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Abstract

This paper aims at analyzing the relationships between teamwork, autonomy and individual evaluation interviews. Within an agency model with teamwork, we show that a production technology characterized by strong horizontal interdependencies and super-modularity does not ensure coordination within a team. Such technological characteristics seem more frequent when firms use new organizational devices favoring quality, time or cost cuts targets. In such organizations, the monetary cost of coordination incentives is increasing with the relative level of technological interdependencies. Hence, the principal is incited to resort to non-monetary incentives that are less costly for her. Evaluation interviews may play a role of non-monetary incentives towards coordination by generating a signal aimed at convincing workers of the existence of a team spirit. According to this point of view, the traditional issue of the relationship between autonomy and evaluation interviews vanishes. The predictions of this model are then tested empirically using French data drawn from the surveys “Changement Organisationnel et Informatisation” (1997), “Techniques et Organisation du Travail” (1987 and 1993), and Conditions de Travail (1991 and 1998).

Key Words: Teamwork, Moral Hazard, Coordination, Monetary and Non-monetary Incentives, Evaluation.

JEL Classification: L23, D82, J33.

1. Introduction.

Since the mid-1990s, the causes and consequences of widening earnings inequality have been widely debated among Anglo-Saxon economists. A growing literature argues that the traditional link between employment and earnings becomes obsolete in a context of increasing competition and changes in technologies and organizations. Employers would no longer find it profitable to pay a fixed wage as a counterpart of the right to decide about job contents. They would have to stimulate the adhesion of workers to the firm objectives while letting them the discretion to choose their work method and to share industrial risks by indexing earnings on individual or collective performance measures. In fact, governments in the United States as well as in the United Kingdom have adopted programs favoring profit sharing, profit related pay, save schemes and company stock option plans (Conyon and Freeman, 2001), thereby contributing to the development of earnings inequality.

The classical agency model of Holmström and Milgrom (1991) gives a theoretical justification for the joint development of autonomy and pay plans based on individual performance measures. An agent is autonomous if she is given freedom to choose how to allocate her time, pursuing personally beneficial activities being no longer deterred. In such settings, it is optimal for the principal to make the agent financially responsible for her productive performance. Autonomy and individual performance based pay are therefore associated with strong performance evaluation.

Together with the diffusion of autonomy, an important direction in firm level organizational changes in the 1990s is the development of horizontal interdependencies between workers (Greenan, 2001). Organizations that use cost cut devices (lean production) impose tight time constraints on production (just in time) or set high quality standards (TQM, ISO certification) make employees work more sensitive to each other. The diffusion of teamwork (autonomous team work, problem solving groups, value analysis groups, project teams etc.) is often considered as a complementary device to these changes in work organization.

Accounting for interactions within a team of workers renders the predictions of the agency theory far more complex. Itoh (1992) shows that, in Holmström and Milgrom's (1991) model, the optimal contract with relative performance evaluation is incompatible with teamwork (joint responsibility for two tasks to two agents) because it could lead to "sabotage" behaviors. Using a sample of steel minimills establishments, Boning, Ichniowski and Shaw (2001) show that teams are efficiently adopted only in the presence of group incentive rather than individual incentive pay plans. Kandel and Lazear (1992) also show that free riding within teams can be solved only through non-monetary mechanisms such as peer pressure or social norms. In this case, the group that serves as a reference for the collective performance index should be the peer group.

Finally, an element often emphasized in the Anglo-Saxon literature relates to the complementarity between organizational practices and incentive devices. The productivity gain from adopting the complementary practices together would exceed the sum of their individual productivity effects if they were adopted separately. This idea is developed for instance by Milgrom and Roberts (1990), Holmström and Milgrom (1994) and Baker, Gibbons and Murphy (1994). Several studies on American data, in particular Ichniowski, Shaw and Prennushi (1997), give empirical evidence of this property.

Our short survey of the literature tends to stress a first line of complementarity between autonomy and individual performance based pay, and a second one between horizontal interdependencies within groups, collective performance based pay and peer pressure or social norms.

Up to now the discussion has focused on Anglo-Saxon economies since it is implicitly in reference to this institutional context that most of the incentives literature has expanded. If we consider the French context, there seems to exist a paradox. In the 1990s, compared to Anglo-Saxon economies, France could be described as an economy with flexible employment and rigid wages. If flexibility in work contracts has been privileged, there has been a very little diffusion of wage individualization and non-compulsory profit sharing schemes. Work flexibility has also expanded: new organizational practices have widely been adopted (Greenan, 2001, Greenan and Hamon-Cholet, 2000) and the nature of job content described by employees has largely changed (Césard, Dussert and Gollac, 1991 ; Aquain, Bué and Vinck, 1994 ; Bué and Rougerie, 1999). Lastly, if individual performance based pay is less adopted in French firms than in Anglo-Saxon ones, individual evaluation interviews have become a widespread practice: in 1997, among the permanent employees of manufacturing firms with more than 50 employees, 68% of bosses and 45% of their subordinates were evaluated through an interview at least once a year.

This paper aims at identifying the underlying logics of individual evaluation interviews. Whereas performance evaluation receives a large attention, firm-level evaluation interviews are strikingly left aside from economic analysis. On the contrary, French sociologists did investigate this line of research. We will refer to these works along the article. We both wish to shed a light on the contradictions that seem to emerge from theoretical and empirical analyses regarding the Anglo-Saxon economies, and to understand the conditions under which individual evaluation practices may diffuse, in a context where individual performance based pay has remained inert. We choose to explore theoretically and empirically the relationships between teamwork, horizontal interdependencies and individual evaluation interviews.

In a first section, we present a basic agency model with individual and team production. We show that the standard contract proposed by the principal does not allow solving the problem of moral hazard within team in the presence of horizontal technological interdependencies. In a second section we establish the conditions under which coordination within team may emerge. We show that evaluation interviews may serve as a non-monetary mechanism towards coordination and we reconsider organizational and technological choices in the light of such a result. Our third section summarizes the results of the model. Lastly, in a fourth section, the main predictions of this model are tested econometrically using French data from a matched employer /employee survey on Computerization and Organizational Change (survey "Changements Organisationnels et Informatisation"), conducted in 1997 by the French ministries of Labor (DARES), Industry (SESSI), Trade and Services (SCEES) and INSEE.

2. Individual and team production in a standard agency model

The development of various managing devices favoring teamwork (quality circles, autonomous work groups, problem solving groups, project teams etc.) and thereby joint responsibility for complex tasks reveals that firms often confront team production when choosing their organization. We formalize it by considering a *static* principal-agent framework, inspired by Che and Yoo (2001), in which production requires only one task. This task can be performed by a single agent (individual production) or by a team of two agents (team production). In both cases, agents make an effort decision unobservable by the principal. The agency relationship hence is characterized by moral hazard. The following table characterizes the production technology depending on whether the task is performed by an individual or by a team.

	INDIVIDUAL PRODUCTION	TEAM PRODUCTION
PRODUCTION Random variable X $X = \begin{cases} 1 & \text{if success} \\ 0 & \text{otherwise} \end{cases}$	1 task 1 agent X is the performance of the task by one agent	1 task 2 agents (1 and 2) X is the performance of the task by a team of 2 agents (X is a group signal)
EFFORT Aggregate effort takes 3 values : 0,1 or 2	Individual effort of the agent : $K \in \Theta = \{0,1,2\}$ (K is a random variable)	Individual effort of agent i : $K_i \in \Theta = \{0,1\}$, $i=1,2$ (K_i is a random variable)
PROBABILITIES Of success or failure of the task	$Pr(X=1 K=k) = q_k$ $Pr(X=0 K=k) = 1 - q_k$	$Pr(X=1 K_i=k_1, K_j=k_2) = p_{k_1 k_2}$ $Pr(X=0 K_i=k_1, K_j=k_2) = 1 - p_{k_1 k_2}$ $i=1,2 ; j=1,2, i \neq j$

Note that aggregate effort is normalized to 2. The fact that agents can perform at most one unit of effort within the team is not problematic since, on the one hand, we are interested in the conditions that guarantee the actual selection of such an effort level, and on the other hand, the agents' aggregate working cost remains the same as the one of an agent picking two units of effort under individual production.

Production, that is the realization of the task, is a random variable X that can either succeed ($X=1$) or fail ($X=0$), giving R and 0 payoffs to the principal, respectively.

2.1. Assumptions and definitions

The main properties of the model are defined by three assumptions stated in the table below. Assumption 1 defines standard utility functions. Assumption 2 establishes the relationships between effort of probability of success. The task is more likely to succeed the higher the agent's effort level. The assumptions $p_{11} > p_{01}$ and $2q_1 \geq q_2$ guarantee that the participation constraints are fulfilled (see Appendix A), and $p_{01} = p_{10}$ implies symmetry of agents within team. Assumption 3 lastly expresses the possibility of a sabotage behavior within team. When an agent shirks, the probability of success can be positive, but it is higher within a team than under individual production ($p_{10} > q_0$). However, if the aggregate effort is null (all agents shirk), the probability of success is lower with team production than with individual production ($p_{00} < q_0$). This may stem from a negative shirking externality (Lazear, 1989). Here, sabotage is assimilated to a free-riding behavior, costless for the agent but with a negative impact on the peers. Intuitively, when an agent shirks and lowers information flows within a team, she reduces the productivity of the other team members. By the way, when the aggregate effort level is null, the probability of success of the task is not necessarily null since free-riding does not automatically destroy the entire production.

	INDIVIDUAL PRODUCTION	TEAM PRODUCTION
ASSUMPTION 1 : Utility functions	<i>The principal is risk-neutral, with a linear VNM utility function $b(r)=r$</i> <i>The agents are risk-averse with a utility function</i> <i>$U(r,k) = u(r)-v(k)$ where :</i> <i>- u is increasing, concave such that : $u(0)=0$, $u(r) \geq 0 \ \forall r \geq 0$.</i> <i>- The agent's disutility of effort is given by $v(k) = e \times k$ where the effort unit, labeled e, is strictly positive.</i> <i>- The agents' utility reservation is null.</i>	
ASSUMPTION 2 : Links between effort and probability of success	$1 > q_2 > q_1 > q_0 \geq 0$ $2q_1 \geq q_2$	$p_{11} > p_{01} = p_{10} > p_{00} \geq 0$
ASSUMPTION 3 : Possibility of sabotage	$p_{10} > q_0 > p_{00}$	

When deriving the characteristics of the model, we will stress three properties of the production technology. The first one is a technical characteristic that can be defined both with individual and with team production: super-modularity or sub-modularity. When production is super-modular (respectively sub-modular), the return on effort is increasing (respectively decreasing) in the level of effort.

	INDIVIDUAL PRODUCTION	TEAM PRODUCTION
DEFINITION 1.		
Super-Modularity :	$q_2 - q_1 \geq q_1 - q_0$	$p_{11} - p_{10} \geq p_{10} - p_{00}$
Sub-Modularity :	$q_2 - q_1 \leq q_1 - q_0$	$p_{11} - p_{10} \leq p_{10} - p_{00}$

The two other properties characterize team production only: horizontal technological interdependence and synergy. Horizontal technological interdependencies measure the increase in the probability of success (i.e. in the productivity) when one agent increases her effort level, for a given effort level of the other team member. When they are positive, such interdependencies capture the fact that teamwork makes an employee's productivity more dependent on the effort expended by her co-workers. Synergy makes team output higher than the sum of individual production levels.

	TEAM PRODUCTION
DEFINITION 2.	
Horizontal technological interdependencies :	Assumption 2 implies $\Delta_0 = p_{01} - p_{00} > 0$ and $\Delta_1 = p_{11} - p_{10} > 0$ Where $\Delta_k = p_{k1} - p_{k0}$ measures the level of technological interdependence within team
DEFINITION 3.	
Synergy :	Degree of synergy within team: $s = p_{11} - q_2$

These properties can be related to the descriptions made in the literature on new organizational forms. Empirical works on work intensification (Gollac and Volkoff, 1996) suggest that firms would prefer higher effort levels, which we associate in our model to technological super-modularity. Besides, innovative organizational practices adopted at the firm level all tend to make one's work outcome more sensitive to the others' efforts rather than to « individualize »¹ work by isolating workers from one another. The strong requirements of reorganized firms in terms of quality, time constraints, cost cut devices and layering reinforce interactions by eliminating factors facilitating the absorption of local shocks such as a machine breakdown, a worker tiredness, a supply problem (Greenan, 2001). In our model, this may lead to team work with strong technological interdependencies. Lastly, by developing new group work techniques, management might seek to promote synergy within teams.

2.2 Optimal contract proposed by the principal and moral hazard within team

The contract proposed by the principal is composed of two variables: the effort level required and the corresponding premium. The optimal premia are determined by the incentive compatible constraints and by the participation constraints. The participation constraint establishes that the agent's expected utility must be at least equal to her reservation utility (if she refuses the contract) and the incentive compatible constraint guarantees that the effort level chosen by the agent maximizes her expected utility.

In the case of team production, only a global group signal is available for the principal. Hence, she can only propose contracts with symmetric effort levels. The characteristics of the optimal

¹ Within manufacturing companies, work is not spontaneously « individual » as it can be within craft firms. It is rather a set of devices that shape it as such. « Individualization » of blue-collar work is a major stake of principles of scientific organization of work recommended by engineers like Taylor.

contract are summarized in the following table. Results 1 and 2 are proved in Appendix A, and result 3 in Appendix B. w_k^* is the optimal premium for a required effort k and $w_{k_1 k_2}^*$ is the optimal premium for effort levels k_1 et k_2 required to agents 1 and 2.

Individual Production	Team Production
Result 1 $w_0^* = 0$ <i>Sub-Modularity:</i> $w_1^* = u^{-1}(e/(q_1 - q_0))$, $w_2^* = u^{-1}(e/(q_2 - q_1))$ <i>Super-Modularity:</i> w_1^* indeterminate, $w_2^* = u^{-1}(2e/(q_2 - q_0))$ <i>Optimal contract proposed :</i> $(k^* = 2 ; w_2^*)$	Result 2 $w_{00}^* = 0$ $w_{11}^* = u^{-1}(e/(p_{11} - p_{01}))$

In the team production regime, after signing the contract proposed by the principal, agents make their effort decision in the context of a coordination game, which payoffs matrix is given in Appendix B.

Result 3. The incentive premium does not solve the moral hazard problem of the team.

Under assumptions 2 and 3, the coordination game within team has :

- *A unique Nash equilibrium (1,1) when $\Delta_1 < \Delta_0$ (case a).*
- *Two Nash equilibria (0,0) and (1,1) when $\Delta_1 \geq \Delta_0$ (case b) .*

The Pareto-optimal equilibrium (1,1) is unique only when the team production technology is sub-modular. However, if new organizational forms are characterized both by higher horizontal interdependencies and by super-modularity (under team production), the equilibrium (1,1) is no longer unique, it is even risk-dominated in the sense of Harsanyi and Selten (1988) by the equilibrium (0,0). Despite positive horizontal interdependencies and synergy, the optimal incentive premium does not solve the moral hazard problem that can lead to a sub-optimal effort equilibrium level (both agents shirk).

Definition 4. Coordination within the team.

Coordination within the team corresponds to the implementation of the Nash Pareto-Optimal equilibrium (1,1) by the agents.

3. Teamwork and Coordination.

Since the optimal contract does not allow solving the moral hazard problem of the team, two issues arise for the principal. On the one hand, should the principal resort to individual or team production? On the other hand, if she prefers team production, can the principal incite agents to coordinate on the Pareto-optimal equilibrium?

3.1. Monetary incentives towards Coordination.

Let w_{11}^{**} be a wage premium that, when it exists, motivates team members to reach the Pareto-optimal equilibrium (1,1). w_{11}^{**} must satisfies, in addition to the participation and incentive compatible constraints, the following *coordination constraint* : $(p_{10} - p_{00}).u(w_{11}^{**}) > e$.

Such a coordination constraint guarantees that the working strategy (effort level equal to 1) is the best reply to the shirking strategy (partner choosing a zero effort). When it is satisfied, (1,1) is the unique Nash equilibrium of the coordination game with super-modularity. We therefore have the following result.

Result 4. The Moral hazard problem can be solved by a Bonus.

When $\Delta_1 \geq \Delta_0$, the principal can propose a bonus w_{11}^{**} which motivates team members to coordinate, where $w_{11}^{**} = u^{-1}(e/(p_{01} - p_{00})) + \varepsilon$, $\varepsilon > 0$.

When $\Delta_1 \geq \Delta_0$, $u^{-1}(e/(p_{01} - p_{00})) > u^{-1}(e/(p_{11} - p_{01}))$. Since $\varepsilon > 0$, w_{11}^{**} is much higher than w_{11}^* . The principal hence has to pay a bonus to each agent. Besides, the higher the gap between Δ_1 and Δ_0 , the higher the difference $w_{11}^{**} - w_{11}^*$. Monetary incentives towards coordination reveal to be highly costly for the principal.

3.2. Non-monetary incentives towards Coordination: correlated equilibrium.

Given that the monetary cost of coordination incentives is increasing with the relative level of horizontal interdependence, can the principal resort to non-monetary incentives devices to reach the Pareto-optimal outcome? In such a moral hazard problem within team, each agent ignores whether her co-worker shirks or not. Each individual hence forms beliefs over her partner's strategy, and chooses an effort level given these beliefs. Let $m_i = \Pr(k_i=1)$ and $1-m_i = \Pr(k_i=0)$. Such probabilities may be interpreted as the players' beliefs over their peer's behavior. We now therefore consider a mixed strategies Nash equilibrium. Such an equilibrium is characterized by the following result (the proof is given in Appendix B).

Result 5. Coordination equilibrium in mixed strategies.

The only mixed strategies Nash equilibria are degenerated : $((1,0), (1,0))$ and $((0,1), (0,1))$.

Result 5 shows that both agents make an effort decision $k_i = 1$ ($i = 1, 2$) only if they are sure that their partner adopts the same strategy. If the principal wants agents to coordinate on the Pareto-optimal equilibrium, she must design organizational devices affecting the probabilities associated with each strategy. We argue that evaluation interviews, which are formally defined in Appendix C.5, represent a mean to generate an ex ante signal towards the other agents to reinforce their beliefs over the team spirit. Our approach therefore contradicts the common view of evaluation interviews as devices aimed at evaluating ex-post effort or performance².

An important difficulty lies in the fact that the outcome of an evaluation interview is only known by the principal and the interviewed agent. It is therefore not public. In turn, it seems hard to figure out how the evaluation interview of an agent i would generate a signal (regarding herself) towards the other agents j , $j \neq i$.

Though this may seem counter-intuitive at first sight, we will show that the individual evaluation interview is such that it does in fact make public the outcome of the interview. We assume that the interview is run before production takes place and agent i 's type $t_i \in \Lambda_i = \Lambda = \{H, L\}$ is private information where $H = \ll \text{has team spirit} \gg$ and $L = \ll \text{has no team spirit} \gg$.

How to define Team Spirit ? We will adopt the following Kant based definition.

² Some field works show that the interview does not necessarily lead to an immediate wage bargaining but rather to a transfer of information and an exchange over the representations and reciprocal expectations of the employee and her interviewer (Eustache, 2001), whereas others stress the increasing emphasis on behavioural criteria in these interviews, team spirit being one criterion among others such as « savoir être », motivation, hard working, ability to communicate (Myniem, 2002). Here, we consider the simple case where the only criterion to evaluate is *team spirit*.

Definition 5. Team Spirit.

Let us consider a 2-persons team. An agent i , $i=1,2$, (who belongs to this team) has a team spirit if she plays the effort $k_i^* \equiv \underset{k_i}{\text{ArgMax}} \phi(p_{kij} \cdot u(w_{11}^*), p_{kij} \cdot u(w_{11}^*) - e \cdot k_j)$, $i \neq j$.

Where ϕ is an aggregation function, $p_{kij} \cdot u(w_{11}^*)$ is the expected utility of agent i , $p_{kij} \cdot u(w_{11}^*) - e \cdot k_j$ is the net expected utility of agent j , and w_{11}^* is the optimal wage the principal is willing to pay.

Broadly speaking, an agent i has a team spirit if he takes into account, when choosing his effort:

- his expected utility but his effort,
- both the expected utility and the effort of the other agent,
- the incentive wage the Principal is willing to pay.

This definition seems interesting because it includes a large range of behaviors, from $\phi(p_{kij} \cdot u(w_{11}^*), p_{kij} \cdot u(w_{11}^*) - e \cdot k_j) = p_{kij} \cdot u(w_{11}^*)$ to $\phi(p_{kij} \cdot u(w_{11}^*), p_{kij} \cdot u(w_{11}^*) - e \cdot k_j) = p_{kij} \cdot u(w_{11}^*) - e \cdot k_j$.

For the sake of simplicity, let us take $\phi = +$. Therefore, $\phi(p_{kij} \cdot u(w_{11}^*), p_{kij} \cdot u(w_{11}^*) - e \cdot k_j) = p_{kij} \cdot u(w_{11}^*) + p_{kij} \cdot u(w_{11}^*) - e \cdot k_j$. That is $\phi(p_{kij} \cdot u(w_{11}^*), p_{kij} \cdot u(w_{11}^*) - e \cdot k_j) = 2p_{kij} \cdot \frac{e}{\Delta_1} - e \cdot k_j$.

Agent i has to choose between $k_i = 1$ and $k_i = 0$. Since $p_{1kj} > p_{0kj}$, $\forall k_j = 1, 0$ then $2p_{1kj} \cdot \frac{e}{\Delta_1} - e \cdot k_j$

$> 2p_{0kj} \cdot \frac{e}{\Delta_1} - e \cdot k_j$. That is an agent i who has a team spirit will always choose $k_i = 1$.

Let us go back to the individual evaluation interview. The goal of the interview³ is to make agents reveal their type, but there is no reason for them to tell the truth.

Let now define the following mechanism M:

- 1) The interview is run over a population of n individuals, $n \geq 2$.
- 2) The Principal knows (without loss of generality⁴) the proportion n_0/n of agents who have team spirit, where $n_0 \geq 2$.
- 3) The Principal runs the interview and if she observes that the number of individuals who declare to be of type H (labeled \hat{n}_0) is strictly higher than n_0 , then she knows that at least one individual (among the \hat{n}_0) lies. In such a case, the Principal stops the process : *No team*.
- 4) If $\hat{n}_0 \leq n_0$, the Principal randomly selects two agents among the \hat{n}_0 who declare to be of type H.
- 5) Each interviewed individual receives the outcome of her own interview.

We assume that the mechanism M is *common knowledge* and that there is *no envy* from the individuals.

Result 6.

The mechanism M is strategy-proof.

³ Our approach may be considered as traditional in the sense that it simply consists in elaborating a revelation mechanism (see for instance Barbera and Dutta, 2000). Another approach would consist in allowing a pre-play communication among agents (cheap-talk) during which the latter mutually send each other private messages over their types, such a communication being followed by a public checking of the messages sent (see Forges, 1990 ; Barani, 1992 ; Ben-Porath, 2003).

⁴ If the principal does not know the proportion of agents who have team spirit, then this proportion is a random variable for him. Let us call it \aleph and let us suppose that the principal knows its support $\aleph = [n_{\inf}/n, n_{\sup}/n]$, with of course $n_{\inf} \geq 2$. Then if the principal takes $\text{Inf}\aleph$ (that is if the principal is *prudent*) as the proportion of agents who have team spirit then the mechanism M is still strategy-proof.

Result 6 shows that M is such that truth-telling is a dominant strategy for the interviewed agents.

Proof.

See Appendix C.1.

■

Corollary 1.

M being common knowledge, when the Principal forms the team, each agent within the team infers that the other team member has team spirit, even though she does not observe the outcome of the other agent's interview.

■

In other words, the mechanism M generates⁵ public signals⁶ θ_i ($i=1,2$) over the type of each team member. Besides, since M is strategy-proof, such public signals exactly coincide with the t_i s.

Corollary 2.

M being common knowledge, when the Principal forms the team, each agent within the team fully trust in the reliability of the signals sent.

■

Hence, before making her effort level decision, each agent can observe the realization of a signal $\theta_i \in \Lambda = \{H, L\}$, $i = 1, 2$, where θ_i is a random variable concerning the « team spirit » of player i . It also seems natural to assume that the signals θ_1 and θ_2 are independent.

Corollaries 1 and 2 show that agents *fully trust* in the reliability of the signals generated by such a mechanism and that the former are *public*. Lastly, let us remark that the *principal* knows that the agents take w^*_{11} into account when choosing their optimal effort level, so that she keeps on paying the bonus after having observed the agents' type (H or L). Moreover, it follows directly from the definition of team spirit that the agents *do believe* that the signal θ_i is *perfectly correlated* with the effort variable of agent i , K_i , so that when i observes $\theta_j = H$ (respectively $\theta_j = L$), $i \neq j$, she believes that $k_j = 1$ (respectively $k_j = 0$) and it is then optimal to decide $k_i = 1$ (respectively $k_i = 0$).

Result 7. Nash Correlated Equilibrium.

When the mechanism M is implemented, the unique Nash correlated equilibrium is $(1,1)$.

Proof.

See Appendix C.2.

■

⁵ It seems that in France, entry contests college establishments ("Grandes Ecoles") give a good illustration of the mechanism M . Indeed, students who enter such establishments believe they are of the same type and such a belief contribute to the emergence of a « corporative spirit » which, according to Bourdieu (1989) « is the condition for the emergence of social capital, this collective resource that allows each member of an integrated group participating in the individual capital owned by all the others ». The relationship between evaluation interview and teamwork is clearly highlighted in a monography of Balazs and Faguer (1996) realized in a firm from the information technology sector. These authors describe how headquarters manipulate, during the evaluation interview, the employees' relation to the education system, the latter being often « over-educated » in this firm.

⁶ A public signal is not necessarily made explicitly public (by the principal).

Receiving a signal from the principal leads to a Nash correlated equilibrium. The production cost of such a signal, that is the cost of an evaluation interview, is measured by the time devoted to this interview. The principal runs the interview and does not receive any reward from it, the interview cost per agent therefore is equal to αw_{11}^* , $\alpha \in [0,1]$.

Definition 6. Value of the individual evaluation interview.

*The value of the individual evaluation interview is given by function $\psi(\alpha) = w_{11}^{**} - (1+\alpha)w_{11}^*$, where $\alpha \in [0,1]$.*

According to this definition, $\psi(0) > 0$. When the interview cost is null, non-monetary incentives towards coordination are always optimal. Such a remark can be generalized in the following result (see the proof in Appendix C.3).

Result 8. *There exists $\alpha_0 \in]0,1]$ such that $\psi(\alpha) > 0$ for all $\alpha < \alpha_0$.*

The value of α being under control of the principal, the latter finds it profitable to resort to evaluation interview to encourage coordination, especially when technology is strongly super-modular (see appendix C.4)

Corollary 3. Negative impact of individual evaluation interviews on the premium.

The principal pays a lower premium when agents are individually interviewed than when there are no evaluation interviews (and monetary incentives have to be proposed).

3.3. Technological and organizational decisions

We have shown (result 3) that the traditional incentive premium does not allow solving the problem of moral hazard within team in the presence of super-modularity. Two issues are therefore still at stake: on the one hand, given the production structure, will the principal choose a super-modular or a sub-modular technology? On the other hand, given the production technology, is teamwork more profitable than individual production? Technological and organizational choices are characterized by the following three results (proofs are given in Appendix D).

Result 9. Superiority of super-modular technology.

Whatever the production structure (teamwork or individual production), the principal will choose a super-modular technology.

Let assume that the principal has access to a super-modular technology, and let consider the issue of organizing production: team production *versus* individual production.

Result 10. Team value for the principal.

When technology is super-modular, the following conditions are equivalent:

(1). *The principal prefers team production to individual production.*

(2). $\Delta_1 = p_{11} - p_{01} > \eta$ where $\eta = \frac{e}{u \left[R(p_{11}-q^2)+q^2 \right] u^{-1} \left(\frac{2e}{q^2-q_0} \right) / 2p_{11}(1+\alpha)}$

Hence, when technology is super-modular, the team value is positive⁷ when $\Delta_1 = p_{11} - p_{01}$ is higher than a threshold level η that depends on the *cost of the evaluation interview* (α), the *agent's attitude towards risk* (function u) and the *degree of synergy*.

Lastly, the principal will choose between two organizational designs: either « individualizing » production and intensifying effort by making the agent both more autonomous and financially more responsible for her performance, or forming a team that will share effort, rely on synergy and structure itself upon horizontal interdependencies. In the former organization, the principal needs to monitor the employee's performance. In the latter organization, evaluation interview guarantees the existence of a team spirit inducing coordination on the Pareto-optimal equilibrium. Results 9 and 10 show that such a configuration is not only feasible, it is also very likely to occur.

Let consider now the agent's point of view. Let assume that sabotage behaviors may arise when the principal unilaterally imposes teamwork. Result 11 defines⁸ the conditions under which the principal can rely on technological super-modularity, teamwork and voluntary participation of each agent to the team.

Result 11. Team value for the agent.

When technology is super-modular, the following conditions are equivalent:

- (1). *The agent prefers team production to individual production.*
- (2). $\frac{p_{11}}{q_2} < \frac{p_{01}}{q_0}$.

This result shows that team production leads to two conflicting effects for the agents: a negative effect when team has synergy (with the ratio p_{11}/q_2), and a positive effect associated with an insurance mechanism (with the ratio p_{01}/q_0). Team makes agents more dependent on the final outcome, and all the more as the team has synergy. But team also allows each agent insuring herself against the risk of her own failure when one agent shirks (p_{01}/q_0 hence represents the degree of insurance against the risk of failure within team). In turn, agents prefer team production to individual production only when the insurance motive is stronger than the negative synergy effect. Such a condition is independent of agents' attitude towards risk, and when it is fulfilled, it states that team represents a mean of sharing the effort level required by the principal between agents (the maximum effort level equal to 2).

4. Summary of the main results of the model

The model proposed in this paper shows that new organizational forms characterized by a production technology having horizontal interdependence, super-modularity and synergy find it profitable to implement teamwork. To encourage teamwork, new organizational forms resort to three main tools:

- They use horizontal interdependence and synergy to pay a lower premium with team production than with individual production.
- Without synergy ($p_{11} = q_2$), they use self-monitoring ($p_{01} = q_0$) when it is available.
- Lastly, they present team as a risk-sharing and effort-sharing productive structure.

However, since coordination on the Pareto-optimal equilibrium is not automatic and monetary incentives towards coordination are costly, new organizational forms find it profitable to implement non-monetary incentives towards coordination within team. In this retrospect,

⁷ Appendix D.3 shows the relationship with a result of Che and Yoo (2001).

⁸ We find in Appendix D.5 a case where production is impossible.

individual evaluation interviews, rather than evaluating effort, which is unobservable within teams, would produce a signal towards employees regarding the "team spirit" of their peer.

Finally, the issue of autonomy that is of the freedom to pursue personally beneficial activities vanishes. Indeed, what governs the time allocation of workers among productive tasks is the degree of synergy and horizontal interdependence between workers. If autonomy is higher within new organizational forms, it is not, in this model, the outcome of a strategic decision by the principal.

5. Empirical analysis.

We wish to check the underlying logics of evaluation interviews in French firms. Are evaluation interviews a byproduct of the triplet « individualized work », autonomy and performance based pay peculiar to the standard agency theory, or are they rather complementary to teamwork, strong horizontal interdependence and synergy ? We are going to use the matched employer / employee survey on Computerization and Organizational Change (COI, 1997) in order to test the main predictions of our theoretical model.

5.1 Testable predictions of the model

A first implicit assumption in our argument is that organizations that use practices like cost cut devices (lean production), impose tight time constraints (just in time) or set high quality standards (TQM, ISO certification) increase the productive interdependence between workers (horizontal interdependence and super-modularity). The underlying technology of these new organizational forms increases the efficiency of team production compared to individual production (results 9 and 10). Our theoretical model hence provides analytical foundations to the complementarity between workplace practices that increase interdependencies and teamwork such as « self managed teams », « problem-solving teams » or « project teams » which both imply joint responsibility of complex tasks and favor synergy. This leads to the following prediction:

Prediction 1: Lean production, just in time, high quality standards (TQM, ISO certification) or layering are complementary to teamwork. Within firms that have adopted these new organizational devices, employees are more interdependent in terms of production flows and/or information flows.

The model also shows that the monetary cost of incentives towards coordination is high (result 4). We argue that by using individual evaluation interviews, the principal produces signals aimed at strengthening beliefs in team spirit. It thus encourages coordination towards the Nash Pareto-optimal equilibrium while minimizing the incentive costs (results 7 and 8). We therefore expect that:

Prediction 2: Individual evaluation interviews are more often implemented within collective work contexts and/or within organizations adopting innovative workplace practices.

Our model proposes a theory of annual evaluation interviews that stands as an alternative to the standard agency model according to which interviews would aim at measuring ex post performance of agents free of allocating their productive time.

The evaluation device would be associated with performance based pays in order to make employees financially responsible of their work involvement (Holmström and Milgrom, 1991)⁹. The following three predictions allows testing the relative contributions of the agency theory and our model to the observed distribution of annual evaluation interviews. If the dominant force governing evaluation interviews in France is captured by our model, then the issue of the agent's autonomy in the allocation of productive time vanishes to the benefit of the intensity of the agent's interactions with her peers :

Prediction 3: The degree of interdependence between workers has a stronger impact on the use of individual evaluation interviews than does autonomy.

In the line of results 6 to 10, we also consider that individual evaluation interviews are not implemented to support an incentive rewarding policy but rather to support a system of beliefs and expectations over team spirit and work recognition within team by the principal. Hence :

Prediction 4: Evaluation interviews are not associated with monetary gains for employees.

Prediction 5: Evaluation interviews are associated with beliefs regarding team spirit and work recognition.

Are there other explanations of annual evaluation interviews, further than the standard agency theory ? Yes, if we consider sociology, the theories of organizations or industrial relations. For Gollac and Volkoff (1996), evaluation interviews are a « domination method » used by firms that intensify work by imposing both business-bureaucratic constraints and market constraints. Such an argument meets the standard agency model which describes the interview as a mean to encourage effort and reinforce the relationship work/pay. It also fits, in our model, the individual production strategy in a context where technology is super-modular since, in this case, only the employee bears the cost of a higher effort level. In the same line of argument, computerization could contribute to the diffusion of evaluation interviews by reducing the monitoring cost born by the principal. Computerization would hence facilitate performance evaluation in real time and interview would have the simple goal of complementing these measures and building an agreement over a global evaluation. Evaluation interviews may also represent contribute to elaborate the formalization of work organization. They would therefore be implemented more frequently within large-scale collective work contexts and when business activity can easily be standardized. Lastly, evaluation interviews might deter social unrest within organizations in which the dispute potential is important. Faced with the possibility of expressing themselves during interviews, employees would be less incited to contest management. In order to avoid problems of omitted variables, our empirical test must take into account such possible explanations.

5.2 Data

The data source we mainly use here is a system of surveys on organizational change and computerization carried out by DARES, SESSI, SCEES and INSEE in 1997, conceived and coordinated by the "Centre d'Etudes de l'Emploi" (COI survey, 1997). This system of surveys

⁹ This explanation fits the underlying rationality of evaluation interviews that is frequently expressed by human resources departments within firms. The arguments of our theoretical model hence contradict the principles spontaneously argued by one of the actors of the evaluation process. Do human resources departments ignore the actual goals of annual evaluation interviews ? As we discuss it in footnote 2, some observations show that several forces govern evaluations. The final rationality of evaluation is the outcome of interactions between agents' strategies and institutions. In this retrospect, the French context, characterized by wage rigidity and unemployment threat, is very different from the Anglo-Saxon one which produced several methods of evaluation interview that are used in firms settled in France. A field work would be useful to examine more deeply these issues.

matched a business survey and a labor force survey. Small samples of employees (two or three) have been randomly selected in each interviewed firm. A sample of 8812 employees attached to 4025 firms have been surveyed thanks to a two level sampling method in annual surveys of manufacture (EAE – random selection of firm) and in a file from government origin aimed at computing social contributions (DADS file – random selection of employees within firms). This system of surveys obtained a high response rate on the two level of data gathering: more than 80% of firms and 71% of employees responded.

On the firms' side, we have a representative sample of units with more than 50 employees in manufacturing industries (including food industries) and a quasi exhaustive census of units with more than 20 employees in two branches of the service sector where the survey has been more exploratory: accountants and home depots type of stores. On the employees' side, the survey is representative of individuals with stable employment, that is at least one year of seniority in their firm at the date of the survey. This characteristic of employees' field directly stems from the sampling method: employees interviewed at the end of 97 have been selected in the DADS file covering year 1996. In our empirical work, we focus on manufacturing firms that hosts the larger part of the interviewed sample (6796 employees and 3019 firms). We are going to work with a sub-sample of interviewed employees with close colleagues. It groups 4620 employees attached to 2688 firms.

The labor force section of the COI survey comprises questions on annual evaluation interviews. The exact designs of the questions are given in appendix E. The available information on the practice of individual evaluation interviews hence stems from questions directly asked to employees. This information is broken down in table 1 according to the employee's occupation. We also distinguish between all employees (4620) and employees that do not have subordinates (3317). The latter sub-sample is more adapted to test our model since it is composed of individuals in a simple agency relationship: none of them is both the agent and the supervisor of another agent¹⁰.

[Insert table 1]

52% of employees from our field have at least one evaluation interview per year. This proportion reaches 68% when the employee has some subordinates and 45% in the opposite case. Having subordinates therefore reinforces the probability of being individually interviewed. The practice of individual evaluation interviews is more frequent for executives and middle management than for clerks, skilled blue collars and unskilled blue collars: 76% and 64% versus 42%, 40% and 35%. Therefore, there seems to exist a link between skill and evaluation. This link may stem from the fact that executives are more likely to have higher skills. However, we observe that the ranking of percents observed over the overall sample remains similar as the one over the sample of employees that are not in a hierarchical position: respectively 73%, 58%, 43%, 39% and 37%. The “executive” effect is higher for middle management than for all other occupations. In total, the diffusion of individual evaluation interviews is far from marginal¹¹.

The majority of evaluated employees declare that interviews are based on precise and measurable criteria (88%), that there is a unique evaluation grid for the firm's staff (70%) and that their direct superiors participate in their evaluation (91%). The participation of colleagues

¹⁰ Our model could be extended to the situation of bosses. The evaluation of employees in a hierarchical position is analysed empirically in Crifo-Tillet, Diaye and Greenan (2003).

¹¹ In 1994, the DARES conducted a survey on the technique and organization of work incorporating questions on evaluation, which inspired the COI questionnaire. According to this survey, 50% of middle management and executives, 30% of clerks and 25% of blue collars have at least one evaluation interview per year (Gollac and Volkoff, 1996). Unfortunately, the field of both surveys is not comparable since the 1994 survey is representative of all employees, while we are working on a sample of individuals with stable employment within firms with more than 50 employees in manufacturing. It is therefore hard to derive a time profile of the diffusion of interviews.

or of superiors other than the direct one in the evaluation is less frequent and varies more from one occupational group to the other: respectively 9% and 49% of employees. Furthermore, 60% of employees think that the evaluation has an influence on their wage or progression versus 52% for employees that are not in a hierarchical position. Being in the position to evaluate others comforts the idea that the evaluation has an influence on wage trajectories. It is less frequent to think that the evaluation has an impact on job security: 38% of employees only think so and such an opinion seems independent of the hierarchical position.

In the COI survey, employees give indications over their socio-demographic characteristics and describe their working situations, in particular their interactions with other employees, their scope of initiative and their perception of what affects wages and career opportunities¹². Lastly, since employees have been surveyed within a file from government origin aimed at computing social contributions (DADS file), we have a measure of their net wage in 1996 and their wage trajectory over the previous years. Apart from standard variables, the business section of the COI survey focuses on firms' organizational practices, associated tensions and computer use. We are going to use all this information to test the predictions of our theoretical model.

5.3 Why do firms evaluate individually their employees?

5.3.1 Firms' organizational devices and interdependencies between employees

Prediction 1 deals with the links between the different innovative workplace practices and their impact on interdependencies between employees. The complementarity between organizational practices has been explored empirically by numerous works, mostly focusing on the interactions between quality devices, multi-tasking and employee involvement devices and/or teamwork (for example Osterman, 1994; Ichniowski, Shaw and Prennushi, 1997 and Bresnahan, Brynjolfsson and Hitt, 2002). They all conclude that these organizational practices are positively correlated with one another, and some of them tend to show that firms are more productive when they use such practices jointly.

Greenan and Hamon-Cholet (2000) and Greenan and Mairesse (2003) used the COI survey to analyze the relationships between organizational practices by adopting a wider set than what is used in the preceding works: in addition to management tools inspired by the Japanese model (quality devices, just in time devices, teamwork devices), they consider tools associated with the Anglo-Saxon "corporate governance" model such as organization in profit centers or formal in-house customer / supplier contracts ("pseudo-market" devices), outsourcing of functions or subcontracting of production. They observe that, whatever their type, new organizational practices are highly correlated. There exist however some tensions between just in time devices and quality devices on the one hand, and teamwork devices on the other hand.

Thanks to the matching possibilities of the 1997 COI survey, they also examine how new workplace practices influence job content. They observe that firms with an increasing use of new organizational devices have their blue collar workers and middle management more involved in information exchange networks. Moreover, employees in firms using quality devices declare more often that they work in groups or collectively to carry out conception, research and analysis tasks, that they give indications to close or distant colleagues and that they participate more frequently to meetings. Similarly, interdependencies between workers are stronger within firms using just in time devices, but they are more constrained and linked to productive flows than within firms using quality devices. Among the other practices, only

¹² These indications are given prior to the questions on evaluation interviews.

organization in profit centers seems to affect work of stable employees by increasing their autonomy et reinforcing team work.

In total, prediction 1 is confirmed in the COI survey for stable employees of French manufacturing firms with more than 50 employees. However, the source of horizontal interdependencies seems different between quality devices and just in time devices: information exchanges and mutual help for quality devices; interdependence of work rhythm for just in time.

5.3.2 Determinants of evaluation interviews

Prediction 2 indicates that the degree of interdependence between employees should favor the practice of individual evaluation interviews. Those kinds of firm and work context imply situations where it is advantageous for the principal to develop teamwork and to stimulate cooperation among employees within teams. The field work study undertaken by Gheorgiu (2000) with a sample of employees that had declared in COI that they were working in groups or collectively shows that if employees often refer to a “team spirit”, its presence in teams is not automatic. This fits with the idea that evaluation interviews could play a role of signal favoring coordination within teams.

In order to measure the participation of an employee into collective work, we follow Moatty and Gheorghiu’s approach by working with 6 alternative definitions of collective work: *according to the type of tasks undertaken by the team* (conception, research and analysis task versus production tasks), *to the time spent working collectively*, *to the time spent in meetings*, *to the intensity of communication between close or distant colleagues*, *to the intensity of mutual aid* and *to the interdependency of work rhythms*. The exact designs of questions we use to measure these 6 different kinds of collective work are given in appendix E. We measure the intensity of communication and help by adding up dummy variables presented in this appendix (4 for the former, 3 for the latter).

Prediction 3 tells us that the autonomy of the employee is a possible determinant of evaluation interviews. We measure autonomy, using the first factor of a multiple correspondence analysis built on variables describing the employees’ scope of initiative. The questions from which these variables derive are given in appendix E. It is straightforward to interpret this factor as the intensity of the employee’s autonomy. It opposes employees who can change their deadlines and the nature and quantity of work they have to do, who do not follow instructions to the letter and who fix up themselves unforeseen contingencies occurring in the course of their work to employees who are not allowed to change their work, who strictly follow assignments and whose superiors explain in detail how to do the work, intervene in case of hitches and exert hierarchical supervision and control. The coordinates of employees on this factor have been transformed into an ordered qualitative variable with four items, using the quartiles computed on the whole sample¹³.

According to prediction 2, firms using new organizational practices are also more apt to implementing evaluation interviews. We measure these practices using the business section of the COI survey that includes questions on the use of organizational devices evoked in the previous section: quality, just in time, teamwork, and pseudo market devices, outsourcing of functions and sub-contracting. To these variables measuring directly the use of new

¹³ Autonomy and collective work are two dimensions of work that are hard to measure. The measure we adopt for both variables is asymmetric because of a different degree of maturity of the issues raised regarding these two fields. Issues related to autonomy have been raised in a comparable way in several successive surveys on work whereas the issue of collective work has been considered in a more unstable way and the COI survey incorporates totally new questions (see Crifo-Tillet, Diaye and Greenan, 2003 for further information).

organizational practices, we add other variables measuring indirectly firms' organizational choices: the evolution of hierarchical levels and the degree of co-responsibility between production worker, hierarchy and specialist for a set of 10 indirect tasks performed in the workshop. The exact formulation of questions is given in appendix F that also displays the description of the control variables we are going to use to explain the practice of individual evaluation interviews. Control variables describe employees' characteristics (sex, occupation, education, age and seniority) and firm characteristics (size and industry).

We evoke in section 5.1 a number of alternative or complementary explanations to the one proposed in our model and in the classical agency theory. Variables stemming from the labor force and the business sections are introduced in our regressions to evaluate these effects. We measure work intensification at the employees level from an indicator of cumulative market and industrial constraints proposed by Gollac and Volkoff (1996). Several variables describe firm's computer use: use of large computer systems, micro-computers not connected or computer networks, by distinguishing the use of these tools in production and management. The degree of formalization of work organization is correlated to firm's size. We supplement this information by the number of hierarchical levels. Regarding variables from the labor force section, we introduce the existence of precise quality norms to be met. As an indicator of work formalization, quality norms are also correlated to new organizational practices, in particular ISO certification. Lastly, to measure the social climate we introduce four questions concerning the difficulties encountered by firms when implementing organizational choices: tensions between services, problems of involvement or adaptation of executives and non executives, existence of disputes with the staff.

For each definition of collective work, we estimate three different logit models. In model 1, the practice of evaluation interviews is explained by collective work variables and by the intensity of autonomy. In model 2, we introduce all the control variables and model 3 adds to model 2 variables describing the organizational devices used by the firm and variables from employees and firms accounting for other possible factors. We have run regressions on the sample of employees without subordinates (3081 employees attached to 1715 firms). The size of the sample drops compared to table 4 because of firm's non-response. The results of regressions are given in tables 2a and 2b.

[Insert table 2a]

All collective work variables except dependence on colleagues' work rhythm (definition 6) are significantly correlated with evaluation interviews. The intensity of autonomy also has a positive and significant impact. When we introduce control variables (model 2), the first two items of the autonomy variable are no longer significant while variables measuring collective work remain significant. Introducing variables related to organizational practices and other possible factors (model 3) does not affect the coefficient associated with the last item of the autonomy variable while only one variable of collective work loses its explanatory power: communication with colleagues and other people in the firm (definition 4). The variable with the strongest impact is participation in meetings (definition 3). Greenan and Mairesse (2003) show that this variable is also strongly correlated with the use of new organizational practices in the firm. However, the introduction of firm's organizational practices does not weaken its link with evaluation interviews.

[Insert table 2b]

Table 2b gives the coefficients of variables introduced in addition to autonomy and collective work variables in model 3. We report only the variables significant at the 10% level in at least one regression (except for industry dummies). We observe that three organizational practices are significantly correlated with evaluation interviews: ISO certification, productive maintenance methods and problem solving teams. On the contrary, the fact that management takes part in project teams reduces the probability of having an evaluation interview. Evaluation interviews therefore seem to be associated with new organizational forms that are more participative, inspired by the Japanese industrial model, which are characterized by a lighter presence of management. When examining prediction 1, we observed that such organizational forms implied, for the employees, participation in a larger network of communication. The loss of explanatory power of the communication variable (definition 4) in model 3 might stem from this correlation.

Executives and middle management, as well as workers with third level education, are more frequently individually interviewed. One may think that interviews are easier to run with such employees because they are more used to bargain in the framework of their job. However, we do not observe any significant impact of age or seniority.

Regarding alternative explanations, we do not observe any particular impact of the indicator of work intensification. Evaluation interviews for employees without subordinates are associated neither with a heavier pressure weighing on work, nor with the corporate governance organizational practices aimed at introducing market forces as a regulator firm's activity. On the contrary, work formalization does favor evaluation interviews: the firm size and the requirement of meeting quality norms for the employee increase the probability of being interviewed. Business data processing also goes hand in hand with work formalization. Lastly, if we consider variables measuring the social climate, we observe that situations of tensions with executives have a positive impact on evaluation interviews. The latter effect does not exactly fit with our expectations and would suggest that executives are not necessarily prepared to run evaluation interviews.

In total, our estimations seem to confirm predictions 2 and 3, with some further precisions. Horizontal interdependencies generated by productive flows (work rhythm connected with that of colleagues) do not favor evaluation interviews. This result echoes the fact that just in time devices do not seem to affect evaluation practices. Similarly, work intensification and practices aimed at introducing market forces within firm are not positively associated with evaluation interviews. The latter seem develop mainly within organizations relying on collective work to manage quality problems. Such organizations are bigger, they formalize work and have an advanced business data processing system.

5.3.2 Evaluation interviews, compensation and beliefs' formation

To test predictions 4 and 5, we use additional information on compensations included in the labor force section of the COI survey. We consider three measures describing employees' earnings: the logarithm of net wage in 1996 (LSNET), its mean and its standard error over the 1993-1996 period. The latter indicator measures earning's time variation. Information over the 1993-1996 period are taken from the DADS file, which leads us to work over a smaller sample of employees (2135). We also consider three other variables describing what employees perceive what affects his wages and his career opportunities. They indicate whether he thinks that his wage and progression depends on special dimensions of his work (PEVSAL), on his own work (TRAPER) or the work of the team (TRAEQ). Appendix G explains how these variables are built.

We explain each of these variables by the fact of having an evaluation interview at least once a year, using three different methods. 1) By computing simple mean or percent differences, 2) by estimating a model including the evaluation interview variable and all the variables used in model 3, and 3) by taking the participation in meetings as the variable measuring collective work and 3) by using a propensity score method where the variable indicating an evaluation interview is taken as the treatment variable¹⁴. Our estimations are run using the definitions of collective work that are the most robust to the introduction of control variables in model 3 (definitions 1, 2, 3 and 5). Estimations regarding LSNET, PEVSAL, TRAPER and TRAEQ are run both on the baseline sample (3081 employees) and on the cylindrical sample over three years after the matching with the DADS file (2135 employees). Table 3 gives the results of these estimations.

[Insert table 3]

We first observe that evaluation interviews are not associated with higher monetary gains measured by net annual compensation once control variables are introduced or when we use a propensity score method. We also check that wage is not more variable when the employee is evaluated at least once a year. These results are in line with prediction 4. The net compensation we measure represents the output of the wage policy of the firm. It includes all bonuses except when they are exonerated from taxes like most of the premiums stemming from legal participation schemes. But, we measure the compensation received in 1996 when the questions about evaluation interviews concern 1997. We may think however that there is some inertia in evaluation practices. Most of the evaluated employees were able to answer questions on the influence of interviews on wage and progression, suggesting that 1997 was not their first year of evaluation. If this lag could weaken the relation between compensation and evaluation interviews, we do not think that it could destroy it.

While compensation variables do not interact with evaluation interviews, subjective variables describing the employee's beliefs over wage formation do matter. The effects measured by difference in means are dampened but remain very significant when we introduce as control variables all the determinants of evaluation interviews used in model 3, and their magnitude does not vary when we use a propensity score method. Evaluated employees have the feeling that their work is better recognized. Hence, when they are evaluated, employees indicate that more dimensions of their work influence their wage and progression, like as if their work was better acknowledged. They also declare more often that it is mainly their own work or mainly the work of the team (or both) that influence their wage and progression. Evaluation interviews thus seem to be associated with a system of beliefs on the recognition of their work, which confirms prediction 5.

6. Conclusion.

New organizational forms using cost cut devices, imposing tight time constraints on production or setting high quality standards that have been diffusing the past two decades at the firm level have experienced the contemporaneous development of employees' autonomy, teamwork and individual evaluation interviews. If standard agency models allow explaining the

¹⁴ Variables from model 3 are used as common determinants of treatment (evaluation interview) and of performance variables (wage, wage variability over time, PEVSAL, TRAPER, TRAEQ) to compute the difference in propensity score. We used a program developed by Emmanuel Duguet which relies on the gaussian kernel method with a Silverman window (Duguet, 2003).

complementarity between autonomy and individual relative performance evaluation, both devices are hardly compatible with teamwork.

The theoretical model proposed in this article highlights two major advantages of teamwork for users of organizational practices favoring horizontal interdependencies and super-modularity. First, team production allows compensation schemes based on lower incentive premia than those with individual production, either because of synergies within team or – in the absence of synergy – because of self-monitoring mechanisms (or sabotage). Besides, team represents a risk-sharing structure between agents.

However, coordination within team is not automatic and monetary incentives towards coordination are highly costly for the principal. Hence, new organizational forms will find it profitable to implement non-monetary incentives to promote coordination within the teams. We show that resorting to individual evaluation interviews may help generating a signal aimed at convincing employees of the existence of a « team spirit » within the group.

The issue of autonomy, that is of the freedom to pursue personally beneficial activities vanishes. Indeed, what governs the time allocation of workers among productive tasks is the degree of synergy and the horizontal interdependencies between workers. If autonomy is higher within new organizational forms, it is not, in this model, the outcome of a strategic decision by the principal.

The main predictions of this model are then tested econometrically using French data from a matched employer /employee survey on Computerization and Organizational Change (COI). We observe that teamwork devices are positively correlated to all innovative workplace practices and that within reorganized firms, employees more often interact on the basis of information flows. Besides, individual evaluation interviews are more often implemented within collective work contexts and/or within organizations adopting innovative workplace practices. Furthermore, the collective nature of work has a stronger impact on the use of individual evaluation interviews than does autonomy. Lastly, evaluation interviews are not associated with monetary gains but rather with beliefs regarding team spirit and work recognition.

Such results, obtained on French data, confirm our theory according to which individual evaluation interviews serve as non-monetary incentives towards coordination with teams and contradict the theory according to which they would incite agents, free of allocating their productive time, to expand effort by allowing to measure performance ex post.

References.

- Aquain V., Bué J., Vinck L. (1994)** : « L'évolution en deux ans de l'organisation du travail : plus de contraintes mais aussi plus d'autonomie pour les salariés », *Premières synthèses*, DARES, N° 54, juin.
- Balazs G. et Faguer J.-P. (1996)** : « Une nouvelle forme de management, l'évaluation », *Actes de la recherche en sciences sociales*, N°114, pp. 68-88.
- Bué J., Rougerie C. (1999)** : « L'organisation du travail : entre contraintes et initiative », *Premières synthèses*, DARES, N° 32.1
- Baker G., Gibbons R. S., Murphy K. J. (1994)** : « Subjective Performance Measures in Optimal Incentive Contracts », *Quarterly Journal of Economics*, Vol. 109, N°4, November, pp. 1125-1156.
- Barani I. (1992)** : « Fair Distribution of Protocols of How the Players Replace Fortune », *Mathematical Operation Research*, Vol. 17, pp. 329-340.
- Barbera S., Dutta B. (2000)** : « Incentive Compatible Reward Schemes for Labour-managed Firms », *Review of Economic Design*, Vol. 5, N°2, pp. 111-127.
- Ben-Porath E. (2003)** : « Cheap Talk in Games with Incomplete Information », *Journal of Economic Theory*, Vol. 108, pp. 45-71.
- Boning B., Ichniowski C., Shaw K. (2001)** : « Opportunity Counts: Teams and the Effectiveness of Production Incentives », NBER Working Paper, N°8306, may.
- Bourdieu P. (1989)** : *La noblesse d'état, grandes écoles et esprit de corps*, Paris, Les éditions de minuit, Collection le sens commun.
- Bresnahan T. F., Brynjolfsson E., Hitt L. M. (2002)** : « Information Technology, Workplace Organization and the Demand for Skilled Labor: Firm-Level Evidence », *Quarterly Journal of Economics*, Vol. 117, N°1, pp. 339-376.
- Cézard M., Dussert F., Gollac M. (1991)** : « Les changements dans l'organisation du travail », *Premières informations*, N°253, Ministère du travail
- Crifo-Tillet P., Diaye M.-A., Greenan N. (2003)** : « Pourquoi les entreprises évaluent-elles individuellement leurs salariés », *Document de travail du CEE*, N°21, février.
- Che Y.-K., Yoo S.-W. (2001)** : « Optimal Incentives for Teams », *American Economic Review*, Vol. 91 N°3, June, pp. 525-541.
- Conyon M. J., Freeman R. B. (2001)** : « Shared Modes of Compensation and Firm Performance: UK Evidence », Miméo.
- Duguet E. (2003)** : « Are R&D subsidies a substitute or a complement to privately funded R&D? Evidence from France using propensity score methods for non experimental data », *Cahiers de la MSE*, N°75.
- Eustache D. (2001)** : « Politique salariale, régulation et échange social », *Revue française de sociologie*, Vol. 42, N°2, pp. 295-326.
- Forges F. (1990)** : « Universal Mechanisms », *Econometrica*, Vol. 58, pp. 1341-1364.
- Gheorghiu M. D. (20002)** : *Les relations de coopération au travail*, rapport final pour la DARES, Centre d'études de l'emploi, 02/04.
- Gheorghiu M. D., Moatty F. (2001)** : « Le travail collectif chez les salariés de l'industrie: groupes sociaux et enjeux de la coopération au travail », *Document de travail du CEE*, N°29.
- Gollac M., Volkoff S. (1996)** : « Citius, altius, fortius: l'intensification du travail », *Actes de la Recherche en Sciences Sociales*, N°114, pp. 54-67.
- Greenan N. (2001)** : *Changements organisationnels et performances économiques: théories, mesures et tests*, Unpublished Ph.D. Thesis (Ecole des Hautes Etudes en Sciences Sociales).
- Greenan N., Hamon-Cholet S. (2000)** : « Les salariés industriels face aux changements organisationnels en 1997 », *Premières Synthèses*, DARES, N°09.3.
- Greenan N., Mairesse J. (2003)** : « How do new organizational practices shape production jobs? Results from a matched employer-employee survey for French manufacturing », *Document de travail du CEE*, N°28, Septembre.
- Harsanyi J., Selten R. (1988)** : *A General Theory of Equilibrium Selection in Games*, MA: MIT Press.

- Holmström B., Milgrom P. (1991)** : « Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design », *Journal of Law, Economics and Organization*, Vol. 7, pp. 24-52.
- Holmström B., Milgrom P. (1994)** : « The Firm as an Incentive System », *American Economic Review*, Vol. 84, n°4, pp. 972-991.
- Ichniowski C., Shaw K., Prennushi G. (1997)** : « The Effects of Human Resource Management Practices on Productivity: a Study of Steel Finishing Lines », *American Economic Review*, Vol. 87, N°3, June, pp. 291-313.
- Kandel E., Lazear E. P. (1992)** : « Peer Pressure and Partnership », *Journal of Political Economy*, Vol. 100, N°4, pp. 801-817.
- Kremer M. (1993)** : « The O-Ring Theory Of Economic development », *Quarterly Journal of Economics*, Vol. CVIII, N°3, August, pp. 551-575.
- Lazear E. P. (1989)** : « Pay Equality and Industrial Politics », *Journal of Political Economy*, June, Vol. 97, N°3, pp. 561-580.
- Le Minez S., Roux S. (2002)** : « Les différences de carrières salariales à partir du premier emploi », *Economie et Statistique*, N° 351, pp. 31-63.
- Milgrom P., Roberts J. (1990)** : « The Economic of Modern Manufacturing: Technology, Strategy, and Organization », *American Economic Review*, Vol. 80, N°3, June, pp. 511-528.
- Myniem J.-B. (2002)** : « Le système d'évaluation individuelle dans la gestion des ressources humaines: dispositif de sanction ou outil de développement? », in L'Horty Y. (Dir.) *Emplois flexibles, salaires rigides, les transformations des modes de rémunération*, rapport de recherche pour l'ACI « Travail » du MRT.
- Osterman P. (1994)** : « How Common is Workplace Transformation and Who Adopts it ? », *Industrial and Labor Relations Review*, Vol. 47, N°2, pp.173-184.

APPENDIX A. Optimal Contracts.

A.1. Optimal Contracts with Individual Production

When the task succeeds, the agent receives a premium $w_k \geq 0$ for an individual effort level required k , and nothing otherwise. The agent hence faces three lotteries $Z_k : Z_k = (q_k, w_k ; 1 - q_k, 0)$, $k=0,1,2$, of net expected payoff $E(Z_k) = q_k \cdot w_k - e \cdot k$.

Similarly, the principal faces three lotteries $Y_k : Y_k = (q_k, R - w_k ; 1 - q_k, 0)$, $k=0$, with expected payoff $\Pi_k = E(Y_k) = q_k (R - w_k)$

Proof of result 1.

Participation constraints are given by: $E(u(Z_k)|k) - e \cdot k \geq 0$, with $k=0,1,2$

That is equivalent to: $q_k \cdot u(w_k) + (1 - q_k) \cdot u(0) - e \cdot k \geq 0 \Leftrightarrow w_k \geq u^{-1}(e \cdot k / q_k)$

Incentive compatible constraints are given by: $E[u(Z_k) | k] - e \cdot k \geq E[u(Z_k) | k'] - e \cdot k'$, k and $k'=0,1,2$, $k' \neq k$.

That is equivalent to: $q_k \cdot u(w_k) + (1 - q_k) \cdot u(0) - e \cdot k \geq q_{k'} \cdot u(w_{k'}) + (1 - q_{k'}) \cdot u(0) - e \cdot k'$

That is: $(q_k - q_{k'}) \cdot u(w_k) \geq e \cdot (k - k')$, k and $k'=0,1,2$, $k' \neq k$.

- For an effort level $k=0$, incentive compatible and participation constraints lead to the following conditions : $w_0 \geq u^{-1}(0/q_0)$, $w_0 \leq u^{-1}(e/q_1 - q_0)$ and $w_0 \leq u^{-1}(2e/q_2 - q_0)$, therefore $w_0^* = 0$.

- For an effort level $k=1$, incentive compatible constraints lead to :

$$w_1 \geq u^{-1}(e/(q_1 - q_0)) \quad \text{and} \quad w_1 \leq u^{-1}(e/(q_2 - q_1))$$

We then deduce that :

$$w_1^* = u^{-1}(e/(q_1 - q_0)) \quad \text{if} \quad q_2 + q_0 \leq 2q_1$$

$$w_1^* \text{ is indeterminate if } q_2 + q_0 > 2q_1.$$

- For an effort level $k=2$, incentive compatible constraints lead to : $w_2 \geq u^{-1}(2e/(q_2 - q_0))$ and $w_2 \geq u^{-1}(e/(q_2 - q_1))$

That is :

$$w_2^* = u^{-1}(e/(q_2 - q_1)) \quad \text{if} \quad q_2 + q_0 \leq 2q_1$$

$$\text{and } w_2^* = u^{-1}(2e/(q_2 - q_0)) \quad \text{if} \quad q_2 + q_0 > 2q_1.$$

When $k=1,2$, the incentives premia w_1^* and w_2^* guarantee the agent's participation if and only if $2q_1 \geq q_2$. Under Assumption 2, participation constraints are hence satisfied when $k=1,2$.

When technology is sub-modular, we will use the below assumption A1 to show that the principal will propose the contract corresponding to the maximal effort ($k^*=2$; w_2^*). When technology is strictly super-modular, the principal will neither require the effort level $k=1$ because the corresponding incentive premium is indeterminate. So the principal will choose between the effort levels $k=2$ and $k=0$. And assumption A1 shows that she will propose the contract corresponding to the maximal effort ($k^*=2$; w_2^*).

Assumption A1.

$Y2 \text{ DS2 } Y1$ and $Y2 \text{ DS2 } Y0$: lottery $Y2$ is second-order stochastic dominant over lotteries $Y1$ and $Y0$.

Thus $Y2 \text{ DS2 } Y1 \Leftrightarrow E[Y2] \geq E[Y1]$ and $Y2 \text{ DS2 } Y0 \Leftrightarrow E[Y2] \geq E[Y0]$: lottery $Y2$ maximizes the principal's net expected payoff. Recall that the principal is risk neutral.

A.2. Optimal Contracts with Team Production

When the task succeeds, the agents earn an identical premium $w_{k_1 k_2} \geq 0$, and nothing otherwise. Agents hence face four lotteries $Z_{k_1 k_2}$ given their effort levels k_1 and k_2 :

$$Z_{k_1 k_2} = (p_{k_1 k_2}, w_{k_1 k_2}; 1 - p_{k_1 k_2}, 0); k_1, k_2 = 0, 1.$$

The agents know the premium level before they make their effort decision. The agent's net expected payoff of lottery $Z_{k_1 k_2}$ is given by : $E(Z_{k_1 k_2}) = p_{k_1 k_2} \cdot w_{k_1 k_2} - e \cdot k_1$.

Similarly, the principal faces four lotteries : $Y_{k_1 k_2} = (p_{k_1 k_2}, R - w_{k_1 k_2}; 1 - p_{k_1 k_2}, 0)$, $k_1, k_2 = 0, 1$ with expected payoff $\Pi_{k_1 k_2} = E(Y_{k_1 k_2})$.

Proof of result 2.

Participation constraints are given by : $E[u(Z_{k_1 k_2}) | (k_1, k_2)] - e \cdot k_1 \geq 0 \quad k_1, k_2 = 0, 1$

That is : $p_{k_1 k_2} \cdot u(w_{k_1 k_2}) + (1 - p_{k_1 k_2}) \cdot u(0) - e \cdot k_1 \geq 0$

That is : $w_{k_1 k_2} \geq u^{-1}(e \cdot k_1 / p_{k_1 k_2})$.

Incentive compatible constraints are given by:

$$E[u(Z_{k_1 k_2}) | (k_1, k_2)] - e \cdot k_1 \geq E[u(Z_{k_1 k_2}) | (k_1', k_2)] - e \cdot k_1' \quad k_1, k_2, k_1' = 0, 1 \quad k_1' \neq k_1$$

That is : $p_{k_1 k_2} \cdot u(w_{k_1 k_2}) - e \cdot k_1 \geq p_{k_1' k_2} \cdot u(w_{k_1 k_2}) - e \cdot k_1'$

That is : $(p_{k_1 k_2} - p_{k_1' k_2}) \cdot u(w_{k_1 k_2}) \geq e \cdot (k_1 - k_1')$

- For an effort pair $(k_1, k_2) = (0, 0)$, participation and incentive compatible constraints lead to : $p_{00} \cdot u(w_{00}) \geq 0$ and $(p_{00} - p_{k_1' 0}) \cdot u(w_{00}) \geq -e \cdot k_1'$, $k_1' = 0, 1$ leads to $w_{00}^* = 0$.

- For an effort pair $(k_1, k_2) = (1, 1)$, incentive compatible constraints are given by :

$$(p_{11} - p_{01}) \cdot u(w_{11}) \geq e; (p_{11} - p_{00}) \cdot u(w_{11}) \geq e; (p_{11} - p_{01}) \cdot u(w_{11}) \geq 0$$

That is : $u(w_{11}) \geq e / (p_{11} - p_{00})$ and $u(w_{11}) \geq e / (p_{11} - p_{01})$

Hence, if $e / (p_{11} - p_{00}) \leq e / (p_{11} - p_{01})$ that is if $\Delta_0 = p_{01} - p_{00} \geq 0$, then $w_{11}^* = u^{-1}(e / (p_{11} - p_{01}))$.

And if $\Delta_0 = p_{01} - p_{00} < 0$, then $w_{11}^* = u^{-1}(e / (p_{11} - p_{00}))$. Assumption 2 however rules out this case.

When $\Delta_0 > 0$, $w_{11}^* = u^{-1}(e / (p_{11} - p_{01}))$ and the participation constraint is given by : $u^{-1}(e / (p_{11} - p_{01})) \geq u^{-1}(e / p_{11})$. Since u^{-1} is increasing, we have : $e / (p_{11} - p_{01}) \geq e / p_{11}$. This condition is true under Assumption 2 : $\Delta_1 > 0$.

APPENDIX B. Nash Equilibria

B.1. Nash Equilibria in Pure Strategies

Facing a contract with a premium w_{11}^* , agents choose between two effort levels (0 or 1). After signing the contract, they hence play a coordination game characterized by the following payoffs matrix :

k_1, k_2	1	0
1	$p_{11}.u(w_{11}^*)-e ; p_{11}.u(w_{11}^*)-e$	$p_{10}.u(w_{11}^*)-e ; p_{10}.u(w_{11}^*)$
0	$p_{01}.u(w_{11}^*) ; p_{01}.u(w_{11}^*)-e$	$p_{00}.u(w_{11}^*) ; p_{00}.u(w_{11}^*)$

To determine the possible Nash equilibria of this game, first note that given the incentive compatible constraints : $p_{11}.u(w_{11}^*)-e \geq p_{01}.u(w_{11}^*) = p_{10}.u(w_{11}^*)$

Hence (1, 1) constitutes a Nash equilibrium.

If $\Delta_0 = p_{01} - p_{00} > 0$ ($\Delta_0 \leq 0$ being ruled out by assumption), then $w_{11}^* = u^{-1}(e/(p_{11}-p_{01}))$.

$$p_{01}.e/(p_{11}-p_{01}) - e \leq p_{00}.e/(p_{11}-p_{01}) \Leftrightarrow (p_{01} - p_{11} + p_{01})/(p_{11}-p_{01}) \leq p_{00}/(p_{11}-p_{01})$$

$$\Leftrightarrow 2p_{01} - p_{11} \leq p_{00} \text{ (since } \Delta_1 = p_{11}-p_{01} > 0) \Leftrightarrow \Delta_1 \geq \Delta_0 .$$

Hence, if $\Delta_0 = p_{01} - p_{00} > 0$, $\Delta_1 = p_{11}-p_{01} > 0$ and $\Delta_1 \geq \Delta_0$ then (0,0) constitutes a Nash equilibrium.

B.1. Nash equilibria in Mixed Strategies

If $k_1 = 1$, player 1's expected utility is : $m_2.(p_{11}.u(w_{11}^*)-e)+(1-m_2).(p_{10}.u(w_{11}^*)-e)$

If $k_1 = 0$, player 1's expected utility is : $m_2.(p_{01}.u(w_{11}^*))+(1-m_2).(p_{00}.u(w_{11}^*))$

If $k_2 = 1$, player 2's expected utility is : $m_1.(p_{11}.u(w_{11}^*)-e)+(1-m_1).(p_{10}.u(w_{11}^*)-e)$

If $k_2 = 0$, player 2's expected utility is : $m_1.(p_{01}.u(w_{11}^*))+(1-m_1).(p_{00}.u(w_{11}^*))$

Let assume that $\sigma^* = (\sigma_1^*, \sigma_2^*)$ constitutes a Nash equilibrium in mixed strategies where

$\sigma_1^* = (\sigma_1^*(k_1=1), \sigma_1^*(k_1=0))$ and $\sigma_2^* = (\sigma_2^*(k_1=1), \sigma_2^*(k_1=0))$, with $m_i = \sigma_i(k_i=1)$, $1-m_i = \sigma_i(k_i=0)$, $i = 1, 2$.

If $\sigma_1^*(k_1=1) = 1$ or 0, we have the following two degenerate equilibria : ((1,0), (1,0)) and ((0,1), (0,1)).

Let assume that $\sigma_i^*(k_i=1) \neq 1$ or 0 and $\sigma_i^*(k_i=0) \neq 1$ where $i = 1, 2$.

A profile σ is a Nash equilibrium if : player 1 (respectively 2) is indifferent between choosing $k_1=1$ and $k_1=0$, given the mixed strategy of player 2 (respectively 1).

Regarding player 1, we therefore have :

$$m_2.(p_{11}.u(w_{11}^*)-e) + (1-m_2).(p_{10}.u(w_{11}^*)-e) = m_2.(p_{01}.u(w_{11}^*)) + (1-m_2).(p_{00}.u(w_{11}^*))$$

$$\text{Therefore } m_2 = [e - \Delta_0.u(w_{11}^*)] / [(\Delta_1-\Delta_0).u(w_{11}^*)]$$

$$\text{Regarding player 2, we have : } m_1 = [e - \Delta_0.u(w_{11}^*)] / [(\Delta_1-\Delta_0).u(w_{11}^*)]$$

Thus, if m_2 and m_1 are probabilities, then a non-degenerate Nash equilibrium in mixed strategies exists : $((m_1, 1-m_1) ; (m_2, 1-m_2))$.

However, m_2 and m_1 can not be probabilities because they do not belong to the interval $]0,1[$. There is therefore no non-degenerate Nash equilibrium in mixed strategies.

APPENDIX C. Proofs and Formal definition of the individual evaluation interview

APPENDIX C.1. Proof of result 6.

There are two cases. The first one corresponds to the situation where the team is formed *for the first time*, and the second one corresponds to the case where *the team already exists*. The individual evaluation interview is costly (for the interviewed) $\zeta \geq 0$, which we assume to be the same for all individuals. We also assume that the expected payment of a type H agent participating in the interview is higher than the evaluation cost : $(2/n_0) \times (p_{11}u(w_{11}^*) - e) \geq \zeta$. Let first note that a type H individual will always tell the truth because if she lies, she obtains 0 which is lower than $(2/n_0) \times (p_{11}u(w_{11}^*) - e)$.

1st Case : First formation of the team.

Sub-case 1.1 : Recruitment among outsiders.

- When $\zeta > 0$, only type H individuals will participate in the interview. Indeed, a type L individual knows that type H agents will all tell the truth and if she lies, the number of individuals announcing to be of type H (\hat{n}_0) will be strictly higher than n_0 . In such a case, the team will not be formed. Hence, the expected payment of a type L individual if she lies is 0, strictly lower than ζ the interview cost.
- If $\zeta = 0$, then even type L agents may find it profitable to participate in the interview. Since they know that type H agents will all tell the truth, they are indifferent between lying (and getting 0) or no lying (and getting 0). Since there is no gain to lie, type L agents will tell the truth if they participate.

Hence, M is strategy-proof in sub-case 1.1.

Sub-case 1.2 : Recruitment among insiders.

In such a case the interview cost is null since the interview is run during working time. As before, type L agents will be indifferent between participating and lying, participating and telling the truth or not participating. On the contrary, type H agents will participate and tell the truth. Hence M is strategy-proof in sub-case 1.2.

2nd Case : The team (of two individuals) already exists.

It is easy to see that M is strategy-proof in this case.

In the rest of the article, we assume (without loss of generality) that the team already exists.

APPENDIX C.2. Proof of result 7.

When implemented the mechanism M generates public signals θ_i assumed *by the agents* to be perfectly correlated to the K_i (effort variables). Given the definition of the mechanism M, the signals are always such that $\theta_i = H$, $i = 1, 2$.

■

APPENDIX C.3. Proof of result 8.

$\psi(\alpha) = w_{11}^{**} - (1+\alpha)w_{11}^*$ is a line with slope $-\alpha$, it is therefore decreasing. But $\psi(0) > 0$. In turn, either $\psi(1) \geq 0$ in which case $\alpha_0 = 1$; or $\psi(1) < 0$ implying that there exists a $\alpha_0 \in]0, 1[$ such that $\psi(\alpha_0) = 0$ and ψ changes sign in α_0 . The value of α_0 is given by : $\alpha_0 = (w_{11}^{**} / w_{11}^*) - 1$.

■

APPENDIX C.4. There is an obvious link between the choice of non-monetary incentives towards coordination (compared to monetary incentives) and the characteristics of the production technology. We have shown that the cost of monetary incentives is increasing in the relative degree of technological interdependence. Here, that is with a non-monetary device based on evaluation interviews, strong super-modularity supports the choice of non-monetary incentives within team. To see this, let us consider the simple case of a linear utility function and let us assume that technology is *strongly* super-modular that is $\Delta_1 \geq d \times \Delta_0$, with $d \geq 1 + \alpha$, $\forall \alpha \in [0, 1]$. In such a case, $\psi(\alpha) > 0 \forall \alpha \in [0, 1]$.

This result still holds when technology is *strongly* super-modular, function u is *concave*, and its reciprocal function is homogenous (that is for all $\lambda \geq 1$, $u^{-1}(\lambda x) \geq \lambda u^{-1}(x)$ and for all $0 < \lambda < 1$, $u^{-1}(\lambda x) < \lambda u^{-1}(x)$).

APPENDIX C.5. Definition of an individual evaluation interview.

Assume that there are n agents and that the principal *determines* a finite set of S *criteria* (characteristics) which she considers important for the interview. Let $v_i^s \in \Xi^s$ denote the mark for criterion s ($s = 1$ to S) according to agent i . We assume that the latter is a *private information*, that is that v_i^s is a random variable whose realization is observed by agent i only. The principal does not observe the realization of v_i^s so when she asks an agent to describe her characteristics, she is confronted to a revelation problem. However, we assume that the distribution of $v^s = (v_1^s, \dots, v_n^s)$ is common knowledge.

Consider the following *direct mechanism* $\Sigma^s = (\Xi^s, \Xi^s, \dots, \Xi^s; g)$ where g is a *result function*,
 $g : \prod_{i=1}^n \Xi^s \rightarrow \prod_{i=1}^n \Xi^s$
 $v^s \mapsto g(v^s)$

The mechanism Σ^s can be considered as an institution setting rules that govern the procedure resulting in the principal's decision. The actions allowed to each agent i belong to Ξ^s and the rule that transforms the agents' actions into a decision is given by function g . We could for instance consider that g is the identity function.

Definition of the individual evaluation interview.

An *Individual Evaluation Interview* is the device $\Sigma = (\Sigma^1, \Sigma^2, \dots, \Sigma^S; a)$ where the Σ^s 's are the direct mechanisms and a is an aggregation function of the marks per criterion.

$$a : \prod_{s=1}^S (\prod_{i=1}^n \Xi^s) \rightarrow A$$

$$(g(v^1), g(v^2), \dots, g(v^S)) \mapsto a((g(v^1), g(v^2), \dots, g(v^S)))$$

$a((g(v^1), g(v^2), \dots, g(v^S))) = (a_1, \dots, a_n)$ where a_i is the aggregate mark of individual i .

Our model considers the simple case where $n=2$ and $S=1$, that is two agents and one criterion to be evaluated, namely *team spirit*.

APPENDIX D. Technological and organizational decisions

APPENDIX D.1. Proof of result 9.

With team production, $w_{11}^* = u^{-1}(e/\Delta_1)$ is *strictly* decreasing in Δ_1 (because u^{-1} is increasing). Let Δ_1^a such that $\Delta_1^a < \Delta_0$ and Δ_1^b such that $\Delta_1^b \geq \Delta_0$. We therefore have : $w_{11}^*(\Delta_1^a) > w_{11}^*(\Delta_1^b)$. Hence, if the cost of the individual interview is null ($\alpha=0$), the principal finds it profitable to choose a super-modular technology because the premium is lower. This result holds when the cost of the interview is non-null. Indeed, according to result 8, the parameter $\alpha < \alpha_0$, $\alpha_0 \in]0,1]$, is chosen by the principal. But $w_{11}^*(\Delta_1^a) > w_{11}^*(\Delta_1^b)$. The principal can therefore set α such that $w_{11}^*(\Delta_1^a) > w_{11}^*(\Delta_1^b) + \alpha w_{11}^*(\Delta_1^b)$.

With individual production, $w_2^* = u^{-1}(2e/(q_2 - q_0))$ if $q_2 - q_1 > q_1 - q_0$ and $w_2^* = u^{-1}(e/(q_2 - q_1))$ otherwise. With strict super-modularity, $q_2 - q_1 > q_1 - q_0 \Rightarrow q_2 - q_0 > 2 \cdot (q_1 - q_0)$. Let $(q_2 - q_0)^b$ denote $q_2 - q_0$ in the strict super-modularity regime. For $q_1 - q_0$ given, define $(q_2 - q_1)^a$ such that $(q_2 - q_1)^a \leq q_1 - q_0$. We therefore have $(q_2 - q_0)^b > 2 \cdot (q_1 - q_0) \geq (q_2 - q_1)^a \Rightarrow (q_2 - q_0)^b > 2(q_2 - q_1)^a \Leftrightarrow 2e/(q_2 - q_0)^b < e/(q_2 - q_1)^a \Rightarrow u^{-1}(2e/(q_2 - q_0)^b) < u^{-1}(e/(q_2 - q_1)^a)$ (u^{-1} is increasing). When technology is super-modular, the premium is lower than when it is sub-modular.

■

APPENDIX D.2. Proof of result 10.

With individual production, the principal's expected profit is : $B_I = q_2(R - w_2^*)$ with $w_2^* = u^{-1}(2e/(q_2 - q_0))$ if $q_2 + q_0 > 2q_1$ and $w_2^* = u^{-1}(e/(q_2 - q_1))$ otherwise.

With team production, the principal's expected profit is: $B_E = p_{11} \cdot (R - 2 \cdot (1 + \alpha)w_{11}^*)$ if $\Delta_1 \geq \Delta_0$ and $B_E = p_{11} \cdot (R - 2 \cdot w_{11}^*)$ if $\Delta_1 < \Delta_0$, where in both cases, $w_{11}^* = u^{-1}(e/\Delta_1)$

Definition D1. The team value is the function $\mathcal{G} = B_E - B_I$.

The team value when technology is super-modular (only case to be considered given result 9) is given by (after some simplifications):

$$\mathcal{G} = R(p_{11} - q_2) - [2p_{11} \cdot (1 + \alpha) \cdot u^{-1}(e/(p_{11} - p_{01})) - q_2 \cdot u^{-1}(2e/(q_2 - q_0))] \text{ where } \alpha < \alpha_0, \alpha_0 \in]0,1].$$

First note that, for fixed p_{11} or q_2 , the team value increases with synergy : $\partial \mathcal{G} / \partial s > 0$ ¹⁵. Similarly, for fixed p_{11} or p_{01} , the team value increases with horizontal interdependence between agents : $\partial \mathcal{G} / \partial \Delta_1 > 0, \partial \mathcal{G} / \partial \Delta_0 > 0$.

Besides $\mathcal{G} > 0 \Leftrightarrow \Delta_1 = p_{11} - p_{01} > \eta$ where $\eta = \frac{e}{u \left[R(p_{11} - q_2) + q_2 u^{-1} \left(\frac{2e}{q_2 - q_0} \right) / 2p_{11}(1 + \alpha) \right]}$

■

APPENDIX D.3. Link with Che and Yoo (2001).

Let $\alpha = 0$, u linear and $p_{11} = q_2$ then $\mathcal{G} > 0 \Leftrightarrow p_{11} - p_{01} > q_2 - q_0$. But from assumption 3 we have $p_{01} > q_0$. Hence : $p_{11} - p_{01} < q_2 - q_0$, which implies $\mathcal{G} < 0$. Since \mathcal{G} decreases with synergy, we have $\mathcal{G} < 0$ when $p_{11} \leq q_2$. This result is similar to what Che and Yoo (2001) obtain when they show that, in a static framework, the principal prefers individual production to team production when there is no synergy : $p_{11} = q_2$. However, such a result is based on the assumption of *risk-neutrality* for the agents (u linear).

¹⁵ We use the monotonicity property of u^{-1} , corollary 1, and the fact that it is implicitly assumed in the analysis of team production that $R > 2w_{11}$.

APPENDIX D.4. Proof of result 11.

With individual production, for an effort level equal to 2, the agent faces lottery $Z_2 = (q_2, w_2^*; 1-q_2, 0)$. Similarly, with team production, for an effort level equal to 1, the agent faces lottery $Z_{11} = (p_{11}, w_{11}^*; 1-p_{11}, 0)$.

The agent prefers team production to individual production if and only if $\frac{E[u(Z_{11})] - e}{e} > \frac{E[u(Z_2)] - 2e}{2e}$. But $E[u(Z_{11})] = p_{11} \cdot u(w_{11}^*)$ where $w_{11}^* = u^{-1}(e/\Delta_1)$ and $E[u(Z_2)] = q_2 \cdot u(w_2^*)$ where $w_2^* = u^{-1}(2e/(q_2 - q_0))$. ■

APPENDIX D.5.

Let note that $p_{01} > q_0$ (assumption 3), hence result 11 implies that if $p_{11} \leq q_2$ then agents always prefer team to individual production. But given Appendix D.3., if $\alpha = 0$, u is linear, and $p_{11} = q_2$ then the principal always prefers individual to team production. In such a case, production is impossible, except if we change assumption 3 into $p_{01} \geq q_0$. In such a case, if $p_{01} = q_0$ then both the agents and the principal are indifferent between team and individual production.

APPENDIX E. Questions from the labor force section of the COI survey

Evaluation interviews

- E1: Do you have at least one evaluation interview per year? (yes/no)
E2 : Is this interview based on precise and measurable criterions ?(objectives, results obtained, competences acquired,...)? (yes/no/does not know)
E3 : Has the assessment issued from this interview an influence on your wage or your progression? (yes/no/does not know)
E4 : Has the assessment issued from this interview an influence on your job security? (yes/no/does not know)
E5 : Is there an evaluation grid for the staff of the company? (yes/no/does not know)
Who participates in your evaluation ?
E6 : Your direct superior ? (yes/no/does not know)
E7 : Your colleagues? ((yes/no/does not know)
E8 : A superior other than your direct one ?(Head of HRM department for example) ((yes/no/does not know)

Collective work

Definition 1 : Type of teamwork

Do you sometimes do your work in group or collectively ? (yes/no)
if yes, in your work, do you rather pursue 1) conception, research or analysis activities? 2) production activities?

Definition 2 : Time spent in teamwork

How much of your working time does work in group or collectively takes?
1) Almost all the time 2) more than a quarter of your time 3) less than a quarter of your time

Definition 3 : Participation into meetings

How frequently do you participate into meetings in the context of your work? (at least once a year)

Definition 4 : Communicate in the firm (with others than a direct superior)

Apart from your superiors, are there other persons that give you indications on what you have to do?

Colleagues you usually work with? (yes, it happens/no/it does not apply)

Other persons or departments in the firm? (yes, it happens/no/it does not apply)

Do you give indications to other persons (apart from your subordinates) on what they have to do?

Colleagues you usually work with? (yes, it happens/no/it does not apply)

Other persons or departments in the firm? (yes, it happens/no/it does not apply)

Definition 5 : Benefit from others' help

If you have a temporary excess workload or if you are uneasy with a difficult or tricky task are you helped by...

Your superiors? (yes, it happens/no/it does not apply)

Colleagues you usually work with? (yes, it happens/no/it does not apply)

Other persons or departments in the firm? (yes, it happens/no/it does not apply)

Definition 6 : To have a work rhythm connected with that of colleagues

Is your work rhythm imposed by immediate dependence of one or more colleagues in the work done? (yes/no)

Autonomy

A1 : Is your work rhythm imposed by the following permanent (or at least daily) checks or supervision by the hierarchy? (yes/no)

A2 : You receive orders, assignments, and instructions. In order to perform your work correctly, which of the following applies? 1) You carry the assignments to the letter? 2) In certain cases, you act differently? 3) You act differently most of the time? 4) It does not apply (no orders, assignments, and instructions)

A3 : Instructions given by your superiors in the company tell you what must be done. 1) In general do they also tell you how to do the work? 2) or do they tell you the objective of your work, but leave you to decide how to achieve this objective?

A4 : To do your work, are you allowed to change deadlines? (yes/no/it does not apply)

A5 : In general, when in the course of your work, something unforeseen occurs, what happens ? 1) You fix the problem on your own 2) You manage it with the colleagues around you 3) You call on other people (a superior, a colleague, a specialist department).

A6 : In general, does your superior intervene to show you how to do the work ? (yes/no)

A7 : Do you have occasion to modify the nature and quantity of the work that you will have to do, or the manner of proceeding ? (yes/no)

APPENDIX F. Control variables and variables relative to other explanations

The last item of each variable has been chosen as a reference in table 4.

Firms' organizational practices :

Use of new organizational devices :

In 1997, does the firm use one of the following organizational devices:

ISO 9001, ISO 9002, EAQF certification? (yes/no)

Other certification or total quality management? (yes/no)

Value analysis, functional analysis or "AMDEC" method? (yes/no)

System of just in time delivery? (yes/no)

System of just in time production? (yes/no)

5S method or TPM (Total Productive Maintenance)? (yes/no)

Organization in profit centers? (yes/no)

Formal in-house customer / supplier contracts? (yes/no)

Team work

In 1997, what is the share

- of production workers in your firm participating in

...self managed teams ? (more than 50%, 10-50%, 0-10%)

...problem solving groups ? (more than 50%, 10-50%, 0-10%)

...project teams ? (more than 50%, 10-50%, 0-10%)

- of other workers in your firm participating in :

...self managed teams ? (more than 50%, 10-50%, 0-10%)

...problem solving groups ? (more than 50%, 10-50%, 0-10%)

...project teams ? (more than 50%, 10-50%, 0-10%)

Reduction in hierarchical layers between 1994 and 1997:

Reduction in 2 hierarchical levels or more, reduction in one hierarchical level and stability or increase in the number of hierarchical levels.

Shared responsibility for indirect tasks

In general, who is/was authorized in 1997 to... (more than one answer possible):		Management	Production worker	Specialist
1	... adjust installations			
2	... perform 1 st level maintenance			
3	... allocate tasks to production workers			
4	... inspect quality of supplies			
5	... inspect quality of production			
6	... participate in performance improvements			
7	... participate in project teams			
8	... stop production in case of an incident			
9	... troubleshoot in case of an incident			
10	... start production again in case of an incident			

Three variables are constructed from question 7: management, production worker and specialist are authorized to participate in project teams. We compute the average number of tasks each type of individual is responsible for (NMT), from 1 to 3. A qualitative variable with 4 items is constructed as follows: $NMT \geq 1,7$ (joint responsibility of indirect tasks), $1,4 \leq NMT \leq 1,7$ (medium sharing of responsibility), $1 < NMT \leq 1,4$ (low sharing of responsibility), $NMT \leq 1$ (disjoined responsibilities)

Socio-demographic characteristics of the employee :

Sex : Female, male

Occupation :Executive, middle management, clerk, skilled blue collar in manufacturing industries, skilled blue collar in craft industries, driver, handler, unskilled blue collar in manufacturing industries, unskilled blue collar in craft industries.

In the regression using the sample of employees with a hierarchical position, blue collars from manufacturing and craft industries have been grouped together. There are no drivers in this sample.

Education :

Third level education: college, engineering school, institute of technology, training in health and welfare, “grande école”

Second level education: BAC or equivalent

Vocational training : CAP, BEP, BEI, BEC, BEA

No diploma

Age : 15 to 24, 25 to 39, 40 to 49, 50 and more

Seniority: 1 to 2 years, 3 to 4 years, 5 to 6 years, 7 to 10 years, 10 years and more

General characteristics of the firm

Size in number of employees : 1000 and more, 500 to 999, 100 to 499, 50 to 99

Industry : Industries of mineral products ; textile industries ; clothing and leather industries ; wood and paper industries ; printing, press, publishing ; production of propellants and fuels ; chemicals, rubber and plastic products ; pharmaceutical, perfumes and cleaning products ; Foundry and metal work products ; mechanical engineering industries ; household equipment industries ; electrical and electronic equipment industries ; electrical and electronic components industries ; automobile industry ; shipbuilding, aircraft and railway industries ; food industries.

Other explanations measured at the firm level

Number of hierarchical layers: 5 to 9 levels, 4 levels, 3 levels, 0 to 2 levels

Social climate:

Between 1994 and 1997, the following difficulties represented (low, relatively important, important or very important) constraints on organizational choices?

Tensions between services ?

Problems of involvement or adaptation of non executives ?

Problems of involvement or adaptation of executives ?

Disputes with staff (petitions, strikes...) ?

Computer use:

In 1997, were accounting services (yes/no) and production services (yes/no) endowed with the following computer systems ?

Large centralized computer systems ? Micro-computers not connected in networks ? micro-computers connected in networks ?

APPENDIX G : Variables on wages

Net compensation (LSNET)

The net compensation we measure is used to compute the tax on wages. It groups all earnings paid in cash or kind between the 1st of January and the 31st of December 1996 less social contributions (social security, pensions, unemployment benefit).

This compensation includes base wage, all bonuses, taxed allowances and compensations in kind. Bonuses associated with the two French profit sharing regimes (“participation” and “intéressement”) are not included when they are not taxed. However, bonuses connected to “participation” schemes are generally not taxed when the reverse is true for bonuses connected to “intéressement” schemes. It is the length of the period during which bonuses remain unavailable that determines taxation. In the case of “participation”, when this unavailability period is shortened to three years, the bonuses become partly eligible to taxation. In the case of “intéressement”, bonuses are partly exonerated from taxes when they are blocked for a while in a company saving scheme.

If we except bonuses connected with “participation”, compulsory in firms with more than 50 employees, most of the earnings that contribute to an individualization of compensations are taken into account in our variable. Thus, we may interpret it as an “output” of the wage policy of the firm.

Lastly, compensations correspond to employment periods that vary from one employee to the other. We have annualized the information we had, taking into account the number of days worked. This does not correct for part time, but only 6% employees in our sample declare working part time.

Employees interviewed in the COI survey also belong to the DADS file¹⁶. We therefore know their past wage trajectory. From this file, we compute the mean over 4 years (1993-1996) of the logarithm of annual net wage (LSNET) and its standard error which represents an indicator of wages’ time variability.

Share of relevant dimensions of work that are perceived by the employee as having a significant influence on wages and progression (PEVSAL)

This variable is built from the answers to 8 questions asked to the whole sample of employees : Which elements have an influence on your wage or progression?

- a) Do high quality work (yes/no/ it does not apply)
- b) Carry the assignments to the letter (yes/no/ it does not apply)
- c) Be in good terms with your boss (bosses) (yes/no/ it does not apply)
- d) Be in good terms with your colleagues (yes/no/ it does not apply)
- e) Take up training courses (yes/no/ it does not apply)
- f) Learn how to use new technologies (yes/no/ it does not apply)
- g) The company’s performances (yes/no/ it does not apply)
- h) other reasons (if yes, please give more precisions)

PEVSAL is the number of “yes” given to these 8 questions, divided by the number of questions where the employee answered yes or no.

¹⁶ For a presentation and use of the DADS file, see le Minez and Roux (2002).

The employee declares that his wage or his progression mainly relies on his own work (TRAPER)

The employee declares that his wage or his progression mainly relies on the work of the team or on his own work and on the work of the team (TRAEQ)

These two variables are built from a questions asked to the whole sample of employees.

Your wage or progression? ...

1 – mainly relies on your own work

2 – mainly relies on the work of the team (shop floor, department) to which you belong

3 – relies on both

4 – relies on neither of the two

9 – does not know

TRAPER = (the employee answers 1)

TRAEQ = (the employee answers 2 or 3)

Table 1 : How do firms individually evaluate employees in industry in 1997?

results in %	Executives		Middle management		Clerks		Skilled blue collars		Unskilled blue collars		Total sample	
	Total	SR	Total	SR	Total	SR	Total	SR	Total	Not boss	Total	SR
<i>Do you have at least one evaluation interview per year ?</i>	76	73	64	58	42	43	40	39	35	37	52	45
Employees with at least one evaluation interview per year (52%)												
The interview is based on precise and measurable criteria	87	78	89	91	88	87	88	86	85	84	88	86
There is an evaluation grid for the staff of the company	75	72	72	70	81	82	66	65	52	52	70	67
Direct superiors participate in the evaluation	96	90	92	96	90	89	86	84	90	89	91	89
Colleagues participate in the evaluation	7	4	2	2	4	4	11	11	32	35	9	11
A superior other than the direct one participates in the evaluation	38	49	39	30	49	48	63	60	68	69	49	52
The assessment issued from this interview has an influence on your wage or your progression	71	58	68	63	66	66	51	49	26	25	60	52
The assessment issued from this interview has an influence on your job security	47	47	33	38	37	36	34	34	40	41	38	38
Number of employees in the total sample	588	169	1108	596	358	328	1716	1435	850	789	4620	3317

Source. COI survey, Labor force section (1997 ; DARES)

Note : This table describes the situation of employees with at least one year of seniority, having colleagues in manufacturing firms with more than 50 employees. Figures are corrected for the survey and non-response rates. The “Total” column corresponds to statistics computed over the whole sample and the “SR” column to the one computed over the sample of employees having no subordinates.

Table 2a : The determinants of evaluation interviews: collective work and intensity of autonomy

6 definitions of collective work	Model 1			Model 2			Model 3		
	Collective work	Autonomy intensity		Collective work	Autonomy intensity		Collective work	Autonomy intensity	
Definition 1: Do you sometimes do your work in group or collectively?									
No teamwork	0	1	Ref.	0	1	Ref.	0	1	Ref.
Teamwork in production activities	0,26**	2	0,26*	0,33**	2	ns	0,30**	2	ns
Teamwork in conception, research or analysis activities	0,86**	3	0,31**		3	ns		3	ns
		4	0,55**	0,50**	4	0,33*	0,46**	4	0,36*
Definition 2: How much of your working time does work in group or collectively takes?									
No teamwork	0	1	Ref.	0	1	Ref.	0	1	Ref.
Less than ¼ of your time	0,49**	2	0,29**	0,38**	2	ns	0,36**	2	0,29
More than ¼ of your time	0,44**	3	0,40**	0,29*	3	ns	0,26*	3	ns
Almost all the time	0,40**	4	0,70**	0,45**	4	0,36**	0,41**	4	0,38**
Definition 3 : In the context of your work, do you participate in meetings ?									
No meetings	0	1	Ref.	0	1	Ref.	0	1	Ref.
1 or 2 meetings / year	0,65**	2	0,27*	0,54**	2	0,22	0,49**	2	0,24
3 to 10 meetings / year	1,07**			0,81**			0,74**		
11 to 16 meetings / year	1,35**			0,19			1,04**		
More than 17 meetings / year	1,71**			0,34**			1,18**		
		3		1,10**	3	ns		3	ns
		4		1,32**	4	0,26*		4	0,31*
Definition 4 : Intensity of communication with colleagues and other people in the firm									
Low intensity of communication	0	1	Ref.	0	1	Ref.	0	1	Ref.
Communication intensity 1	0,21*	2	0,26*	0,20*	2	ns	ns	2	ns
Communication intensity 2	0,36**	3	0,33**	0,25*	3	ns	ns	3	ns
Communication intensity 3	0,58**	4	0,61**	0,38**	4	0,31*	0,33**	4	0,34*
Definition 5 : Intensity of help from direct superiors, colleagues or other people in the firm									
Not being helped	0	1	Ref.	0	1	Ref.	0	1	Ref.
Help intensity 1	ns	2	0,29**	ns	2	ns	ns	2	ns
Help intensity 2	0,26**	3	0,40**	0,31**	3	ns	0,29**	3	ns
Help intensity 3	0,53**	4	0,72**	0,51**	4	0,34**	0,45**	4	0,37*
Definition 6 : Is your work rhythm connected with that of colleagues?									
No connection with coll.	0	1	Ref.	0	1	Ref.	0	1	reference
Being dependent on colleagues	ns	2	0,28**	ns	2	ns	ns	2	ns
		3	0,41**		3	ns		3	ns
		4	0,73**		4	0,36**		4	0,39**

Source. COI survey, labor force section (1997, DARES) and business section (1997, SESSI and SCEES)

Note: The regressions are run on a sample of 3081 employees with at least one year of seniority, having colleagues, attached to 1715 manufacturing firms with more than 50 employees and having no subordinates. Logistic type regressions have been used. ** indicates that the coefficient is significant at the 1% level, * at the 5% level and ns that it is not significant at the 10% level. In model 1, we explain the fact of having at least one evaluation interview per year by a variable measuring the intensity of autonomy and a variable measuring collective work. Six different “collective work” variables are tested. In model 2, we add socio-demographic variables (sex, 4 age groups, 5 seniority groups, 4 education levels and 9 occupation groups) and variables characterizing the firm (4 size and 16 industry dummies). Model 3 is model 2 augmented with variables describing the organizational practices of the firm in 1997 and variables capturing other alternative explanations (2 “employees” variables and 7 “firms” variables).

Table 2b: The determinants of evaluation interviews: organizational practices, control variables and other factors

<i>Control variables and alternative explanations</i>	<i>Model 3 / definitions of collective work</i>					
	<i>N°1</i>	<i>N°2</i>	<i>N°3</i>	<i>N°4</i>	<i>N°5</i>	<i>N°6</i>
<i>Firm's organizational practices</i>						
<i>ISO 9001, 9002, EAQF Certification</i>	<i>0,43**</i>	<i>0,43**</i>	<i>0,37**</i>	<i>0,42**</i>	<i>0,42**</i>	<i>0,42**</i>
<i>5 S method or TPM</i>	<i>0,30**</i>	<i>0,30**</i>	<i>0,27*</i>	<i>0,31**</i>	<i>0,33**</i>	<i>0,32**</i>
<i>Problem solving groups</i>						
<i>10 to 50% of direct</i>	<i>0,39**</i>	<i>0,39**</i>	<i>0,34**</i>	<i>0,41**</i>	<i>0,40**</i>	<i>0,40**</i>
<i>More than 50 of direct</i>	<i>0,54*</i>	<i>0,54*</i>	<i>0,41</i>	<i>0,56*</i>	<i>0,55*</i>	<i>0,54*</i>
<i>Management participates in project teams</i>	<i>-0,27*</i>	<i>-0,26*</i>	<i>-0,28*</i>	<i>-0,26*</i>	<i>-0,25*</i>	<i>-0,25*</i>
<i>Firm's general characteristics</i>						
<i>Firm with 100 to 499 employees</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Firm with 500 to 999 employees</i>	<i>0,40**</i>	<i>0,40**</i>	<i>0,37*</i>	<i>0,43**</i>	<i>0,42**</i>	<i>0,43**</i>
<i>Firm with more than 1000 employees</i>	<i>0,38*</i>	<i>0,39*</i>	<i>0,30</i>	<i>0,40*</i>	<i>0,40*</i>	<i>0,41*</i>
<i>Other possible factors measured at the firm level</i>						
<i>3 hierarchical levels</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>4 hierarchical levels</i>	<i>0,22</i>	<i>0,22</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>5 to 9 hierarchical levels</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Network of micro-computers in accounting</i>	<i>0,23*</i>	<i>0,22*</i>	<i>0,24*</i>	<i>0,24*</i>	<i>0,24*</i>	<i>0,24*</i>
<i>Large computer system in accounting</i>	<i>0,19</i>	<i>0,19</i>	<i>ns</i>	<i>0,19</i>	<i>0,20</i>	<i>0,19</i>
<i>Problems of involvement of executives</i>						
<i>relatively important</i>	<i>0,28**</i>	<i>0,28**</i>	<i>0,30**</i>	<i>0,28*</i>	<i>0,27*</i>	<i>0,27*</i>
<i>important or very important</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Employee's socio-demographic characteristics</i>						
<i>AGE : 15 to 24</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>25 to 39</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>40 to 49</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>0,22</i>	<i>0,23</i>
<i>Vocational training (CAP and BEP)</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Second level education (BAC)</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Third level education</i>	<i>ns</i>	<i>0,31</i>	<i>ns</i>	<i>0,29</i>	<i>0,32</i>	<i>0,31</i>
<i>Executive</i>	<i>0,64*</i>	<i>0,68*</i>	<i>ns</i>	<i>0,65*</i>	<i>0,72**</i>	<i>0,71*</i>
<i>Middle management</i>	<i>0,54*</i>	<i>0,56*</i>	<i>ns</i>	<i>0,53*</i>	<i>0,56*</i>	<i>0,59*</i>
<i>Clerk</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Skilled blue collar in manufacturing industries</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Skilled blue collar in craft industries</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Driver</i>	<i>ns</i>	<i>0,70</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Handler</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Unskilled blue collar in manufacturing industries</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Other possible factors measured at the employee level</i>						
<i>The employee meets precise quality norms</i>	<i>0,32**</i>	<i>0,31**</i>	<i>0,27**</i>	<i>0,32**</i>	<i>0,33**</i>	<i>0,34**</i>

Source. COI survey, labor force section (1997, DARES) and business section (1997, SESSI and SCEES)

Note: This table gives the coefficient associated with the other variables of model 3, except for industry dummies. We do not report variables with a coefficient that is not significant at the 10% level in any regression. For each variable, an item is omitted, contributing to the definition of the reference situation: male above 50, with seniority above 10 years, with no degree expect CEP or BEPC, unskilled blue collar in craft industries, who does not have to meet precise quality norms or industrial and market constraints, affiliated to a firm with less than 100 employees with 0, 1 or 2 hierarchical levels, in the food industries, that does not use new organizational practices, with a strict division of labor in the workshop, that has experienced neither tensions between services, nor problems of adaptation of its staff, nor disputes when changing organization and that is not equipped with computers.

Table 3 : Relationships between evaluation interviews, workers perception of what affects wage or progression and compensation

<i>Treatment = At least one evaluation interview in 1997</i>	<i>Definition 1 production / research in group</i>	<i>Definition 2 working time in group</i>	<i>Definition 3 meetings</i>	<i>Definition 5 help</i>
<i>Log annual net compensation estimated from wages declared by the employer in the DADS file in 1996 and the number of days worked (LSNET)</i>				
<i>Difference in means</i>	0,148** (base sample ; N=3081) 0,126** (panel ; N=2135)			
<i>Regression</i>	<i>ns</i> <i>ns</i>	<i>ns</i> <i>ns</i>	<i>ns</i> <i>ns</i>	0,023 <i>ns</i>
<i>Propensity score</i>	0,027 <i>ns</i>	0,027 <i>ns</i>	<i>ns</i> <i>ns</i>	0,027 <i>ns</i>
<i>Individual Mean of LSNET 1993-1996</i>				
<i>Difference in means</i>	0,113** (panel ; N=2135)			
<i>Regression</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Propensity score</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Individual standard-error of LSNET 1993-1996</i>				
<i>Difference in means</i>	<i>ns</i> (panel ; N=2135)			
<i>Regression</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Propensity score</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
<i>Share of relevant dimensions of work perceived by the employee as having an influence on his wage and progression (PEVSAL)</i>				
<i>Difference in means</i>	0,169** (base sample ; N=3055) 0,177** (panel ; N=2121)			
<i>Regression</i>	0,118** 0,128**	0,118** 0,129**	0,109** 0,118**	0,118** 0,128**
<i>Propensity score</i>	0,114** 0,130**	0,116** 0,132**	0,107** 0,122**	0,117** 0,183**
<i>The employee declares that his wage and progression mainly rests on his own work (TRAPER)</i>				
<i>Difference in percents</i>	0,116** (base sample; N=3081) 0,105** (panel ; N=2135)			
<i>Regression</i>	0,069** 0,067**	0,068** 0,068**	0,055** 0,050*	0,066** 0,063**
<i>Propensity score</i>	0,076** 0,078**	0,076** 0,078**	0,058* 0,060*	0,075** 0,079**
<i>The employee declares that his wage and progression mainly re-lies on the work of the team or on his own work and on the work of the team (TRAEQ)</i>				
<i>Difference in percents</i>	0,083** (base sample ; N=3081) 0,072**** (panel ; N=2135)			
<i>Regression</i>	0,069** 0,055**	0,068** 0,051**	0,068** 0,054**	0,071** 0,057**
<i>Propensity score</i>	0,067** 0,049**	0,066** 0,046**	0,067** 0,051**	0,069** 0,050**

Source. COI survey, labor force section (1997, DARES) and business section (1997, SESSI and SCEES)

Note : The compensation we measure is an annualized net wage computed from the total net compensations declared in the 1996 DADS file and taking into account the period of work expressed in a number of days. The explanatory model of evaluation interviews we use corresponds to model 3 and, depending on the column, to definitions 1, 2, 3 and 5 of collective work.

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