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Employee ownership: does firm's size matter ? *

Marc-Arthur Diaye†, Amal Hili‡, Rim Lahmandi-Ayed §

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Abstract

A theoretical model is considered in a monopoly setting, where the production cost of the firm depends on the efforts of employees who may receive a positive part of the capital if the shareholders find profitable to do so. We specify the condition under which at Nash equilibrium the firm distributes a positive part of its capital to employees, and analyze the effects of this employee ownership strategy on social welfare. We show that the conditions under which shareholders attribute a positive share of capital to employees, is related jointly to the firm's size and effort disutility, which makes the novelty of our paper relative to the previous papers considering the firm's size alone. This joint role is tested empirically, using a French data base "REPONSE 2004-2005". Our paper may allow to explain why in the empirical literature there is no consensus regarding the relationship between firm's size and employee ownership implementation.

Keywords: employee ownership, employees' efforts, firm's size, effort disutility, social welfare, absenteeism.

JEL Codes: C25, C7, M5.

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1 Introduction

Employee ownership has been progressing in European countries since the subprime crisis. According to the most recent report of The European Federation of Employee Share Ownership, the percentage of European companies having employee ownership rose from 79,3 % in 2006 to 91,7 % in 2010, with a significant increase in the number of employees owning shares in the firms. For instance, the number of such employees has increased by 18.2% in Italy; by 7.9% in the United Kingdom, and by 28% in France. Among the French employee ownership schemes, compulsory profit sharing is a financial participation system according to which all companies employing more than 50 workers must attribute to them a profit share[1].

In this paper, we propose to study the determinants of employee ownership and to account for its effects on the firm's performance, employees efforts, consumers and social welfare. We consider a monopoly where the production cost of the firm depends on the efforts of employees who might receive a positive part of capital if the shareholders find this strategy profitable. The condition under which there is distribution of shares among employees is related to the firm's size and the effort disutility. The obtained relation is tested empirically using the French data base "REPONSE 2004-2005".
We consider a monopoly employing a fixed number of employees to whom shareholders may attribute shares of capital. The effort of employees reduces the production cost[2] while implying a disutility to employees. The number of employees does not affect the quantity produced, being assumed to result from an anterior optimization. Thus, the employees considered in our game are not directly linked to the production tasks. Their efforts are supposed to reduce the production cost, which may correspond to efforts in research and development, marketing, administrative tasks, etc.
We find that there is distribution of shares to employees when the firm's size and/or the effort disutility of employees are sufficiently low. The obtained relation is tested empirically using a French data base "REPONSE 2004-2005". Empirical findings agree with the theoretical ones for low and high effort disutility.

The related literature.

Our paper is related to five streams of literature: profit sharing, managerial incentive theory, agency theory, ownership rights theory, and the team production theory, which is perhaps the closest one to our work. The theoretical profit sharing literature considers two arguments. The first one is microeconomic and shared by Fitzroy and Kraft (1987), Cahuc and Dormont (1997), stipulating as in our work, that profit sharing is a potential way to increase involvement, motivation and job satisfaction among employees, thus increasing their productivity. Weitzmann (1987) emphasizes the macroeconomic benefits of profit sharing in terms of unemployment reduction. In both streams of literature, consumers and social welfare are not analyzed as done in

[1] An amount corresponding at least to the minimum deferred profit-sharing fund (RSP) calculated on the basis of a legally pre-determined profit-sharing formula.

[2] The considered hypothesis according to which employee effort reduces the marginal cost when profit is shared between shareholders and employees is analogous to an assumption considered in Laffont and Tirole (1993).

our model.
In most of papers related to the managerial incentive theory such as Freshtman and Judd (1988), the effect of the manager's effort on the firm's costs is neglected and the optimal managerial contract is proven to be the one where the managerial remuneration is contingent on a linear combination of returns (sales) and profits. The agency theory introduced by Berle and Means (1932), focuses on the remuneration of the manager as an agent hired by a principal in an asymmetric information context leading to a moral hazard problem. The main purpose of this theory is to provide the appropriate incentives to agents to make sure that they act in the way principals wish and to reduce their informational advantage. The theory of ownership rights pioneered by Alchian and Demsetz (1973) argues that the capitalistic firm where the manager is the owner is the most efficient ownership structure as it allows firms to eliminate free riding and manager opportunism. However, the last three theories are exclusively interested in the managers' attitude, opportunism and interests, ignoring the other types of employees. Moreover, most of the models considered are formulated in an abstract way not considering explicitly the production and demand sides. In particular, they do not allow to specify the condition under which capital holders attribute capital shares to employees, and the models also ignore welfare considerations.
The closest literature on employee incentives to our work is perhaps the team production theory. According to this literature, the output results from the contribution of many workers, and the individual contribution of each agent to this output cannot be precisely identified. Employees receive the same remuneration based on the output of the team, whatever their individual efforts. This way of remuneration increases the incentives among workers to free-ride as in Holmstrom (1982) and Heijden et al. (2009). This problem can be solved by peer pressure as in Kandel and Lazear (1992) or by management pressure as in Holmstrom (1982). In our model, each worker receives the same share of the capital whatever his/her individual effort, which also creates a free riding problem among employees. However, our purpose is quite different as we do not focus on solving this free riding problem. We mainly aim at determining the condition under which there is distribution of capital shares among employees and to account for its impact on social welfare.

The condition under which shareholders attribute a positive share of capital to employees is proved to be related to the firm's size and effort disutility. The role of firm's size in explaining employee ownership is not new (see for instance Core and Guay 2002, Baker and Hall 2002). What is new in our paper is the fact that firm's size and workers disutility of effort play a joint role in the firms' decision to launch an employee ownership scheme. Our result may allow to understand why in empirical works, there is no consensus regarding the relationship between firm's size and employee ownership. For instance in Core and Guay (2002) and Oyer and Shafer (2005), this relationship is negative, in Baker and Hall (2002), considering only the Chief Executive Officers, the relation is shown to be constant or slightly negative; while in Demsetz and Lehn (1985), this relationship is positive. Our result could allow to reconcile these studies, as we show that the nature of the relationship between the decision of setting up employee ownership and the firm's size, depends on the effort disutility.

Our paper is organized as follows. In section 2, the theoretical model is presented. Section 3 provides the main results and an analysis in terms of social welfare. In section 4, the result entailing the link between ownership implementation, employees' effort disutility and firm's size is empirically tested. Section 5 concludes.

2 The theoretical model

We consider a monopoly producing a good for which the reverse demand writes : $p = a - q$, where a represents the market size, p the market price and q the produced quantity. n employees work in the firm. The firm pays each one of them a fixed wage w.

The observable firm's profit is written as follows:

$$\pi = (a - q)q - (c - \overline{e})q - nw + \varepsilon, \tag{2.1}$$

where c $\in [0, a]$ is the initial unitary cost, $\overline{e} \in [0, c]$ is the average effort of the n workers and $\varepsilon \in [\underline{\varepsilon}, \overline{\varepsilon}]$ a normally distributed variable $(0,\sigma^2)$. As the profit π is not observable, efforts are not verifiable.
Initial shareholders may give a part $\alpha \in [0, 1]$ of their capital to their employees[3]. Each employee i has a CARA utility function:

$$U_i = -\exp[-rR_i],$$

where r is the agent i's coefficient of absolute risk aversion and R_i his/her income net of effort disutility $(\delta\frac{e_i^2}{2})$, that is:

$$R_i = w + \alpha\frac{\pi}{n} - \delta\frac{e_i^2}{2}, \tag{2.2}$$

$\delta \geq 0$ measuring the intensity of effort disutility which will be referred to later as effort disutility.

The employees considered here do not take operational decisions unlike the manager in the agency theory models. But as their effort reduces the production cost but is not directly correlated to the production level (the production cycle continues even if the considered employees do not work), we may think of them as qualified employees working in research and development, marketing, administrative tasks, etc.

Decisions take place through the following game:

- *The initial shareholders choose the ownership structure ($\alpha \in [0, 1]$) and propose a contract (w, α) that may be accepted or refused by the employees.*
- *The employees who accept the contract choose their efforts simultaneously.*
- *The board of directors chooses the quantity to be produced.*

[3]As in the ESOP (Employee Stock Ownership Plan) or in the Saving Plans.

We suppose that H_0: $r\sigma^2 \leq \inf[\frac{n^2\delta(a-c)^2(2n^3\delta-\alpha)}{\alpha(2n^2\delta-\alpha)^2}, \frac{n(\alpha a^2-2n\delta c^2)}{2\alpha^2}]$, which is a technical hypothesis supposed to ensure that the employee's participation constraint is satisfied (Proof of Proposition 1).

3 The main theoretical results

We first solve the above game then compare the equilibrium outcome to the socially optimal one.

3.1 The solution of the game

The game is solved by Backward Induction.

3.1.1 Quantity choice

The board of directors chooses quantity q so as to maximize function F given by :

$$F = (1-\alpha)^2 EC[\pi] + \alpha EC[\sum_{i=1}^{i=n} U_i],$$

which is equivalent in this context to maximizing the certainty equivalent of the profit ($EC[\pi]$) with respect to the same variable. The control rights given to employees are here artificial and do not have any incentive effects.
The solution is provided by : $q(\overline{e}) = \frac{a+\overline{e}-c}{2}$ and $\pi(\overline{e}) = (\frac{a+\overline{e}-c}{2})^2 - nw + \varepsilon$.

3.1.2 Efforts choice

In this step, employees choose their efforts simultaneously. Each worker chooses his/her individual effort so as to maximize the certainty equivalent of his/her individual utility, written as follows :

$$EC[U_i] = EC[w+\alpha[\frac{(\frac{a+\overline{e}-c}{2})^2 - nw + \varepsilon}{n}]-\delta\frac{e_i^2}{2}] = w+\alpha[\frac{(\frac{a+\overline{e}-c}{2})^2 - nw}{n}]-\delta\frac{e_i^2}{2}-\frac{1}{2}r[\frac{\alpha}{n}]^2\sigma^2.$$

The symmetrical equilibrium is given by:

$$e(\alpha) = \begin{cases} \frac{\alpha(a-c)}{2n^2\delta-\alpha} & \text{if } \alpha < \frac{2n^2\delta c}{a}, \\ c & \text{if } \alpha \geq \frac{2n^2\delta c}{a}, \end{cases} \tag{3.1}$$

The expected payoff function of the firm denoted $EC[\pi]$, is thus given by:

$$EC[\pi] = \begin{cases} (\frac{n^2\delta(a-c)}{2n^2\delta-\alpha})^2 & \text{if } \alpha < \frac{2n^2\delta c}{a}, \\ \frac{a^2}{4} & \text{if } \alpha \geq \frac{2n^2\delta c}{a}, \end{cases} \tag{3.2}$$

The relationship between employee ownership (α) and the firm's performance measured by its expected profit $EC[\pi]$ is represented in Figure 1.

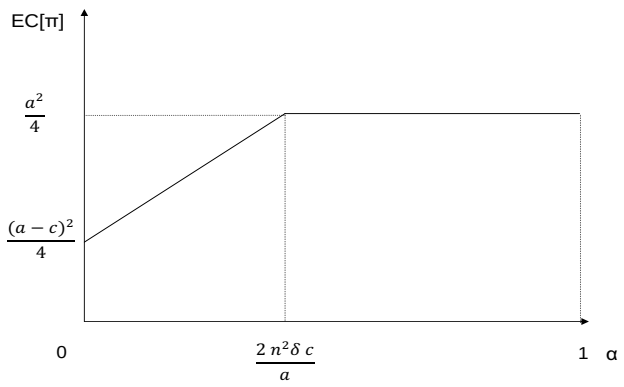

Figure 1: The relationship between the firm's performance and employee ownership

This relationship has been studied mainly empirically and the results are controversial. Indeed, studies are split between positive, negative and neutral findings. Livingston and Henry (1980) proved that employee ownership tends to decrease the firm's performance in opposition to Blasi and Kruse (1999), Blair et al. (2000), Ikbal and Hamid (2000) and Sesil et al. (2001), for which the relationship is significantly positive. A result of neutrality has been prove in Trebuck (2002). Other studies prove a threshold effect as in Dondi (1994) and Faleye et al (2006): it is positive up to a threshold on the capital share held by employees, then negative.
In our model, the relationship between employee ownership and firm's performance is first positive as in Blasi and Kruse (1999), Blair et al. (2000), Ikbal and Hamid (2000) and Sesil et al. (2001), then constant as in Trebuck (2002).

3.1.3 The choice of ownership structure

The initial shareholders choose α so as to maximize $EC[(1-\alpha)\pi]$ under the employee's participation constraint. The Subgame Perfect Nash Equilibrium is characterized in Proposition 1.

Proposition 1 *Under H_0, at the Subgame Perfect Nash Equilibrium of the game:*

- *If* $\delta \leq \frac{a}{n^2(a+c)}$ *then* $\alpha^* = \frac{2n^2\delta c}{a}$, $e^* = c$, $q^* = \frac{a}{2}$ *and* $(1-\alpha^*)EC[\pi^*] = \frac{a^2-2an^2\delta c}{4}$.
- *If* $\frac{a}{n^2(a+c)} < \delta < \frac{1}{n^2}$ *then* $\alpha^* = 2(1-n^2\delta)$, $e^* = \frac{(1-n^2\delta)(a-c)}{2n^2\delta} - 1$, $q^* = \frac{n^2\delta(a-c)}{2(2n^2\delta-1)}$ *and* $(1-\alpha^*)EC[\pi^*] = \frac{n^4\delta^2(a-c)^2}{4(2n^2\delta-1)}$.
- *If* $\delta \geq \frac{1}{n^2}$ *then* $\alpha^* = 0$, $e^* = 0$, $q^* = \frac{a-c}{2}$ *and* $(1-\alpha^*)EC[\pi^*] = \frac{(a-c)^2}{4}$.

Proof:
The employee's participation constraint is given at the symmetrical equilibrium, by:

- if $\alpha < \frac{2n^2\delta c}{a}$:

$$w + \frac{\alpha}{n}[\frac{n^2\delta(a-c)}{(2n^2\delta-\alpha)}]^2 - \alpha w - \frac{\delta}{2}[\frac{\alpha(a-c)}{2n^2\delta-\alpha}]^2 - \frac{1}{2}r[\frac{\alpha}{n}]^2\sigma^2 \geq 0 \text{ , which is equivalent to}$$

$$w(1-\alpha) + \frac{\alpha\delta(a-c)^2(2n^3\delta-\alpha)}{2(2n^2\delta-\alpha)^2} - \frac{1}{2}r[\frac{\alpha}{n}]^2\sigma^2 \geq 0.$$

This constraint holds for all $w \geq 0$ and $\alpha \in [0, \frac{2n^2\delta c}{a}[$ under the sufficient condition:

$$r\sigma^2 \leq \frac{n^2\delta(a-c)^2(2n^3\delta-\alpha)}{\alpha(2n^2\delta-\alpha)^2}.$$

- if $\alpha \geq \frac{2n^2\delta c}{a}$:

$$w + \alpha\frac{a^2}{4n} - \alpha w - \frac{\delta}{2}c^2 - \frac{1}{2}r[\frac{\alpha}{n}]^2\sigma^2 \geq 0 \text{ , which is equivalent to}$$

$$w(1-\alpha) + \frac{\alpha a^2 - 2n\delta c^2}{4n} - \frac{1}{2}r[\frac{\alpha}{n}]^2\sigma^2 \geq 0.$$

This constraint holds for all $w \geq 0$ and $\alpha \geq \frac{2n^2\delta c}{a}$ under the sufficient condition:

$$r\sigma^2 \leq \frac{n(\alpha a^2 - 2n\delta c^2)}{2\alpha^2}.$$

Under the sufficient condition H_0: $r\sigma^2 \leq \inf[\frac{n^2\delta(a-c)^2(2n^3\delta-\alpha)}{\alpha(2n^2\delta-\alpha)^2}, \frac{n(\alpha a^2-2n\delta c^2)}{2\alpha^2}]$, the participation constraint being satisfied for all $\alpha \in [0,1]$ and $w \geq 0$, the shareholders choose to give employees the reservation wage ($w = 0$).

The expected payoff function of the initial shareholders denoted by $EC[G]$, is thus given by:

$$EC[G] = EC[(1-\alpha)\pi] = \begin{cases} (1-\alpha)[\frac{n^2\delta(a-c)}{2n^2\delta-\alpha}]^2 & \text{if } \alpha < \frac{2n^2\delta c}{a}, \\ (1-\alpha)\frac{a^2}{4} & \text{if } \alpha \geq \frac{2n^2\delta c}{a}. \end{cases} \tag{3.3}$$

The maximization of this function with respect to α yields at the symmetrical equilibrium:

$$\alpha^* = \begin{cases} \frac{2\delta n^2 c}{a} & \text{if } n^2 \leq \frac{a}{\delta(a+c)}, \\ 2(1-n^2\delta) & \text{if } \frac{a}{\delta(a+c)} < n^2 < \frac{1}{\delta}, \\ 0 & \text{if } n^2 \geq \frac{1}{\delta}. \end{cases} \tag{3.4}$$

■

For ($n \geq 2$), the relationship between the amount of capital to be distributed to employees and their effort disutility is mitigated by the number of employees. Indeed, there is distribution of capital to employees when δn^2 is sufficiently low, i.e., the effort disutility and/or the firm's size are sufficiently low. A firm is willing to give a part of its capital if $\delta < \frac{1}{n^2}$, thus when the effort disutility is low, which is more constraining as n becomes higher. Hence a large size firm is less likely to distribute capital shares

to employees. This result can be explained by the free rider problem, which is more diffused and pronounced for large size firms. If this problem is combined with high levels of effort disutility, firms do not see any advantage in implementing employee ownership.

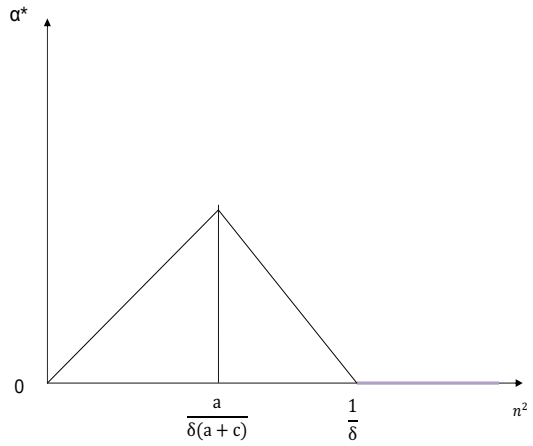

Figure 2: Ownership structure at equilibrium

According to Figure 2 depicting the curve of α^* as a function of n^2, the capital share distributed to employees is first increasing, then decreasing and finally constant with respect to the firm's size. The controversy between empirical papers dealing with the link between employee ownership in one firm and its size may thus be solved. Indeed, the differences in results may be due to difference in samples relative to the three zones identified theoretically. Papers where this relationship is significantly positive, such as Demsetz and Lehn (1985), must have considered a sample of firms whose sizes belong mainly to the interval $[0, \frac{a}{\delta(a+c)}]$. In studies where this link is significantly negative, such as Core and Guay (2002), the firms' sizes considered belong certainly to $[\frac{a}{\delta(a+c)}, \frac{1}{\delta}]$. Finally, the sample firms' sizes are certainly higher than $\frac{a}{\delta(a+c)}$ in the paper of Baker and Hall (2002) who prove that the CEO equity incentives are either constant or slightly decreasing with respect to the firm's size. Therefore, our results show the importance of considering jointly the firm's size and the effort disutility.

3.2 Welfare Analysis

We analyze in this paragraph the viewpoint of a social planner who maximizes the social welfare defined as the sum of the expected initial shareholder surplus (function $EC[G]$), employees' utility and consumers surplus (SC).

It is easy to see that the expected consumers surplus (SC), is written:

$$SC = \begin{cases} (1-\alpha)[\frac{[n^2\delta(a-c)]^2}{2(2n^2\delta-\alpha)^2}] & \text{if } \alpha < \frac{2n^2\delta c}{a}, \\ (1-\alpha)\frac{a^2}{8} & \text{if } \alpha \geq \frac{2n^2\delta c}{a}. \end{cases} \tag{3.5}$$

Likewise, we get the expected social welfare (total surplus) denoted by ST:

$$ST = \begin{cases} \frac{n^2\delta(a-c)^2(3n^2\delta-\alpha)}{2(2n^2\delta-\alpha)^2} & \text{if } \alpha < \frac{2n^2\delta c}{a}, \\ \frac{3a^2}{8} - \frac{n^2\delta c^2}{2} & \text{if } \alpha \geq \frac{2n^2\delta c}{a}. \end{cases} \tag{3.6}$$

We represent in Figures 3 and 4, both payoffs $EC[G]$ and ST as functions of the part of the capital to be distributed to employees (α).

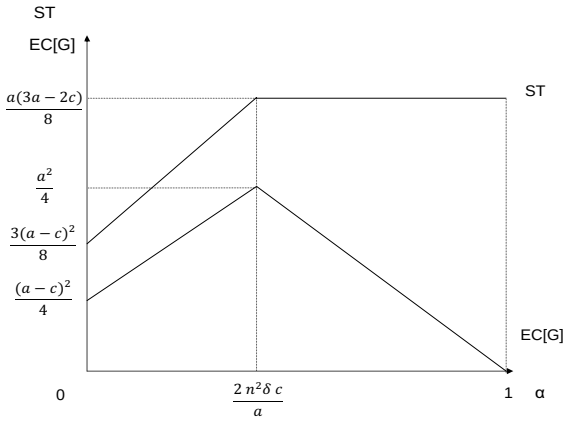

Figure 3: Payoffs $EC[G]$ and ST for $n^2\delta \leq \frac{a}{a+c}$

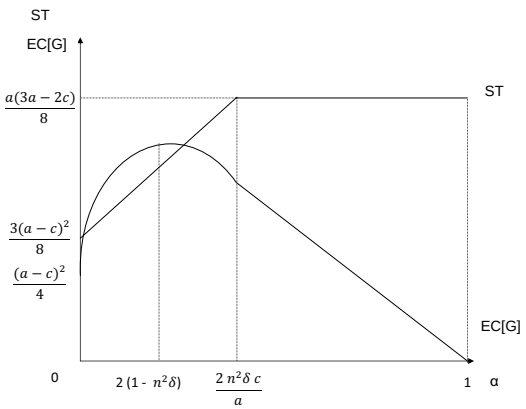

Figure 4.1 Payoffs for $\frac{a}{a+c} < n^2\delta < 1$

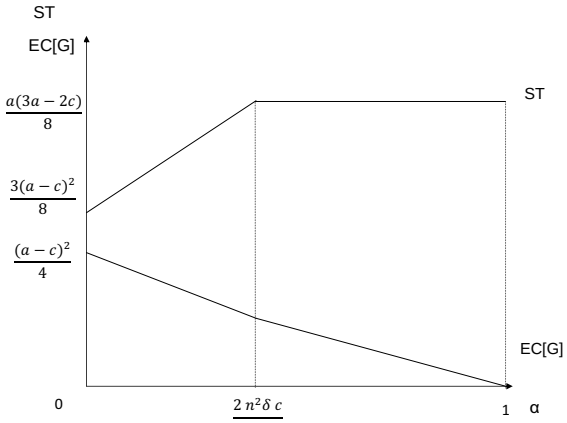

Figure 4.2 Payoffs for $n^2\delta > 1 > \frac{a}{a+c}$

Figure 4: Payoffs $EC[G]$ and ST for $n^2\delta > \frac{a}{a+c}$

Two cases emerge :

- When $n^2\delta \leq \frac{a}{a+c}$ (Figure 3), both functions are maximal at $\alpha^* = \frac{2n^2\delta c}{a}$. In this case, there is no need for the social planner's regulation, as shareholders will naturally distribute an optimal share of capital to employees.

- When $n^2\delta > \frac{a}{a+c}$ (Figure 4), there is no convergence between the interests of both parties, as shareholders will choose a suboptimal value of α^*. Regulation may be needed here to get closer to the optimal situation.

Simply said, too large firms will never distribute optimal parts of their capital to employees. Hence, the French law compelling large firms (more than 50 employees) to distribute some shares to their employees has in our analysis a theoretical foundation.

4 Empirical test

In this section, we derive a prediction from the theoretical model developed above and we test it empirically. However because of data limitation, our empirical analysis is made with the probability of employee ownership implementation, instead of the proportion of shares held by workers.

4.1 A prediction of the model

Recall that the part of the firm's shares held by the employees at equilibrium is given by:

$$\alpha^* = \begin{cases} \frac{2\delta n^2 c}{a} & \text{if } \delta \leq \frac{a}{n^2(a+c)}, \\ 2(1-n^2\delta) & \text{if } \frac{a}{n^2(a+c)} < \delta < \frac{1}{n^2}, \\ 0 & \text{if } \delta \geq \frac{1}{n^2}. \end{cases} \quad (3.4)$$

The adoption of employee ownership by a firm means that the equilibrium part of shares held by employees (α^*) is positive, which corresponds to the first and the second rows of Equation (3.4).

We mean that:

$$\alpha^* \begin{cases} > 0 & \text{if } \delta < \frac{1}{n^2}, \\ = 0 & \text{if } \delta \geq \frac{1}{n^2}. \end{cases} \quad (4.1)$$

The relationship in Equation (4.1) represents an interesting result to be tested empirically as it links employee ownership implementation ($\alpha^* > 0$) to the employees effort disutility (δ), and to the employees number (n) or what we will call firm's size. To the best of our knowledge, most papers in the literature analyze the link between the existence of employee ownership (within firms) and the employees' number, and they conclude a monotonic relationship (positive as in Demstetz and Lehn, 1985 or negative as in Oyer and Shafer, 2005). Our model mitigates this conclusion by pointing out that this relationship is non-linear and depends on the interaction between the firm's size and its employees' effort disutility. This non-linearity is illustrated in Figure 5. For instance, a firm of size $n = \sqrt{10}$ (i.e. $n^2 = 10$ in Figure 5), will decide to launch an employee ownership scheme if its workers' effort disutility is 0.1, and will not if its workers' effort disutility is 0.2.

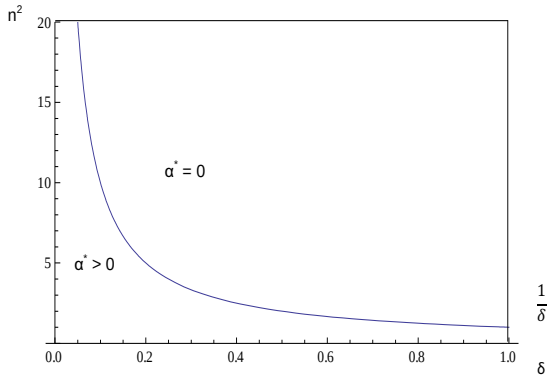

Figure 5: Ownership structure for a firm with n employees

In Figure 6, we draw two vertical axes. The first axis is drawn at δ=0.025 (low effort disutility) and the second axis is drawn at δ=0.8 (high effort disutility).

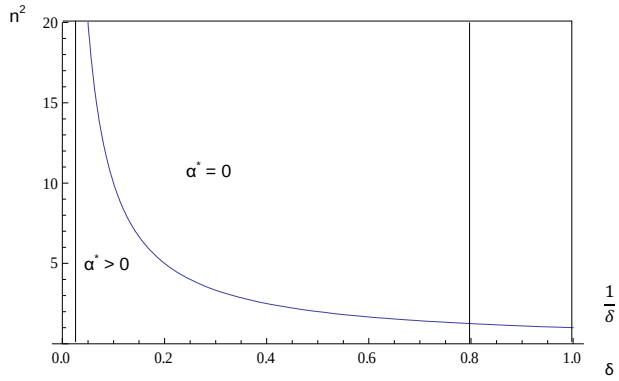

Figure 6: Probability of implementing an employee ownership scheme

If we move up along the first axis, we remain "very long" in the zone where $\alpha^* > 0$. We may even remain "all the time" in this zone if the sample does not contain "too large firms". We may thus have "the feeling" that all the firms will always launch employee ownership whatever their size. Along this axis, we are almost sure that firms will set up employee ownership. If we move up along the second axis, small firms (low n), implement employee ownership while larger ones do not. Hence, the probability of firms implementing employee ownership is expected to decrease when we move from small firms to larger ones.

Hence, we can derive the following prediction **P1**:

(i) *If the effort disutility is low, then the probability of a firm setting up employee ownership is independent of its size.*

(ii) *If the effort disutility is high, then the implementation of employee ownership is expected to be negatively correlated to the firm's size.*

In the subsequent subsections, we propose to test **P1** empirically, using the French data base "REPONSE 2004-2005" which is the French equivalent of the British Workplace Employment Relations Survey (see Kersley et al., 2006). The REPONSE survey, which has been used in several research papers (for instance in Amossé and Coutrot, 2011) is actually a collection of three questionnaires. We use in this paper the questionnaire filled in by the top managers of the firms. The sample contains 2930 establishments from the private sector with 20 employees or more.

4.2 The dependent variable and the main independent variable

The dependent variable (WSHARE) is a binary variable equal to 1 if a part of the firm's share is held by the employees and 0 otherwise.

Table 4.1: Distribution of WSHARE

WSHARE	Frequency	%
0	2106	71.88
1	824	28.12
Total	2930	100.00

If we denote by j the index of firms, then the dependent variable WSHARE:

$$WSHARE_j \;=\; 1_{\{\alpha_j>0\}} \quad \forall\, j = 1 \cdots m, \tag{4.2}$$

where α_j is the proportion of shares held by firm j's workers, as in the theoretical model.
α_j is a latent variable:

$$\alpha_j \;=\; \beta_0 + \beta_1 X_{1j} + \cdots + \beta_p X_{pj} + \varepsilon_j \quad \forall\, j = 1 \cdots m, \tag{4.3}$$

where ε_j is an error term assumed to be an iid variable that follows a normal law.

As we aim at testing Prediction **P1**, we need to have among the independent variables of Equation (4.3) the interaction between the firm's size and the employees' effort disutility. Let $X_{k_0 j}$ be such a variable:

$$X_{k_0 j} \;=\; \phi(n_j, \delta_j) \quad \forall\, j = 1 \cdots m, \tag{4.4}$$

where δ_j is the (average) effort disutility of firm j's employees, as in the theoretical model.

The effort disutility

The REPONSE survey contains the firms' sizes, but it does not (like most databases from the French national system of statistics) include the employees' effort disutility. Our strategy to construct a proxy of the effort disutility is the following.

a) Denote, as in the theoretical model, by U_j the (average) utility function of firm j's workers: $U_j = w_j + \alpha_j \frac{\pi_j}{n_j} - \delta_j \frac{e_j^2}{2}$. Suppose that we can control for the (average) utility function U_j and for its first component $w_j + \alpha_j \frac{\pi_j}{n_j}$ then (other things being equal) if workers from a firm j_0 provide more effort than workers from a firm j_1, then it is necessarily the case that $\delta_{j_0} < \delta_{j_1}$. In such a case, effort and effort disutility are highly correlated: the higher the effort, the lower the effort disutility. As a consequence, we can use effort as a proxy of effort disutility.

b) We approximate effort by absenteeism, and more precisely by the absenteeism problem in the establishment. Let us notice that absenteeism is widely used in the economic literature as a proxy of workers' effort (see for instance Allen 1981, Barmby 2002, Dionne and Dostie 2007, etc.).

From a practical standpoint, we use the below question in order to estimate the (average) effort disutility.

Question: In 2004, did absenteeism represent a problem in your establishment for the following socio-professional categories :

- Managers
- Salespeople
- Technicians and middle supervisors
- Office employees
- Manual laborers

The resulting variable called DISUTILITY takes value 1 if the establishment's manager answers yes to (at least) one of the five items, and takes value 0 otherwise.

Table 4.2: Distribution of DISUTILITY

DISUTILITY	Frequency	%
0	1351	46.11
1	1579	53.89
Total	2930	100.00

As a consequence our proxy of the effort disutility allows us to test in a satisfactory manner only the extreme values of effort disutility (see Figure 6).

DISUTILITY = 0 means here a low effort disutility and DISUTILITY = 1 means a high effort disutility in the establishment.

The firm's size

The data set includes the firms' sizes. But, we want our main independent variable to take into account the interaction between the firm's size and effort disutility. Hence, since our variable DISUTILITY is binary, we need to transform the size variable (which is quantitative) into a qualitative one called SIZE.

Table 4.3: Distribution of the variable SIZE

SIZE	Label	Frequency	%
1	$20-49$	661	22.56
2	$50-249$	1154	39.39
3	$250-499$	364	12.42
4	500 and more	711	25.63
Total		2930	100.00

We call SIZEDISU the variable which results from the composition of SIZE and DISUTILITY: SIZEDISU = SIZE $\otimes$ DISUTILITY, where the operator $\otimes$ is the classical cross product of two qualitative variables. More precisely SIZEDISU takes 8 values (numbered 1 to 8) corresponding to SIZE=1 and DISUTILITY=0, SIZE=2 and DISUTILITY=0, SIZE=3 and DISUTILITY=0, SIZE=4 and DISUTILITY=0, SIZE=1 and DISUTILITY=1, SIZE=2 and DISUTILITY=1, SIZE=3 and DISUTILITY=1, SIZE=4 and DISUTILITY=1.

Table 4.4: Distribution of the variable SIZEDISU

SIZEDISU	Label	Frequency	%
1	low disutility (0) and size 20-49	345	11.77
2	low disutility (0) and size 50-249	519	17.71
3	low disutility (0) and size 250-499	140	4.78
4	low disutility (0) and size 500+	347	11.84
5	high disutility (1) and size 20-49	316	10.78
6	high disutility (1) and size 50-249	635	21.67
7	high disutility (1) and size 250-499	224	7.65
8	high disutility (1) and size 500+	404	13.79
Total		2930	100

Equation (4.4) provides the interaction between Firm j's size and the (average) effort disutility.

$$X_{k_0 j} = \phi(n_j, \delta_j) \quad \forall\, j = 1, \cdots, m. \tag{4.4}$$

In terms of variables SIZEDISU, SIZE and DISUTILITY, function ϕ is the operator $\otimes$ and Equation (4.4) becomes:

$$X_{k_0 j} = SIZEDISU_j = SIZE_j \otimes DISUTILITY_j \quad \forall\, j = 1, \cdots, m. \tag{4.5}$$

4.3 The other independent variables

Equation (4.3) includes some other independent variables (in addition to SIZEDISU) that explain employee ownership scheme implementation. We add some classical variables like the business sector. We take also into account whether the firm is listed or not on the stock market (variable "Stock market") and whether the main market of the firm is international or not (variable "International market"). We expect a positive effect of being listed in the stock market on the implementation of an employee ownership scheme. A reason is that a listed firm can more easily issue some shares for its employees. The effect of the variable "International market" is less clear since there are some reasons both for a positive effect and for a negative one. For instance, a firm whose main market is international is likely to play on a competitive market structure. As a consequence, such a firm may need to provide more incentives to its employees. This firm can either use monetary incentives or a non monetary incentive like employee ownership. In the first case, the effect is positive and in the second one, the effect is negative.

In order to control in Equation (4.3) as much as possible for the (average) utility of workers in firms, we use (given the variables in the data set) the below variables:

- The largest (in proportion) socio-professional category in the establishment.
- The proportion of fixed-term contract workers in the establishment.
- The presence of temporary contract employees, in the establishment.

The choice of these variables is implied by the fact that they explain the utility function and are not highly correlated with SIZEDISU[4].

Table 4.5 summarizes the other independent variables used in the model and gives their descriptive statistics.

[4]Indeed even if we had the utility function we could not put it in the regression, because of its perfect correlation with SIZEDISU (remembering that size and effort are part of the utility function).

Table 4.5: Descriptive statistics of the other independent variables included in equation (4.3)

	Frequency	%
Main socio-professional category		
Manual laborer	1334	45.53
Office employee	920	31.4
Executive	676	23.07
Temporary contract employees		
0 (no)	1348	46
1 (yes)	1582	54
Proportion of fixed-term contract		
0	1074	36.65
More than 0 to less than 5%	1080	36.86
More than 5 to less than 10%	379	12.93
More than 10%	397	13.56
Stock Market		
0 (no)	1811	61.81
1 (yes)	1119	38.19
International market		
0 (no)	1103	37.65
1 (yes)	1827	62.35
Age of the establishment		
20 years or more	1998	68.19
10-19 years	606	20.68
Less than 10 years	326	11.13
Business sector		
Consumer goods	210	7.17
Intermediate goods and Energy	473	16.14
Capital equipment	219	7.47
Retail	506	17.27
Construction	190	6.48
Finance and Real estate	171	5.48
AgroFood industry	119	4.06
Transport	168	5.73
Services to consumers	122	4.16
Services to business	874	29.83
Others	239	8.16
Total	2930	100

4.4 The econometric model

It is likely that the value taken by variable DISUTILITY will be partly explained by the implementation of the employee ownership scheme. For instance Brown et al. (1999) show that both employee ownership and profit sharing schemes are associated with a significantly lower absenteeism among employees. Hence, estimate Equations (4.2), (4.3) and (4.5) would lead to an endogeneity bias.

Consequently, we will add the following Equations (4.6) and (4.7):

$$DISUTILITY_j \;=\; 1_{\{\delta_j > \Delta\}} \quad \forall\, j = 1, \cdots, m, \tag{4.6}$$

where Δ is a positive threshold;

$$\delta_j \;=\; \gamma_0 + \gamma_1 Z_{1j} + \cdots + \gamma_{l'} WSHARE_j + \cdots + \gamma_l Z_{lj} + \eta_j \quad \forall\, j = 1, \cdots, m, \tag{4.7}$$

η_j being an error term assumed to be an iid variable that follows a normal law.

In Equation (4.7), in addition to the other independent variables included in equation (4.3) except the variable "AGE OF ESTABLISHMENT", we use as exclusion variable a dummy variable (INCENTIVE) equal to 1 if the firm uses absenteeism as a criterion for increasing the individual wage of workers. This variable is distributed as follows:

Table 4.6: Distribution of INCENTIVE

	Frequency	%
INCENTIVE		
0 (no)	1817	62.01
1 (yes)	1113	37.99

Hence, the econometric model is written:

$$\left|\begin{array}{ll}
(4.2) & WSHARE_j \;=\; 1_{\{\alpha_j > 0\}} \quad \forall\, j = 1, \cdots, m. \\
(4.3) & \alpha_j \;=\; \beta_0 + \beta_1 X_{1j} + \cdots + \beta_{p'} SIZEDISU_j + \cdots + \beta_p X_{pj} + \varepsilon_j \quad \forall\, j = 1, \cdots, m. \\
(4.5) & SIZEDISU_j \;=\; SIZE_j \otimes DISUTILITY_j \quad \forall\, j = 1, \cdots, m. \\
(4.6) & DISUTILITY_j \;=\; 1_{\{\delta_j > \Delta\}} \quad \forall\, j = 1, \cdots, m. \\
(4.7) & \delta_j \;=\; \gamma_0 + \gamma_1 Z_{1j} + \cdots + \gamma_{l'} WSHARE_j + \cdots + \gamma_l Z_{lj} + \eta_j \quad \forall\, j = 1, \cdots, m.
\end{array}\right.$$

It is easy to see that this model is actually a simultaneous bivariate model with binary dependent variables. We estimate this model by maximum likelihood (with the Qlim procedure of SAS), using the variables "AGE OF ESTABLISHMENT" and "INCENTIVE" as exclusion variables.

4.5 Results and Comments

The complete results of the estimates are provided in Table 4.7.

Table 4.7: Estimates using a simultaneous bivariate probit

	Coefficient	**Std. Err**	**P-value**
Employee Ownership Scheme : WSHARE=1			
Intercept	-0.010524	0.109987	0.9238
SIZEDISU (ref= Low disutility and size 20-49)			
Low disutility and size 50-249	-0.001841	0.016758	0.9125
Low disutility and size 250-499	0.003108	0.023706	0.8957
Low disutility and size 500+	0.003969	0.019211	0.8363
High disutility and size 20-49	-1.652615	0.081343	<.0001
High disutility and size 50-249	-1.616520	0.040825	<.0001
High disutility and size 259-499	-1.612169	0.043740	<.0001
High disutility and size 500+	-1.607414	0.042041	<.0001
Main socio-professional category (ref=Executive)			
Manual Laborer	0.326412	0.061789	<.0001
Office employee	0.370932	0.068094	<.0001
Temporary contract (ref=no)	0.167438	0.047980	0.0005
Proportion of fixed-term contract (ref=0%)			
More than 0 to less than 5%	0.102253	0.050429	0.0426
More than 5 to less than 10%	0.160955	0.071357	0.0241
More than 10%	0.226071	0.071884	0.0017
Age of the establishment (ref= 20 years or more)			
10-19 years	-0.000320	0.011885	0.9785
Less than 10 years	0.000803	0.017911	0.9643
Stock market (ref=no)	0.409548	0.047433	<.0001
International market (ref=no)	-0.160724	0.052382	0.0022
Business sector (ref=Consumer goods)			
Intermediate goods and Energy	-0.019622	0.095024	0.8364
Capital equipment	-0.004441	0.110723	0.9680
Retail	0.179888	0.104462	0.0851
Construction	0.098775	0.119265	0.4076
Finance and Real estate	0.008999	0.126775	0.9434
Agrofood industry	-0.261563	0.133389	0.0499
Transport	0.172300	0.133356	0.1963
Services to consumers	-0.283348	0.122865	0.0211
Services to business	-0.049965	0.100218	0.6181
Others	-0.732528	0.191787	0.0001
High Disutility : DISUTILITY=1			
Intercept	-0.010861	0.109163	0.9207
WSHARE (ref=0 : No employee ownership scheme)	-1.614110	0.038282	<.0001
Firm uses absenteism as a criteria for increasing the individual wage of workers (INCENTIVE) (ref=no)	0.007875	0.011973	0.5107
Main socio-professional category (ref=Executive)			
Manual Laborer	0.336358	0.061585	<.0001
Office employee	0.376479	0.067808	<.0001
Temporary contract (ref=no)	0.166690	0.047790	0.0005
Proportion of fixed-term contract (ref=0%)			
More than 0 to less than 5%	0.104558	0.050261	0.0375
More than 5 to less than 10%	0.164674	0.070913	0.0202
More than 10%	0.226740	0.071527	0.0015
Stock market (ref=no)	0.402623	0.047395	<.0001
International market (ref=no)	-0.159912	0.052252	0.0022
Business sector (ref=Consumer goods)			
Intermediate goods and Energy	-0.019051	0.094770	0.8407
Capital equipment	-0.007726	0.110534	0.9443
Retail	0.176882	0.104095	0.0893
Construction	0.086208	0.119038	0.4689
Finance and Real estate	0.010780	0.126422	0.9320
Agrofood industry	-0.256576	0.132132	0.0522
Transport	0.194085	0.128246	0.1302
Services to consumers	-0.278625	0.121648	0.0220
Services to business	-0.050991	0.099857	0.6096
Others	-0.033123	0.103949	0.7500

Number of observations = 2930 Schwarz Criterion = 5805 Log likelihood = -2707 AIC = 5511

Table 4.8 emphasizes the results concerning the main dependent variable SIZEDISU.

Table 4.8: The determinants of employee ownership: the signs of the parameters associated with SIZEDISU

	Label	Sign of the coefficient
1	*low effort disutility (0) and size 20-49*	*Reference*
2	low disutility (0) and size 50-249	$(-)$ ns
3	low disutility (0) and size 250-499	$(+)$ ns
4	low disutility (0) and size 500+	$(+)$ ns
5	high disutility (1) and size 20-49	$(-)^{***}$
6	high disutility (1) and size 50-249	$(-)^{***}$
7	high disutility (1) and size 250-499	$(-)^{***}$
8	high disutility (1) and size 500+	$(-)^{***}$

ns = non significant at 10%; *** = significant at 1%.

From Table 4.7, we can derive our empirical finding as follows:

1. For a low level of effort disutility, firm's size has no effect on their probability of implementing employee ownership. Indeed, the variable "low disutility (0) and size 20-49" being the reference, the coefficients associated with the variables "low disutility (0) and size 50-249", "low disutility (0) and size 250-499" and "low disutility (0) and size 500+" are all non significant (according to the p-value). This is in accordance with our prediction **P1**.

2. For a high level of effort disutility, firm's size has a significantly negative effect on their probability of implementing employee ownership. Indeed, the variable "low disutility (0) and size 20-49" being the reference, the coefficients associated with the variables "high disutility (1) and size 20-49", "high disutility (1) and size 50-249", "high disutility (1) and size 250-499" and "high disutility (1) and size 500+" are all significantly negative (according to the p-value). This means that the probability of implementing an employee ownership is smaller in firms with high disutility effort than firms with low disutility effort. This result is in accordance with our prediction **P1**.

We show in our paper that firm's size and workers disutility of effort play a joint role in a firm's decision to launch an employee ownership scheme, while most papers in the literature only analyze the link between the existence of employee ownership (within firms) and the employees number and they conclude a positive, negative or neutral relationship. Our findings mitigate this conclusion by pointing out that this relationship is non-linear and depends on the interaction between the firm's size and its employees' effort disutility. Indeed, for low levels of effort disutility, we prove that this relationship is neutral, as in Baker and Hall (2002). For high levels of disutility, this relationship is proved to be negative as in Oyer and Shafer (2005).

5 Conclusion

In our paper, we specify the condition under which shareholders attribute a positive share of capital to employees. This condition is proved to be related to the firm's size and effort disutility. The role of a firm's size in explaining employee ownership implementation is not new. What is new in our paper is the fact that firm's size and workers disutility of effort play a joint role in a firm's decision to implement an employee ownership scheme. Indeed, we prove in the theoretical model that there is distribution of shares to employees when the firm's size and/or the effort disutility of employees are sufficiently low. In this case and from our welfare analysis, we prove that there is no need for the social planner to regulate, as shareholders will naturally distribute an optimal share of capital to employees. However, too large firms will distribute suboptimal parts of their capital to employees, which may justify the social planner's regulation. The French legislation requiring large firms to distribute profit shares to employees could then be seen as an attempt to ensure that large firms distribute an optimal part of their capital.

The finding of the empirical test, dealing with the relation between employee ownership implementation, firm's size and effort disutility, agree with the theoretical ones for low and high effort disutility. Indeed, we find that for low effort disutility, the probability of a firm setting up employee ownership is independent of its size and close to one. Moreover, for high effort disutility, this probability is negatively correlated to firm's size. We explaine this result by the free rider problem, which is more pronounced for large firms. If this problem is combined with high levels of effort disutility, firms do not see any advantage for implementing employee ownership.

Our result allows to understand why in empirical works there is no consensus regarding the relationship between firms' size and employee ownership implementation which can either be significantly negative, positive or neutral. Our result reconciles these studies as we show that the relationship between employee ownership implementation and the firm's size, depends on effort disutility, being possibly positive, negative or neutral, depending on the effort disutility level. However, the main criticism likely to be directed at our empirical model is the fact that due to data limitation, we only test the extreme values of effort disutility (high versus low effort disutility). It will be thus, interesting to do the estimations for intermediate disutility levels through another data base where the percentage of absenteeism among employees is provided.

References

[1] Alchian A. A. and Demsetz H. (1973), "The property rights paradigm", Journal of Economic History, Vol. 33, No. 1, pp. 16-27.

[2] Allen, S.G. (1981), "An Empirical Model of Work Attendance ", Review of Economics and Statistics, Vol. 63, No. 1, pp. 77-87.

[3] Amossé, T. and Coutrot, T. (2011), "Socio-Productive Models in France: An Empirical Dynamic Overview, 1992-2004", Industrial and Labor Relations Review, Vol. 64, No. 4, article 8.

[4] Baker P.G. and Hall J.B (2002), "CEO Incentives and Firm Size", Harvard Business School, Working paper.

[5] Berle, A.A. and Means, G.C. (1932), "The Modern Corporation and Private Property", MacMillan: New York.

[6] Blair, M., Blasi, J. and Kruse, D. (2000) "Employee Ownership: an unstable form or a stabilizing force?" in Margaret M. Blair and Thomas Kochan (eds), The new relationship: human capital in the American Corporation, Brookings Institution Press, Washington D.C.

[7] Blasi, J. and Kruse, D. (1999) "Public Opinion Polls on Employee Ownership and Profit Sharing", Journal of Employee Ownership Law and Finance, Vol. 11, No. 3, pp. 3-25.

[8] Barmby, T. (2002), "Worker Absenteeism: A Discrete Hazard Model with Bivariate Heterogeneity ", Labour Economics, Vol. 9, No. 4, pp. 469-476.

[9] Brown, S., Fakhfakh, F. and Sessions, J.G (1999) "Absenteeism and Employee Sharing: An Empirical Analysis Based on French Panel Data, 1981-1991", Industrial and Labor Relations Review, January 1999. Vol. 52, No. 2, pp. 234-251.

[10] Cahuc, P. and Dormont, B.(1997),"Profit-sharing: Does it increase productivity and employment? A theoretical model and empirical evidence on French micro data", Labour Economics, Vol. 4, pp. 293-319.

[11] Core, J., and Guay, W. (2002) "Estimating the value of employee stock option portfolios and their sensitivities to price and volatility", Journal of Accounting Research. Vol. 40, pp. 613-63.

[12] Demsetz, H., and Lehn, K. (1985), "The structure of corporate ownership: causes and consequences", Journal of Political Economy, Vol. 93, No. 6, pp. 1155-1177.

[13] Dionne, G. and Dostie, B. (2007), "New Evidence of the Determinants of Absenteeism Using Linked Employer-Employee Data", Industrial and Labor Relations Review, Vol. 61, pp. 111-120.

[14] Dondi, J. (1993), "L'actionnariat des salariés dans les entreprises françaises: résultats empiriques", IAE de Bordeaux, Travaux de recherche No. I.9302.

[15] Faleye, O., Mehrotra, V. and Morck, R. (2006), "When labor has a voice in corporate governance", Journal of Financial and Quantitative Analysis, Vol. 41, No. 3, pp. 489-510.

[16] Fitzroy, F.R. and Kraft, K. (1987),"Cooperation, Productivity, and Profit Sharing", The Quarterly Journal of Economics, Vol. 102, No. 1, pp. 23-36.

[17] Freshtman, C. and Judd, K. (1987), "Equilibrium Incentives in Oligopoly", American Economic Review, Vol. 77, pp. 927-40.

[18] Heijden, E.V.D., Potters, J. and Sefton, M. (2009), "Hierarchy and opportunism in teams", Journal of Economic Behaviour and Organization, Vol. 69, pp. 39-50.

[19] Holmstrom, B. (1982), "Moral hazard in teams", The Bell Journal of Economics, Vol. 13, No. 2, pp. 324-340.

[20] Ikbal, Z. and Hamid, S. (2000), "Stock price and operating performance of ESOP firms: a time-series analysis", Quarterly Journal of Business and Economics Vol. 39, No. 3, pp. 25-47.

[21] Kandel, E. and Lazear, E.P (1992),"Peer Pressure and Partnerships", Journal of Political Economy, Vol. 100, No. 4, pp. 801-817.

[22] Kersley, B., Alpin, C., Forth, J., Bryson, A., Bewley, H., Dix, G. and Oxenbridge, S. (2006), "Inside the Workplace: Findings from the 2004 Workplace Employment Relations Survey", London: Routledge.

[23] Laffont, J.J., and J. Tirole, (1993) "A Theory of Incentives in Procurement and Regulation", MIT-Press. Cambridge, Massachusetts.

[24] Livingston, D. and Henry, J. (1980), "The effect of employee stock ownership on corporate profits", Journal of Risk and Insurance, Vol. 47, No. 3, pp. 491-505.

[25] Oyer, P. and Schaefer, S. (2005), "Why Do Some Firms Give Stock Options To All Employees?: An Empirical Examination of Alternative Theories", Journal of Financial Economics, Vol. 76, pp. 99-133.

[26] Sesil, J., Kruse, D. and Blasi, J. (2001), "Sharing ownership via employee stock ownership", Discussion paper no 2001-25, United Nations University, World Institute for Develpoment Economics Research.

[27] Trebuck, S. (2002), "L'actionnariat salarié dans les entreprises familiales du SBF 250: un outil de création de valeur ?", Finance Contrôle Stratégie, Vol. 5, No. 4, pp. 107-135.

[28] Weitzman, M. (1987) "Steady state unemplyment under profit sharing", The Economic Journal, Vol. 97, pp. 86-105.