURPHY** the managers' remunerations are independent of the stock level. Debt may have an incentive role because it reduces the agency costs by decreasing the managers' cash-flow too, see **JENSEN** (1988). The last well-known forms of manager's incentives consist of lay-off threats for **JENSEN-MECKLING** (1976) and take over threats for **JENSEN-MECKLING** (1976), **STEIN** (1988), and **WALKING-LONG** (1985).

The impact of manager's wealth has never been taken into account. However, this variable seems to be relevant for the following reasons : **BAUER** and **BERTIN-MOUROT** (1987) have analyzed the impacts of wealth, diploma and family to become top level managers. Their study uses a data set consisting of the first two hundred French managers. It shows that the agent's amount of wealth is an entry barrier into the club of high level managers. This wealth may come from family inheritance. It also may be acquired by manager's competence during his career and it is then a signal of his own competence. Moreover, economic benefits relative to the management of his wealth portfolio rise as the agent climbs the income scale and as his amount of resources increases.

The manager can then be considered as having two jobs : manager director and manager of his private portfolio. The intuitive idea we want to develop is that the wealth may influence the manager's allocation of effort between his effort for the firm and his effort for his own management portfolio. The concept of the allocation of labor has been developed in several growth models. Thus **MAGEE, BROCK, and YOUNG** (1989), consider a model of the allocation of labor between rent seeking and production. **BAUMOL** (1990) and especially **MURPHY SHLEIFER and VISHNY** (1991) focus on the allocation of talent. In **BAUMOL** (1990),

entrepreneurship can be "productive" or "unproductive" and the allocation of talent between the two activities depends on the relative returns. MURPHY SHLEIFER and VISHNY (1991) discuss the role of increasing returns to ability also. They develop the fact that the same able people have the choice between rent seeking and productive entrepreneurship, and they find the implications for growth.

The present analysis tries to develop the incidence of the allocation of effort of a firm's manager at a microeconomic level. The study is carried out in terms of a principal agent model between the manager and the firm. The problem is that the manager will never be paid the economic value of his contribution to the firm, especially not if taxes are high on the margin. Therefore, he may be induced to manage his portfolio and to reduce the quality of his work effort, even if his job is interesting. Since the manager ignores the firm's objectives, the firm undergoes an opportunity cost. If such a behavior is of importance in the factory, it is even more important at the top management level, where the impact of the entire firm is much greater (cf ROSEN (1981, 1982)). If a good manager becomes inefficient because he pays more attention to the management of his private portfolio, it is very costly for the firm. In order to capture this stylised fact, the implicit assumption is that a good portfolio manager is also a good firm's manager. Therefore, the owners' problem is to determine the optimal wage which induces the manager not to diverge from the firm's interests. However this wage may be so high that it will be impossible to be paid by the owners. Notice that the return from the manager's private portfolio plays the same role as the external market reference salary in several articles by HOMSTROM (1979). In this case, the owners have to raise the salary of their manager if their external market salary reference is higher.

The paper is organized as follows : in the first section we develop the assumptions used. In the second section, we determine by a dynamic model, the optimal contract between the firm and the agent. In the third section we analyse the impact of taxes. The fourth section gives some elements of conclusion.

## 1 GENERAL FRAMEWORK

### 1.1. ASSUMPTIONS

We consider a dynamic model in which the agent lives and works for two periods indexed by 1 and 2.

#### 1.1.1. The agent

At the beginning of the first period, the agent owns an initial amount of stock denoted by  $K_1$ . Let  $r_t$  be the maximum return of wealth if the agent manages it. The agent can increase his portfolio return through clever investments which require effort since the stock market is imperfect. Portfolio management is a profitable action but constitutes a derivation of both attention and time from managing the firm. For simplicity, we make the assumption that the agent does not own stock in the firm where he works (or a negligible quantity). Therefore, there is no profit sharing. Indeed, the modelisation of this concept leads us to analyze a too complex agent problem. That is why we prefer to restrict this version of the paper to a very simple mathematical resolution<sup>1</sup>.

We assume that the agent has a total potential of effort  $\bar{e}$  which is a renewable resource at each period. This effort can be divided into a working-effort  $e_{wt}$  and a management-portfolio-effort  $e_{mt}$ :

$$\bar{e} = e_{wt} + e_{mt}, \quad \forall t = 1, 2$$

The division in terms of effort does not exactly correspond to the division in term of hours. For example, an agent who works during a long time does not necessarily supply an effort at work since he thinks about

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<sup>1</sup>Indeed, to take in consideration a profit sharing remuneration will lead us to replace the optimal value of the profit function inside the optimal agent effort at work. The sign of it would be too difficult to interpret.



his stock assets (or his leisure time). For a manager, we are concerned with his attention and the quality of his work effort rather than with hours effectively spent on the job. An agent who does not offer his total potential of effort  $\bar{e}$  for the firm will be considered as non totally efficient, i.e.  $\bar{e} > ewt$ . This definition differs from the **SHAPIRO-STIGLITZ** (1984) concept of shirking, where  $ewt = 0$ .

In this model, the agent receives the wage  $w_t$  at the end of the period  $t$ , (for  $t=1,2$ ) if he is not caught doing a portfolio-management-effort  $em_t$  with the exogeneous probability  $q$ , or not supervised with the probability  $1-q$ . The monitoring technology is assumed to be perfect and settled such as the agent will be supervised during the current period. The supervision is not realized at the end of the period by the absolute performance remuneration evaluated on the firm profits, or by relative performance remuneration related to the industry or market performances. Indeed in our model the agent may be controlled by the owner during the period. Otherwise, the penalized agent receives only the alternative wage  $\bar{w}_t$ , for  $t=1,2$  such as  $\bar{w}_t < w_t$ . We can rewrite  $\bar{w}_t$  as  $\bar{w}_t = w_t - p_t$ , where  $p_t$  can be interpreted as a career indicator. An agent who always earns  $\bar{w}_t$ ,  $\forall t = 1,2$ , does not progress inside the firm.

The agent has an intertemporal indirect utility function consisting of the sum of temporal indirect utility functions :

$$U(*) = U_1(w_1, ew_1, em_2, s_1, K_1) + \frac{1}{1+\gamma} U_2(w_2, ew_2, em_2, s_2, K_2)$$

where the utility functions  $U_1$  and  $U_2$  are described by :

$$U_t(*) = w_t - s_t - \alpha_{wt}(ewt)^2 - \alpha_{mt}(emt)^2 + K_t$$

The variables  $s_1$  and  $s_2$  denote respectively the saving at the first and the second period:

$$s_1 = s_1 \text{ and } s_2 = 0.$$

The saving amount is settled endogenously at the first period and

is null in the second period because the agent has no reason to save something at the end of the game. This utility function can be interpreted as an indirect utility where  $w_t - s_t$  is equal to the agent consumption.

Making an effort provides a disutility equals to :  $\alpha_{wt}$ ,  $t=1,2$ , is the marginal disutility of working-effort and  $\alpha_{mt}$  is the marginal disutility of management-portfolio-effort. For simplicity and without loss of generality, we make the assumption that  $\alpha_{wt}=\alpha_{mt}=1$ , which means that supply effort at any time provides the same effort disutility.

We assume that both wages and wealth procure utility for the agent.

Wealth benefits are directly included in the utility function. The justification is developed by G. ELIASSON (1982) : "The stock of wealth renders a variety of services in the form of power, or insurance against arbitrary treatment of the employer, to an agent beyond providing for a lifetime optimal consumption path of traditional goods and services of the individual wealth holder". The agent may increase his portfolio return in spending effort in its management.

$\gamma$  is the discount rate.

### 1.1.2. The firm

The intertemporal firm production function with an already fixed capital production factor can be written as follows :

$$f(ew_1, ew_2) = ew_1^c(w_1) + \frac{ew_2^c(w_2)}{1 + \gamma}$$

The production function depends on agent effort and on his competence level  $j$ . If the agent is very competent, then  $c \geq 1$ , otherwise  $c \leq 1$ .

## II THE MODEL

The model is a Stackelberg game between a firm and an agent. The firm plays first at each period by setting the agent's wage. The contract proposes a wage  $w_t$ , a penalty  $\bar{w}_t > 0$  in the case of a detected management portfolio activity in the current period, and the level of effort at work  $ew_t$  which is derived from an optimal rule of decision by the agent.

The game is solved with a backward induction resolution technique. The economic agents make perfect expectation for the second period, then they optimize on the first period knowing exactly the optimal values of the second period variables.

### 2.1. First step: the second period optimal contract

#### 2.1.1. The agent

The agent maximizes his expected utility  $V_2$ . The program is as follows :

$$\text{MAX}_{ew2} V_2 = Aw_2 + B\bar{w}_2 - (ew_2)^2 - (em_2)^2 + C^J K_2$$

$$\text{s.t.} \quad ew_2 + em_2 = \bar{e}$$

with :

$$A = 1 - q(1 - \frac{ew_2}{\bar{e}})$$

$$B = q(1 - \frac{ew_2}{\bar{e}})$$

$$C = r_2 (1 - \frac{ew_2}{\bar{e}})^J$$

A represents the probability to earn the wage  $w_2$  if the agent supplies the effort  $e_{w2}$  or if he manages his own portfolio and is not caught. B denotes the probability to earn a lower wage than  $w_2$  i.e.  $\bar{w}_2$ . It stands for the penalty when the agent turns his attention out of the firm and is caught following his own interests.  $e_{w2}^2 + e_{m2}^2$  is the total effort disutility and C stands for the expected wealth returns. The agent may increase his portfolio returns through spending effort on his private portfolio management.  $J \in \mathbb{R}^+$  denotes a decreasing variable of the agent talent in portfolio management. If the agent is competent, then  $J \leq 1$ , otherwise  $J > 1$ . Consequently if J is equal to zero the agent, who only supplies an effort in portfolio management, can reach the same return as a professional does. We assume that the manager has no interest in letting a professional manage his wealth because it would take effort to supervise him too, and adds a cost to pay him a wage.

The most interesting and probable case is that of an agent who is competent in both portfolio and firm management. Therefore,  $J \leq 1$  is associated with  $c \geq 1$ . For simplicity, we only consider the case where :  $J = 1$ ,  $c = 1$ . As the agent is competent in the firm also, it is relevant for the firm to induce him to work rather than to employ a non-totally efficiency low quality worker.

The resolution of program 1 is straightforward. The first order conditions give the following effort expressions:

$$e_{w2} = \frac{q(w_2 - \bar{w}) + 2\bar{e}^2 - r_2 K_2}{4\bar{e}} > 0 \quad \text{if } q(w_2 - \bar{w}) + 2\bar{e}^2 > r_2 K_2 \quad (1)$$

$$e_{w2} = 0 \quad \text{if } q(w_2 - \bar{w}) + 2\bar{e}^2 \leq r_2 K_2 \quad (2)$$

It is easy to check that the agents' expected utility is concave (the second derivative is negative). According to the efficient wage theory, the differential between the wage and the penalty has an incentive effect on the agent's behavior: if  $q(w_2 - \bar{w})$  increases, then

ew2 increases too. The optimal expression of the effort shows that effort at work is a decreasing function of the agents' portfolio returns. The higher portfolio returns are, the less incentives the agent has to supply an effort at work. When the portfolio returns equal to the wage differential, the agent does not make any effort at work. The returns to the portfolio are high, hence it becomes profitable for the agent to spend effort on this activity and not to offer all effort inside the firm. Finally, we reach a kind of limit case when we have a **SHAPIRO-STIGLITZ** worker with an effort  $ew2 = 0$ . This is the case when the agent is competent and has an important wealth. Since the agent is competent, the firm tries to set a top wage to avoid such a situation.

### 2.1.2. The firm

The firm determines in the labour contract the optimal wage to give the agent so that its profits reach a maximum and so that it takes into account the agent's wealth to a certain extent<sup>2</sup>.

The maximization of the profit function with respect to the wage  $w_1$  gives the following expression, remembering that  $ew2$  has been determined above.

$$\text{MAX}_{w_2} \Pi (ew2^*(w_2), \bar{w}_2, q) = ew2^*(w_2) - w_2 D - \bar{w}_2 E - q w_2$$

$$\text{with } D = [1 - q(1 - \frac{ew2^*(w_2)}{\bar{e}})]$$

$$E = q(1 - \frac{ew2^*(w_2)}{\bar{e}})]$$

$D$  is the wage cost supported by the firm if the agent is honest or if he is not caught doing an effort in portfolio management.  $E$  denotes the cost suffered by the firm if the agent is dishonest. The term  $q w_2$  represents the supervision cost proportional to the supervision rate. It  
*An extension can be made assuming that the firm does not know exactly the agent wealth and estimate it. This does not change the main results.*

is straightforward to check the concavity of the profit function.

The optimal wage expression is :

$$w_2^* = \frac{\bar{e}[q - 4\bar{e} - 2\bar{e}q] + q[2q\bar{w}_2 + r_2K_2]}{2q^2} \quad (3)$$

$\Pi \geq 0$  implies that  $w_2$  must be inferior to a threshold. Therefore, for high level of wealth, the agent always turns his attention out of the firm since the firm can not give him a sufficiently high wage.

As expected from the efficiency wage theory, the optimal wage  $w_2$  decreases when supervision probability increases and it is an increasing function of the capital return (to a certain extent).

Expressions (2) and (3) allow us to determine the optimal effort expression in the second period.

$$e_{w_2}^* = \frac{q\bar{e}(1 + 2\bar{e}) - 4\bar{e} - qr_2K_2}{8q\bar{e}} \quad (4)$$

Two cases may occur : the optimal effort may be equal, or not, to the total potential effort.

#### 1) first case : Corner solution

The optimal effort at work is equal to the total potential

effort. In this case :  $ew_2^* = \bar{e}$ .

$$\frac{q\bar{e}(1 + 2\bar{e}) - 4\bar{e}^2 - qr_2K_2}{q} = \bar{e} \quad (5)$$

$$\text{so } r_2K_2 = \frac{q\bar{e} - (4 + 6q)\bar{e}^2}{q} \quad (6)$$

When capital returns are not too high, the firm can provide a sufficiently high wage to induce the manager to provide his total potential effort at work. Then the agent does not manage his portfolio.

## 2) Second case: Interior solution

The optimal working effort chosen is smaller than the total potential effort of the agent. So  $ew_2^* < \bar{e}$ . This is the case when :

$$\frac{q\bar{e} - (4 + 6q)\bar{e}^2}{q} < r_2K_2 \quad (7)$$

When the capital becomes higher than the threshold (7'), it would cost too much for the firm to incite the agent by offering a higher wage. In the limit case where the wealth of the agent is very high, we have :

$$r_2K_2 = \frac{q\bar{e}(1 + 2\bar{e}) - 4\bar{e}^2}{q} \quad (8)$$

The agent does not make any effort at work. In that case, the probability of being caught following his own interests and to earning only  $\bar{w}$  is high.

To sum up the results, the firm must take into account the agent's wealth in the wage it sets in order to induce him to work since the agent is competent. This is true for a certain threshold after which it would cost too much for the firm because the agent's wealth is very high. In that case it is optimal for the agent to spend his effort on portfolio management rather than on work. The behavior fits well the one described by G. ELIASSON (1982). The author thinks that a small saver

abstains from becoming an investor. Time and knowledge required are prohibitive if the portfolio is very small. Only above a certain wealth level is it profitable to expend effort on the portfolio. When this level is reached, direct benefits from wealth can constitute a sufficient reason for individual quits. Such benefits would increase the economic independence, and increase resources to engage in various kinds of venture that would otherwise be outside the reach of the household. They would, increase ability to take risks or carry dependants over long gestation period in education or training, increase potential to accumulate using "levels of aspiration" or sheer power. According to **G.ELIASSON** the above listed benefits would become increasingly important as the level of wealth in proportion to ones planned lifetime consumption increases. In this model, the agent with a high wealth does not worry about earning only  $\bar{w}$  and waits until being supervised and dismissed by the firm.

The fact that in the second period the wage is correlated positively with respect to the wealth may explain the disparity of wages at a high hierarchical level. However, as we will see, this correlation is only true in the second period. The wages must be higher in the second period than in the first to induce the worker to provide effort.

## **2.2. Second step: the first period optimal contract**

### **2.2.1. The agent**

The agent maximizes the actualized sum of each intertemporal utility function subject to the effort constraint and subject to the capital accumulation conditions. The second period capital stock is defined as follows:

$$K_2 = [1 + r_1(1 - \frac{ew_1}{e})]K_1 + sw_1 \quad (8)$$

The program is :



$$\begin{aligned}
\text{MAX}_{s_1, ew_1} V^e &= U_1(w_1, ew_1, s_1, K_1) + \frac{1}{1+\gamma} U_2[w_2^*, ew_2^*, K_2^*] \\
ew_1 + em_1 &= \bar{e} \\
K_2 &= [1 + r_1(1 - \frac{ew_1}{\bar{e}})]K_1 + sw_1
\end{aligned}$$

The first order conditions define the optimum expressions for the effort and the saving rate. We find :

$$ew_1^* = e[w_1, \bar{w}, \bar{e}, r_1, K_1] \quad (9)$$

$$s^* = g(w_1, \bar{w}, r_1, K_1, \bar{e}) \quad (10)$$

The sign of  $s$  with respect to the function  $g$  is undetermined. (The expression of  $s$  is very complex).

### 2.2.2. The firm

The firm sets the agent's wage  $w_1$  by maximizing its first period profit and its discounted second period profit.

$$\text{MAX}_{w_1} \Pi(ew_1) + \frac{1}{1+\gamma} \Pi(ew_2)$$

The first order conditions allow us to determine the wage expression:

$$w = h[r, K, \bar{w}]$$

In this case, as the function  $h$  is complex, the signs are undetermined, so that nothing can be said about the relationship between wealth and wage in the first period. This reflects the existence of two effects :

First effect : to stimulate the agent to work, the firm should increase the wage in proportion to the wealth.

Second effect : if the wage is too high in the first period, the agent will have too much wealth in the second period. The firm will have to pay a higher wage in the second period. In the limit case, it can not even induce the agent to supply any work effort. Therefore from a dynamic point of view, a high wage in the first period may have a negative impact.

Notice also that in the first period wealth is less important than in the second one. Therefore the efficiency wage is smaller in the first period. In the second, the efficiency wage is higher because the agent's wealth is higher and the wage is positively correlated with it. This gives an explanation of the wage increase during the individual career.

### **3 Tax incidence**

The formalization of the effort and efficiency wage leads us to think that wealth taxes may have an influence.

The impact of taxes is much more interesting to study in the second period since in the first period the relationship between effort, efficiency wage and wealth is unknown.

In the second period, effort at work is negatively correlated to wealth. So wealth taxes decrease the return to wealth and should increase the effort at work. However a second effect may appear : if the agent wants to have the same returns on wealth, in the opposite, he will decrease the work effort and increase the management portfolio effort. In that case, the tax should have a negative impact. These two effects are the well known income and substitution effects of taxes. It is theoretically impossible to find which effect prevails.

Wealth taxes, which decrease capital have an impact on the threshold that determines if the agent accept to work or not. The incidence occurs in the efficiency wage. The efficiency wage decreases or increases depending on which of the two effects prevails.

## **5 Elements of conclusion**

Wealth in the agent's utility function, combined with a new allocation effort concept, allows us to obtain quite different results from the well known efficiency wage theory.

It shows that to reduce the divergence of interest between the firm and a wealthy manager, the owners of the firm have to raise in the second period the wage of his manager in the second period. They must take into account his wealth. The problem is that it may be so high so that it is impossible to be matched by the owners, even though they wish to do so because a good portfolio manager is probably also a good firm manager. Otherwise, the model shows that above a certain level of wealth it is valuable to work on the portfolio : this can induce an agent to allocate effort outside of the firm and even to quit.

Taking into account wealth in the second period wage, contributes to the explanation of the wage disparity through the agent's career and the important wage disparities of high hierarchical level agents.

On the other hand, the model shows the impact of wealth taxes in a principal agent framework.

However, other managers' incentives may exist. The owners can offer profit sharing as an alternative to salary. They can also offer a partnership inviting the manager to invest his money in their own company, perhaps at a favorable rate. Thus the interests of the owners and the private interests of the manager will coincide. This will switch the attention and the quality of the manager 's work effort back into the firm.

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