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PROFIT-SHARING AS TAX SAVING AND INCENTIVE DEVICE

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ABSTRACT :

The theory of labor contract with worker's chosen effort level mainly rests upon the principal-agent paradigm. In many labor markets however, the principal is not as free as assumed in the standard theory, but is submitted to some binding institutional constraints. It is requested in particular to post a wage level, i.e. a non random component of compensation to which high rates of social contribution may apply. The proposed model adapts the standard analysis to situations in which tax rules and possibly predetermined profit-sharing patterns interfere with free contracting.
It formalizes the two-faced aspect of profit sharing having an impact on the firm's objective through tax saving effect and incentive effect.

Key-Words :

- Profit-sharing
- Incentives
- Tax evasion

RESUME :

La théorie du contrat de travail dans la situation où l'effort de l'employé est inobservable, repose pour l'essentiel sur le modèle «principal-agent». Ce texte propose une analyse des contrats optimaux lorsque l'employeur est soumis à des contraintes institutionnelles en particulier fiscales et étudie l'impact des taux de contribution sociale sur les choix de l'employeur, cet impact ayant un double aspect fiscal et incitatif.

Mots-clés :

- Participation
- Incitations
- Evasion fiscale

JEL classification : J31, J33, K34

Abstract

The theory of labor contract with worker's chosen effort level mainly rests upon the principal-agent paradigm. In many labor markets however, the principal is not as free as assumed in the standard theory, but is submitted to some binding institutional constraints. It is requested in particular to post a wage level, i.e. a non random component of compensation to which high rates of social contribution may apply. The proposed model adapts the standard analysis to situations in which tax rules and possibly predetermined profit-sharing patterns interfere with free contracting.

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1 Introduction

General properties of optimal effort stimulating contracts have been widely investigated, especially in application of the well known principal-agent theory, rooted in the seminal articles by Hart (1983) and Hart and Holmström (1987). The available literature expounding this development of incentive theory is too rich to be systematically quoted here, but a host of relevant references may be found in a review by Prendergast (1999).

The principal-agent model can be applied to the analysis of labor contracts when ouput can be individually ascribed to the workers. When this condition is fullfilled, it seems able to successfully predict the commonly observed solutions, including special cases in which the worker is made residual claimant of ouput as seen in Lazear (1995) and in the "sharecropping" tradition.

As has been emphasized by Holmström (1979), the efficiency of contracts in the principal-agent paradigm may be increased by introducing into the compensation formula not only output, but any other variable, if it is statistically related to the effort level with limited noise. According to the "informativeness principle", very complex and varied paying schemes should therefore appear. In many instances however, only simple paying patterns are observed and the sophisticated forms appear only if their benefits outweigh their costs, if their properties are clearly understood in spite of bounded rationality of the parties and if they are tolerated by the institutional environment.

In this paper labor contract design is analyzed, placing emphasis on the role of institutional constraints interfering with private decisions. It must be aknowledged indeed, that factors such as accounting costs, the legal framework, including tax rules and sometimes mandatory profit-sharing rules, account for situations in which the principal is not free to use all the instruments assumed flexible in the most abstract forms of the theory. In particular, in commonly observed legal environments, taxes or social contributions are claimed from the firm and levied on the basis of a fixed component of the worker's compensation defined as "wage". In such a case, introducing or increasing the profit-sharing component of the worker's compensation and correspondingly diminishing the weight of her wage enables the firm to save on payroll taxes. On the first hand, profit being a random variable, this cannot be done without introducing randomness in the worker's situation and therefore bearing the cost of compensating this risk, in keeping with the relevant participation constraint; on the other hand, an increased random component of compensation related to output may also stimulate effort. Tax saving effects and effort stimulating effects are therefore intimately mixed consequences of the contract.

In order to bring out the properties of contracts devised in such circumstances, a model is proposed along the following lines, adapted to weakly unionized environments in which collective bargaining could be neglected:

In a stationary setting, the firm chooses only a wage level and a profit-sharing rate, taking into account a participation constraint which aknowledges the role of competition in the labor market. This behavior is sometimes itself optimal rather than imposed by the environment. Conditions for the optimality of such linear rules have been scrutinized by Milgrom and Holmström (1987). But as mentioned by Dixit (2002), these simple patterns are often observed even when such rigorous conditions are not met, for their simplicity and relative robustness against manipulation. In opposition to the efficiency wage literature, when it deals with payroll taxes (Kevin Lang 2003), effort cannot be monitored, and our model is compatible with market clearing situations.

Contracts are proposed by a risk-neutral employer submitted to a predetermined level of the participation constraint. No standard incentive constraint is introduced, but a continuous "effort supply" function is derived from the worker's preferences and from its ability to influence productivity. Labor being assumed homogenous, the model does not shed direct light on the interesting aspects of workers self selection. It aims at explaining the firm's choice among possible contract patterns in relation with the level of wage based taxes, and with the induced effort levels. It turns out that multiple solutions cannot be ruled out in such a context. The model can finally be used to sketch the analysis of possible legal profit-sharing rules such as those existing for instance in the French legal setting.

It must finally be mentioned that profit-sharing contracts have been analyzed in an original way by Bensaid and Gary-Bobo (1991), who showed that, within an oligopolistic context in the output market, traditional Cournot-Nash equilibrium implicitly based on straight-wage labor compensation is not robust if profit-sharing is allowed. They show that in such a case, each firm individually has an incentive to diminish wages and share profits with workers, increasing its market share and its residual profit. The generalized profit-sharing Nash equilibrium in this case is more favorable to the consumer thanks to an increased industry supply, but profits are reduced. A step towards cooperation between firms of the same trade would consist in ruling out profit-sharing and the law would be required to preclude this form of collusion. This striking result, as well as the results obtained by Bughin (1999) is however, obtained in a special output market structure, without consideration of the role of wage-based taxes in explaining the structure of labor contracts.

The analysis developed in this paper is organized as follows:

Section 2 is devoted to the agent's choice. It specifies her effort supply problem, and explains the responsiveness of the endogenous effort level to the parameters chosen by the firm.

Section 3 explains the principal's choice between different forms of contract, such as straight wage, private profit-sharing or pure partnership.

Section 4 illustrates the model with an example and simulates it numerically. Also, as an application of the model, possible perverse effects of binding mandatory profit-sharing rules are exposed.

2 Effort supply and institutional constraints

2.1 Axioms and notations

We suppose that S states of the world $(1, 2, ...s...S)$ can take place with probabilities $(p_1, ..p_s..p_S)$. In state s, observable net output from a worker is X_s. From the choice of indices, the sequence $\{X_s\}_{s=1}^{S}$ is increasing.

Axiom 1: The probability distribution of output is influenced by the worker's unobservable effort level noted $h \geq 0$. In each state, $p_s = p_s(h)$ and therefore $E\left\{\tilde{X}\right\} = X^e(h) = \sum_{s=1}^{S} p_s(h) X_s$

We define a cumulative function

$F(z) = Pr\left\{\tilde{X} \leq X_z\right\} = \sum_{s=1}^{z} p_s(h)$, for $z = (1, 2, ..., s, .., S)$

Axiom 2: Effort alters the cumulative function with first order stochastic dominance:

$\forall z < S$, $\dfrac{dF(z)}{dh} < 0$ and therefore $\sum_{s=1}^{z} p_s'(h) < 0$

Since $F(S) = 1$, $\dfrac{dF(S)}{dh} = 0$ and $\sum_{s=1}^{S} p_s'(h) = 0$

The lemma exposed in Appendix I implies for $Q_s = X_s$ and $P_s = p_s'(h)$ the following inequality:

$X_h^e = \sum_{s=1}^{S} X_s p_s'(h) > 0$: expected output is increasing in h.

Axiom 3: we assume decreasing marginal effect of effort on the cumulative function in the following sense:

$\forall z < S$, $\dfrac{d^2F(z)}{dh^2} > 0$ or equivalently $\sum_{s=1}^{z} p_s''(h) > 0$

Furthermore, since $\sum_{s=1}^{S} p_s'(h) = 0$, $\sum_{s=1}^{S} p_s''(h) = 0$

The lemma in Appendix I, for $Q_s = X_s$ and $P_s = -p_s''(h)$ implies:

$X_{hh}^e = \sum_{s=1}^{S} X_s p_s''(h) < 0$: effort has decreasing returns in terms of expected output.

Axiom 4: The preferences of the worker are represented by the semi-linear utility function

$$V(h) = \sum_{s=1}^{S} p_s(h) U(C_s) - h \tag{1}$$

where the function $U(\ )$ is concave, and where C_s is the worker's compensation in state s.

Axiom 5: The firm is risk neutral and maximizes the expected value of its residual profit.

2.2 Institutional constraints and notations

Contracts patterns are constrained by institutional rules and the firm cannot freely determine C_s in each state of the world. The firm has to declare a fixed non negative wage, and must pay taxes (or social contributions) at a fixed rate τ on wage. The resulting profit is shared with the worker according to a conventional (but state independent) proportion $\theta \geq 0$.

In state s, the accounted profit is therefore

$$\Pi_s = X_s - w(1+\tau) \tag{2}$$

- the worker's compensation is

$$C_s = w + \theta \Pi_s = \theta X_s + w\left[1 - \theta(1+\tau)\right] \tag{3}$$

- residual profit is defined in each state by

$$R_s = (1-\theta)\Pi_s \tag{4}$$

Note that the sequences $\{\Pi_s\}_{s=1}^{S}$, $\{R_s\}_{s=1}^{S}$ are always increasing and that for $\theta > 0$, $\{C_s\}_{s=1}^{S}$ is increasing and $\{U'(C_s)\}_{s=1}^{S}$ is decreasing

Obviously, any contract (w, θ) determines consumption C_s in each state, but for $S > 2$, this set of rules does not enable the firm to span the whole consumption space.

We assume that the firm is profitable in the stationary state and therefore: $\Pi^e = E(\Pi) > 0$

2.3 Incentive effects: effort supply, interior and corner solutions

2.3.1 Interior solutions: sufficient first order conditions

For any contract (w, θ), the worker determines effort level h, in order to maximize $V(h)$.

If the induced effort level h^* is positive, the following first and second order conditions applying to (1) should hold:

$$V'(h^*) = \sum_{s=1}^{S} U(C_s) p_s'(h^*) - 1 = 0 \tag{5}$$

$$V''(h^*) = \sum_{s=1}^{S} U(C_s) p_s''(h^*) < 0. \tag{6}$$

Since the sequence $\{U(C_s)\}_{s=1}^{S}$ is increasing, the lemma in Appendix I with $Q_s = U(C_s)$ and $P_s = -p_s''(h^*)$ implies:

$\sum_{s=1}^{S} U(C_s)p_s''(h) < 0 \; \forall h > 0$. The function $V(h)$ is concave in h and therefore first order condition(5) is sufficient for a global maximum.

An indirect utility function $V^*(w,\theta)$ is then defined by

$$V^*(w,\theta) = V(h^*) = \sum_{s=1}^{S} p_s(h^*)U(C_s) - h^* \tag{7}$$

It must be noticed that this explanation of the effort supply is strictly individualistic; it neglects the possible "peer pressure" effect as reported for instance by Kandel and Lazear (1992)

Responsiveness of optimal effort to wages. For an interior solution, the responsiveness of the optimal effort to the wage rate and to the profit share is obtained in derivating (5) with respect to w and θ.

$$h_w^* = -\left[1-\theta(1+\tau)\right] \frac{\sum_{s=1}^{S} p_s'(h^*)U'(C_s)}{\sum_{s=1}^{S} p_s''(h^*)U(C_s)} \tag{8}$$

For $\theta > 0$, the sequence $\{U'(C_s)\}_{s=1}^{S}$ is decreasing and the lemma applied to $\{Q_s\}_{s=1}^{S} = \{U'(C_s)\}_{s=1}^{S}$ and $\{P_s\}_{s=1}^{S} = \{p_s'(h^*)\}_{s=1}^{S}$ implies:
$\sum_{s=1}^{S} U'(C_s)p_s'(h^*) < 0$.

Since from (6), $\sum_{s=1}^{S} U(C_s)p_s''(h^*) < 0$, we have
$h_w^* < 0$ whenever $0 < \theta < \dfrac{1}{1+\tau}$.

Unambiguously, an increase in the fixed wage component of compensation reduces the induced effort level.

Notice that this negative incentive effect is related the concavity of the utility function, implying risk aversion. If the worker is risk-neutral, $U'(C_s) = C^{st}$, and since $\sum_{s=1}^{S} p_s'(h^*) = 0$, from (8) $h_w^* = 0$. This situation is analyzed in appendix II.

Responsiveness of optimal effort to the profit-sharing rate The responsiveness of effort to the profit-sharing rate is:

$$h_\theta^* = -\frac{\sum_{s=1}^{S} p_s'(h^*)U'(C_s)\Pi_s}{\sum_{s=1}^{S} p_s''(h^*)U(C_s)} \tag{9}$$

Since the denominator in (9) is negative, an increased participation rate stimulates effort if only if and only if: $\sum_{s=1}^{S} U'(C_s)\Pi_s p_s'(h^*) > 0$

From the lemma exposed in Appendix I, if the sequence $\{U'(C_s)\Pi_s\}_{s=1}^{S}$ is monotonically increasing, then $\sum_{s=1}^{S} U'(C_s)\Pi_s p_s'(h^*) > 0$, a sufficient condition for $h_\theta^* > 0$.

This would be trivially verified when $U'(C) = C^{st}$ (in the absence of risk aversion). We show that some bounded level of relative risk aversion may guarantee this property.

Since each term may be written $Q_s = \Pi_s U'(w + \theta\Pi_s)$ and since the sequence $\{\Pi_s\}_{s=1}^{S}$ is increasing, $\{Q_s\}_{s=1}^{S}$ is itself increasing if $\frac{dQ_s}{d\Pi_s} > 0$, or equivalently, if $U'(C_s) + \theta\Pi_s U''(C_s) > 0$

For $\Pi_s < 0$, this inequality always holds for risk averse workers; if $\Pi_s > 0$, it holds only if

$$-\frac{U''(C_s)}{U'(C_s)} < \frac{1}{\theta\Pi_s} \tag{10}$$

For instance, if we consider the Constant Relative Risk Aversion case: $U(C) = \frac{C^{(1-\sigma)}}{1-\sigma}$ condition (10) is equivalent to $\sigma < 1 + \frac{w}{\theta\Pi_s}$ $\forall s$

The condition is in particular always fulfilled for $U(C) = \ln(C)$ involving $\sigma = 1$.

2.3.2 Corner solutions and the perfunctory behavior domain

If $V'(0) < 0$, perfunctory behavior is a solution. For instance, when $\theta = 0$, consumption is state-independent, $C_s = w$ $\forall s$ and since $\sum_{s=1}^{S} p_s'(0) = 0$,

$$V'(0) = U(w)\sum_{s=1}^{S} p_s'(0) - 1 = -1. \tag{11}$$

No effort is supplied. It is worth noticing that perfunctory behavior $h^* = 0$ is a solution not only for $\theta = 0$ (no incentive), but also for $0 < \theta < \varepsilon$, with $\varepsilon > 0$. Since the term $\sum_{s=1}^{S} U(C_s)p_s'(h)$ is a continuous function of θ, $V'(0)$ is strictly negative in a neighborhood of $\theta = 0$, for some $\varepsilon > 0$, we have $V'(0) < 0$, $\forall\theta < \varepsilon$, implying $h^* = 0$.

A positive profit-sharing rate is not sufficient to induce a positive effort level.

The existence of this perfunctory behavior domain is not an idiosyncratic property of the semi-linear form adopted for $V(h)$: if we replace it with the more general separable form:

$W(h) = \sum_{s=1}^{S} p_s(h)U(C_s) - g(h)$ with $g(0) = 0$, $g'(h) > 0$, $g''(h) > 0\ \forall h > 0$, it is easily shown in the same way that $h = 0$ is a corner solution in a neighborhood of $\theta = 0$.

3 The optimal contract

3.1 General setting

Since the contract has incentive properties, the employer takes into account the effort supply function in determining the optimal compensation rule. The firm's problem consists in maximizing expected residual profit for an endogenous probability distribution of states of the world, under a participation constraint due to competition in the labor market and involving the indirect utility function. This problem is represented by:

$$\begin{cases} \underset{w,\theta}{Max}\{R^e\} \\ subject\ to:\ V^*(w,\theta) \geq \underline{V} \\ w \geq 0 \\ 0 \leq \theta \leq 1 \end{cases} \tag{12}$$

Where $R^e = (1-\theta) \sum_{s=1}^{S} p_s(h^*) [X_s - w(1+\tau)]$, or

$$R^e = (1-\theta) [X^e(h^*) - w(1+\tau)] \tag{13}$$

$$V^*(w,\theta) = \sum_{s=1}^{S} p_s(h^*)U(C_s) - h^* \tag{14}$$

and where $\underline{V}$ is the satisfaction level reflecting the participation constraint. The analytical conditions of the problem are complicated since no simple concavity argument can be applied to second order conditions or to uniqueness. The constraint $w \geq 0$ is relaxed in appendix II.

We first examine some properties of the involved functions.

3.1.1 Responsiveness of residual profit to wages

From (13) $R^e_w = (1-\theta) [X^e_h h^*_w - (1+\tau)]$

Since $X^e_w = X^e_h h^*_w$, with $X^e_h > 0$ and $h^*_w < 0$

$$R^e_w = (1-\theta) [X^e_w - (1+\tau)] < 0 \tag{15}$$

Residual profit is always decreasing in wages.

3.1.2 Responsiveness of residual profit to the profit-sharing rate: sharing effect and incentive effect

From (13) $R^e_\theta = -\Pi^e + (1-\theta)X^e_h h^*_\theta$

$$R^e_\theta = -\Pi^e + (1-\theta)X^e_\theta \tag{16}$$

The effect of increasing θ on the objective function can be broken into two components:

- a pure sharing effect $(-\Pi^e)$ always negative,

- an incentive effect $(1-\theta)X^e_\theta = (1-\theta)X^e_h h^*_\theta$ induced by the responsiveness of effort to the profit-sharing rate, whose sign is determined by the sign of h^*_θ.

The sign of the responsiveness R^e_θ is therefore related to the signs and magnitudes of the two components

3.1.3 Responsiveness of the indirect utility function

Applying the enveloppe theorem, it may be shown from (5) and (7) that :

$$V^*_w = [1-\theta(1+\tau)]\, E\left\{U'(\tilde{C})\right\} \tag{17}$$

$$V^*_\theta = E\left\{\tilde{\Pi}U'(\tilde{C}\right\} \tag{18}$$

The sign of V^*_θ is not always positive. A sufficient condition for $V^*_\theta > 0$ is obviously $w \leq \dfrac{X_1}{1+\tau}$, since in this case $\Pi_s \geq 0\ \forall s$

3.2 Types of solutions

Solutions can belong to three types :

- straight wage contracts: $(w^*, 0)$

- interior solutions: (w^*, θ^*)

- pure partnership contracts: $(0, \theta^*)$

From (2), (3) and (4), if $\theta^* > \dfrac{1}{1+\tau}$, in each state of the world, compensation and residual profit are both decreasing in w, implying a pure profit-sharing contract.

In spite of the increased complexity induced by endogenous probability of the states of the world, it is possible to sketch an analytical and a graphical approach.

The Lagrangian associated to a solution of (12) is in general:

$$\pounds = R^e + \lambda\left[V^*(\theta, w) - \underline{\mathrm{V}}\right]. \tag{19}$$

The necessary first order conditions are for a private optimum:

$$\pounds_w = R^e_w + \lambda V^*_w \leq 0,\ w\pounds_w = 0 \tag{20}$$

and

$$\pounds_\theta = R^e_\theta + \lambda V^*_\theta \leq 0,\ \theta\pounds_\theta = 0 \tag{21}$$

3.2.1 Straight wage impossibility

We show first that the existence of wage based taxes ($\tau > 0$) rules out straight wage as a solution.We have seen that the effort level is constant $h^* = 0$ for $\theta < \varepsilon$ In a neighborhood of $(w, 0)$, the lagrangian takes a special form where effort is nil and the probability distribution of states is unaltered by sufficiently small variations of the parameters defining the contract:

$$\pounds = (1-\theta)\sum_{s=1}^{S} p_s(0)\left[X_s - w(1+\tau)\right] + \lambda\left[\sum_{s=1}^{S} p_s(0)U(C_s) - \underline{\mathrm{V}}\right] \tag{22}$$

In the straight wage case, obviously, from the participation constraint, if $\theta^* = 0,\ w^* > 0$.

A straight wage solution ($\theta = 0$) would require: $\pounds_w = R^e_w + \lambda V^*_w = 0$ and $\pounds_\theta = R^e_\theta + \lambda V^*_\theta \leq 0$

First order necessary conditions related to (22) are therefore for $\theta = 0$:

$$\pounds_w = -(1-\theta)(1+\tau) + \lambda\left[1 - \theta(1+\tau)\right]\sum_{s=1}^{S} p_s(0)U'(C_s) = 0 \tag{23}$$

or for $\theta = 0$:

$$-(1+\tau) + \lambda U'(w) = 0 \tag{24}$$

$$\pounds_\theta = -\Pi^e + \lambda\sum_{s=1}^{S} p_s(0)\Pi_s U'(C_s) \leq 0 \tag{25}$$

or for $\theta = 0$:

$$-\Pi^e + \lambda U'(w)\Pi^e \leq 0 \tag{26}$$

The two necessary conditions (26) and (24) imply respectively $\lambda \leq \dfrac{1}{U'(w)}$ and $\lambda = \dfrac{1+\tau}{U'(w)}$, contradictory conditions for $\tau > 0$

It is worth noticing that this result may be obtained in any situation with no incentive effects, when the probability distribution of the different states does not depend on effort.

3.2.2 Partnership and interior solutions: global and local analysis

A global view and and a full understanding of (12) would require a complete representation in space(w, θ) of three types of curves;

- indifference curves of the effort supplying workers $V^*(w, \theta) = C^{st}$, including the participation constraint $V^*(w,\theta) = \underline{V}$

- curves of constant effort level $h^*(w, \theta) = C^{st}$

- curves of constant expected residual profits of the firm, $R^e(w,\theta) = C^{st}$

We calculate the slopes of the three curves, but leave their convexity properties undetermined.

Indifference curves: From (17) and (18), the slope of the constant indirect utility curve is:

$$\left(\frac{d\theta}{dw}\right)_{V^*=C^{st}} = -\frac{V_w^*}{V_\theta^*} = -\left[1 - \theta(1+\tau)\right] \frac{E\left\{U'(\tilde{C})\right\}}{E\left\{\tilde{\Pi}U'(\tilde{C})\right\}}. \tag{27}$$

The horizontal line $\theta = \dfrac{1}{1+\tau}$ is itself a constant indirect utility curve.

Constant effort curves A locus of constant effort in the $(Ow, O\theta)$ space has the slope $\left(\dfrac{d\theta}{dw}\right)_{h^*=C^{st}} = -\dfrac{h_w^*}{h_\theta^*}$

$$\left(\frac{d\theta}{dw}\right)_{h^*=C^{st}} = -\left[1 - \theta(1+\tau)\right] \frac{\sum\limits_{s=1}^{S} U'(C_s)p_s'(h^*)}{\sum\limits_{s=1}^{S} U'(C_s)\Pi_s p_s''(h^*)}. \tag{28}$$

The horizontal line $\theta = \dfrac{1}{1+\tau}$ is itself also a constant effort curve.

Constant expected residual profit curves, the role of incentive effects From (13) :

$$R_w^e = (1-\theta)\left[X_w^e - (1+\tau)\right] \tag{29}$$

and

$$R_\theta^e = -\Pi^e + (1-\theta)X_\theta^e \tag{30}$$

where $X_w^e = h_w^* \sum\limits_{s=1}^{S} X_s p_s'(h^*) < 0$ and $X_\theta^e = h_\theta^* \sum\limits_{s=1}^{S} X_s p_s'(h^*)$.

The first term in the right-hand side of (29) is related to the incentive effect of wages on expected output and the second term is a pure wage effect on residual profit. Since $h_w^* < 0$ and $\sum\limits_{s=1}^{S} X_s p_s'(h^*) > 0$, $R_w^e < 0$.

The first term in the right-hand side of (30) is a pure profit sharing effect related to an increase in θ and the second term captures the *incentive effect* on residual profit of increasing the worker's share.

The slope of the constant expected residual profit is therefore:

$$\left(\frac{d\theta}{dw}\right)_{R^e=C^{st}} = -\frac{R^e_w}{R^e_\theta} = -\frac{(1-\theta)\left[X^e_w - (1+\tau)\right]}{(1-\theta)X^e_\theta - \Pi^e} \tag{31}$$

The denominator $E\left\{\tilde{\Pi}\right\} - (1-\theta)X^e_\theta$ may happen to be negative when the incentive effect $(1-\theta)X^e_\theta$ is positive and of sufficient magnitude.

Pure partnership Pure partnership is a corner solution of (12) implying $w = 0$ It would require as first order conditions: $\pounds_w = R^e_w + \lambda V^*_w \leq 0$ and $\pounds_\theta = R^e_\theta + \lambda V^*_\theta = 0$

We have seen that the situation in which $\theta^* > \dfrac{1}{1+\tau}$ is always a pure partnership since in this case, both R_s and C_s are decreasing functions of w in each state. The worker and the firm collude to bring the wage rate to zero, at the expense of collected taxes.

Other pure partnership solutions are possible for $\theta^* < \dfrac{1}{1+\tau}$

In this case, first order conditions imply $\left(\dfrac{d\theta}{dw}\right)_{R^e=C^{st}} \leq \left(\dfrac{d\theta}{dw}\right)_{V^*=\underline{V}}$ or from (31) and (27):

$$\frac{(1-\theta)\left[X^e_w - (1+\tau)\right]}{(1-\theta)X^e_\theta - \Pi^e} \geq \left[1-\theta(1+\tau)\right]\frac{E\left\{U'(\tilde{C})\right\}}{E\left\{\tilde{\Pi}U'(\tilde{C})\right\}} \tag{32}$$

It is intuitively expected that pure partnership should prevail when incentive effects are substantial and contribution rates are high. Moreover, we can show that in the limit case where incentive effects are neglected, partnership cannot be solution for small values of the contribution rate.

In the limit case where $p'_s(h) = 0\ \forall s$, perfunctory behaviour always prevails and $X^e_w = X^e_\theta = 0$,

The special form of (32) is:

$$\frac{(1-\theta)(1+\tau)}{\Pi^e} \geq \left[1-\theta(1+\tau)\right]\frac{E\left\{U'(\tilde{C})\right\}}{E\left\{\tilde{\Pi}U'(\tilde{C})\right\}} \tag{33}$$

For $w = 0$, $\tilde{C} = \theta\tilde{X}$, $\tilde{\Pi} = \tilde{X}$, $\Pi^e = X^e$. For notational parsimony, define $\gamma = \dfrac{E\left\{\tilde{X}U'(\theta\tilde{X})\right\}}{X^e E\left\{U'(\theta\tilde{X})\right\}}$ so that (33) can be written:

$$\frac{1-\theta(1+\tau)}{(1-\theta)(1+\tau)} \leq \gamma \tag{34}$$

We assume $\gamma > 0$ and we prove that $\gamma < 1$

From its definition, $\gamma > 0$ iff $E\left\{\tilde{X}U'(\theta\tilde{X})\right\} > 0$; a sufficient condition for this is $X_s > 0\ \forall s$

To check that $\gamma < 1$, since $U(C)$ is neoclassical, and $\theta > 0$, we write:

$COV\left\{\tilde{X}, U'(\theta\tilde{X})\right\} = E\left\{\tilde{X}U'(\theta\tilde{X})\right\} - X^e E\left\{U'(\theta\tilde{X})\right\} < 0$,

implying $\gamma = \dfrac{E\left\{\tilde{X}U'(\theta\tilde{X})\right\}}{X^e E\left\{U'(\theta\tilde{X})\right\}} < 1$

Straightforward calculations show that inequality (34) is equivalent to:

$1+\tau \geq \dfrac{1}{\theta+\gamma(1-\theta)}$. Since $\theta \in]0,1[$the convex combination $\theta+\gamma(1-\theta) \in]0,1[$, and we can define

$\hat{\tau} = \dfrac{1}{\theta+\gamma(1-\theta)} - 1 > 0$.

The condition for pure partnership is therefore $\tau > \hat{\tau}$.

Interior solutions Since solution of (12) always exist (from Weierstrass theorem) and since straight wage cannot be a solution for $\tau > 0$, interior solutions prevail when $0 < \tau < \hat{\tau}$.

By a continuity argument, this analysis still prevails if $|p_s'(h)| \leq \varepsilon\ \forall s$, when the impact of effort is sufficiently small.

The uniqueness of interior solution is not established, for want of simple convexity (concavity) arguments concerning the feasible set and the objective function.

4 A two states case and its simulation

4.1 The model

As a possible illustration, we analyze the optimum private contract and the influence of the legal profit sharing rule, considering a two states case $s = (1, 2)$ in which effort affects the probability distribution of outcomes according to:

$$p_1 = e^{-\alpha h} \; and \; p_2 = 1 - e^{-\alpha h} \tag{35}$$

Such a setting embodies in a simple form first order stochastic-dominance; effort has positive but decreasing returns in terms of expected output since $X_h^e = \alpha e^{-\alpha h}(X_2 - X_1) > 0$ and $X_{hh}^e = -\alpha^2 e^{-\alpha h}(X_2 - X_1) < 0$.

The (positive) parameter α is related to the individual power of a worker to alter the probability distribution of her/his contribution to output. In the absence of effort, $h = 0$, and the output takes on its low value with certainty. Certainty for state 2 would demand an infinite effort level.

The satisfaction level of a worker depends upon the effort level:

$$V(h) = e^{-\alpha h} U(C_1) + \left(1 - e^{-\alpha h}\right) U(C_2) - h \tag{36}$$

For interior solutions $V'(h^*) = 0$, or:

$$e^{-\alpha h^*} \left[U(C_2) - U(C_1)\right] = 1/\alpha \tag{37}$$

It must be noted that perfunctory behavior or zero effort is solution whenever

$$U(C_2) - U(C_1) \leq 1/\alpha \tag{38}$$

The condition $C_2 > C_1$ is therefore not sufficient to induce positive effort, and as intuitively expected, effort stimulation tends to become impossible when $\alpha \to 0$.

Taking logs of (37), the optimal effort level is (for interior solutions):

$$h^* = \alpha^{-1} Ln(\alpha) + \alpha^{-1} Ln \left[U(C_2) - U(C_1)\right]. \tag{39}$$

For interior solutions, the effort supply behavior determines endogenous probabilities:

$$p_1^* = \frac{1}{\alpha \left[U(C_2) - U(C_1)\right]}, \; p_2^* = 1 - p_1^*. \tag{40}$$

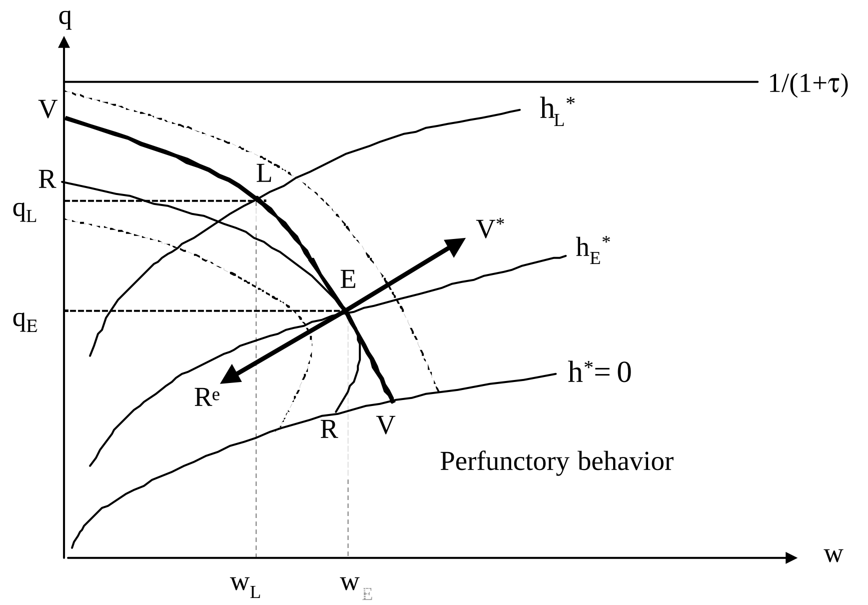
From (39), the responsiveness of effort to the profit-sharing rate is

$$h_\theta^* = \frac{\Pi_2 U'(C_2) - \Pi_1 U'(C_1)}{\alpha \left[U(C_2) - U(C_1)\right]} \tag{41}$$

-We assume bounded risk aversion so that: $h_\theta^* > 0$, as shown in 2.3.1

The curves h^* of constant effort are represented on schedule 1.

Space (w, θ), is divided in two regions by the continuous and ascending line $h^* = 0$; below this line, state S_1 obtains with certainty; above this line, (40) applies.



Schedule 1: Profit-sharing contract

From (27), the thick curve VV, representing constant values of the indirect utility function satisfying the participation constraint is represented with a negative slope. This is the case when $E\left\{\tilde{\Pi}U'(\tilde{C})\right\} > 0$. We have seen in 3.1.3 that this condition is realized in particular for $w \leq \dfrac{X_1}{1+\tau}$.

The curve RR representing constant levels of expected residual output is represented with a positive slope for small values of θ.

In fact, $R^e_\theta = -\Pi^e + (1-\theta)X^e_\theta$ may be positive if the sharing effect on expected residual profit is smaller than the incentive effect. The slope of RR is infinite when the two effects are exactly offsetting $(1-\theta)X^e_\theta = \Pi^e$. For higher values of θ, the incentive effects are decreasing and the substitution rate $\left(\dfrac{d\theta}{dw}\right)_{R^e=Cst}$ is negative.

Point E represents the private optimum as an interior solution. It implies private wage rate w_E, private profit-sharing rate θ_E and equilibrium effort level h^*_E.

4.2 Consequences of a binding legal profit-sharing rate

Point L represents the contract chosen by the firm under the binding legal profit-sharing rate $\theta \geq \theta_L$, implying the reduced wage w_L the increased effort level h^*_L and reduced expected residual profit.

Productivity enhancing effects of mandatory profit-sharing are a debated issue as illustrated by Weitzman and Kruse (1990), Kruse (1992), Jones and

Kato (1995) Prendergast (1999), Fakhfakh and Perotin (2000)

It is important to notice that the legal constraint in our exposed model actually increases expected output as measured by national accounts. But in this case, the obtained growth does not signal increased welfare for any social group, since it is compensated by more intense effort by the workers and is accompanied by reduced expected profits for the firms.

Legal profit-sharing rules do not impose to share the profit attributable to the individual employee, but a company average profit. In this case, the incentive effects tend to fade in large organizations and the model falls back to the special case where there is no incentive. The effort supply function becomes a simple participation constraint.

4.3 Simulation

Since the shape of the curves we have used is partially tentative, a simple simulation has been performed and is illustrated by schedule 2, a computed version of schedule 1.

The visible interior solution has been obtained using Constant Absolute Risk Aversion utility functions $U(C) = -e^{-\gamma C}$, for the following value of the parameters:

$X_1 = 1,\ X_2 = 5$

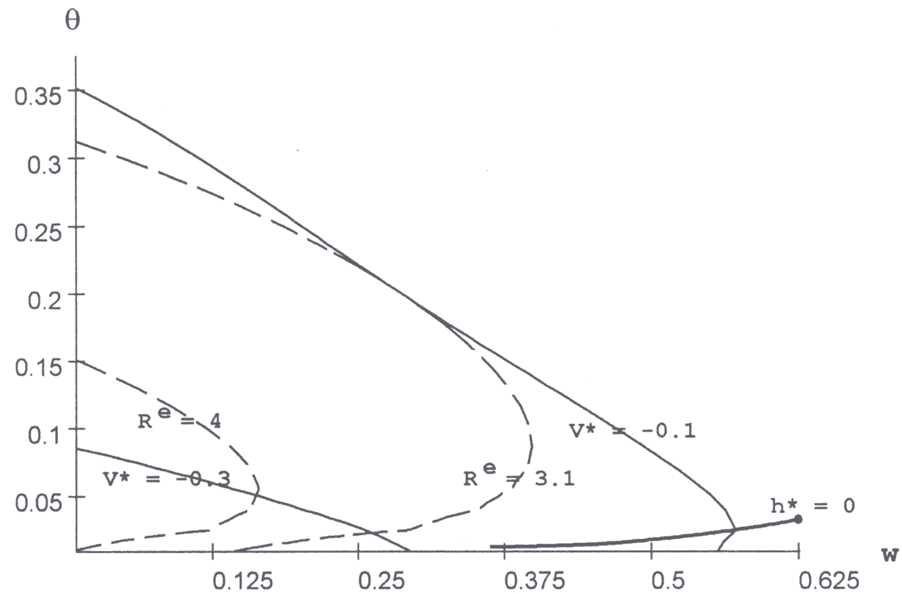
$\tau = 0.5$

$\alpha = 30$

$\gamma = 4$

Simulations confirm that "high" risk aversion levels are necessary to obtain interior solution for the chosen level of the contribution rate ($\tau = 0.5$)

Otherwise, corner solutions (pure partnerships) prevail, a consequence of the high value of the social contribution rate.



Schedule2: computed curves and interior solution

5 Conclusions

Institutional definition of wage as state independent compensation on which taxes are levied contribute, along with incentive effects, to explain the choice of contract patterns. Our model interprets the labor contract as an arbitrage between tax saving and incentive effects opposed to the cost of risk compensation. We have shown that even in the absence of incentive effect (for example in our perfunctory behavior domain) straight wage is not a solution and some risk bearing profit shares must be introduced, as long as the employer saves more on taxes than he spends in risk compensation. Private profit-sharing does not necessarily signal an incentive policy, but tax saving.

High rates of tax collection on wages and small risk aversion may in some instances induce the firm and the worker to switch to pure profit-sharing contracts.

Our investigation has been conducted in assuming that output can be ascribed individually to workers. If technology is such that output can be ascribed only at team or company level, in the adopted context, incentives tend to fade through free riding effects and the analysis is brought back to a special case with predetermined probabilities of the states of the world.

Our model may give some preliminary insights in evaluating the consequences of mandatory profit-sharing. If only a subset of the productive sector is endowed with market power and is really making profit, the rest of the economy being characterized by profit-squeezing open product competition, the firms of the first subset face a stable participation constraint which is explained by the satisfaction obtained by the worker in the competitive sector. *Binding* legal profit-sharing rates tend to induce sub-optimal substitution of wages with profit shares taking place in the profitable subset, diminishing the expected residual profit of firms and profit-based taxes, and diminishing wage rates and wage-based collected social contributions. Government and welfare agencies have therefore either to reduce the flow of their services or to increase the contribution rates they apply to the whole economy, inducing a perverse redistributive effect, the tax burden shifting from the more profitable sector to the whole economy. A noticable substitution of wages with profit shares under the influence of legislated profit-sharing has been highlighted in the French data by Mabile (1998).

6 Appendix I

Lemma

If the sequence $\{Q_s\}_{s=1}^{S}$ is increasing and if the sequence $\{P_s\}_{s=1}^{S}$ is such that $\sum_{s=1}^{S} P_s = 0$ and $\sum_{s=1}^{z} P_s < 0 \ \forall z < S$, then $\sum_{s=1}^{S} P_s Q_s > 0$

Proof : $\sum_{s=1}^{S} P_s Q_s = \sum_{s=1}^{S-1} P_s Q_s + P_S Q_S$

From the assumptions, $-\left(\sum_{s=1}^{S-1} P_s\right) = P_S > 0$

and with the inequality $Q_S > Q_{Q\,S-1}$ this implies:

$$P_S Q_S > -\left(\sum_{s=1}^{S-1} P_s\right) Q_{S-1} \qquad (42)$$

If $S = 2$, this inequality may be rewritten $P_2 Q_2 + P_1 Q_1 > 0$ and the proof is completed.

If $S > 2$, inequality (42) may be written in the following way:

$P_S Q_S > -\left(\sum_{s=1}^{S-2} P_s + P_{S-1}\right) Q_{S-1}$ or

$P_S Q_S + P_{S-1} Q_{S-1} > -\left(\sum_{s=1}^{S-2} P_s\right) Q_{S-1}$

$Q_{S-1} > Q_{S-2} \Longrightarrow -\left(\sum_{s=1}^{S-2} P_s\right) Q_{S-1} > -\left(\sum_{s=1}^{S-3} P_s + P_{S-2}\right) Q_{S-2}$ and therefore:

$P_S Q_S + P_{S-1} Q_{S-1} + P_{S-2} Q_{S-2} > -\left(\sum_{s=1}^{S-3} P_s\right) Q_{S-2}$

Reiterating this process until exhaustion yields the final result $\sum_{s=1}^{S} P_s Q_s > 0$

Conversely, if the sequence $\{Q_s\}_{s=1}^{S}$ is decreasing, the same assumptions about the sequence $\{P_s\}_{s=1}^{S}$ imply $\sum_{s=1}^{S} P_s Q_s < 0$

7 Appendix II

It is possible to check wether our model confirms the solution in which the agent is made residual claimant of output when her/his risk aversion is nil.

In order to exhibit this special case, we have to relax our institutional constraint $w \geq 0$ and admit $\tau = 0$ since there are no negative taxes contributing to residual profit when wages are negative. First order conditions related to the modified problem (12) or the equality of slopes $\left(\frac{d\theta}{dw}\right)_{R^e=C^{st}}$ and $\left(\frac{d\theta}{dw}\right)_{V^*=C^{st}}$ imply:

$$[1-\theta(1+\tau)]\frac{E\left\{U'(\tilde{C})\right\}}{E\left\{\tilde{\Pi}U'(\tilde{C})\right\}} = \frac{(1-\theta)\left[X_w^e-(1+\tau)\right]}{(1-\theta)X_\theta^e-\Pi^e} \tag{43}$$

From (8), in the case of no risk aversion, the effort level is not influenced by the wage rate, since $U'(C_s) = C^{st}$ $\forall s$ and therefore since $h_w^* = 0$, $X_w^e = X_h^e h_w^* = 0$

The condition (43) takes on the simplified form, for $X_w^e = 0$,and $\tau = 0$:

$$\frac{(1-\theta)}{\Pi^e} = \frac{(1-\theta)}{\Pi^e-(1-\theta)X_\theta^e} \tag{44}$$

This equality implies either $X_\theta^e = 0$ or $\theta = 1$

We have shown that in the case of no risk aversion, the responsiveness of effort to the profit-sharing rate h_θ^* is always positive. Since $X_\theta^e = X_h^e h_\theta^*$, the solution $X_\theta^e = 0$ is ruled out, and we conclude that $\theta = 1$.

It is worth noticing that with the adopted continuous effort supply function, the risk neutral worker should therefore be made residual claimant as in Lazear (1999).

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