Informal help in the workplace as organizational capital: Analysis from a matched employer-employee data set [0]

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Abstract.

Coordination through communication is not restricted to the members of an official team. Indeed, different teams can coordinate themselves and different employees working officially independently can interact for productive reasons. In order to catch the relational dimension of work organisation beyond the usual concept of team, the work sociologists have developed the concept of informal help network. This concept means that the work collective formalized by a firm does not sometimes correspond to the one actually observed on the ground. Using French matched employer-employee data sets (COI 1997 and DADS), we analyse the effects of a worker's informal help network membership on his wage, productive effort and cognitive effort. We find out using a PS-matching estimate that these effects are mainly due to selection effect. Hence informal help in the workplace is a product of firms' organisational design. Moreover we show that good workers in terms of effort help good workers.

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1. Introduction.

The team theory describes the decentralization of work by modeling the setting of decisions and by formalizing the information system that support decisions (Marschak and Radner 1972). The general idea is that, in firms, work is mainly teamwork. If teamwork provides some advantages (namely the complementarities and interdependencies which generate positive productive spill-over), it also implies a major disadvantage that produces inefficiency: free-riding behaviors. To thwart the free-riding problem, the management has to choose a coordination mode of the member of the team to make them converge towards a pareto-optimal equilibrium. In this perspective, Kandel and Lazear (1992) suggest that peer pressure can be a coordination mode.

However coordination through communication is not restricted to the members of a given team. Indeed, two different teams may need to coordinate and two different employees working officially independently may interact for productive reasons. In order to catch the relational dimension of work organisation beyond the usual concept of team, the industrial sociologists (see for instance Roy 1954, 1959 or Gross 1953) have developed the concept of *informal help network*[1]. This concept means that the work collective formalized by a firm does not sometimes correspond to the one actually observed on the ground. For instance, some workers may officially work independently one from the other (individual work) but these workers may actually work in team by developing an informal communication system and an informal help system among them. Likewise, an official team can included some informal sub-teams (because some workers specialized themselves informally in one special task, or because of specific social relationship between some workers[2]). According to the industrial sociologists, the existence of informal help networks depends on workers. By helping other employees, workers simply express their class, gender, ethnic (etc…) solidarity in the workplace.

We think that this story is not the complete one. Indeed we argue in this paper that by helping other employees, workers mainly obey to an organisational design set up by firms in order to incite workers to help one another. By using the Al-Najjar, Anderlini and Felli (2006)'s definition of describability/undescribability, we argue that firms do so because any task in the workplace has a describable dimension and an undescribable one. While the describable dimension of a task can be contractualised by the Principal, the undescribable dimension cannot. However both dimensions have an influence on the probability of task success, hence on firms' expected profit and on workers expected utility. Thus by incite workers, through the work organisational design, to help each other, firms reduce the negative impact of the undescribable dimension of tasks on their expected profit. Likewise by helping each other, workers reduce the negative impact of the undescribable dimension of tasks on their expected utility.

Our explanation of informal help in the workplace is tested over a data set consisting of a matched employer-employee data set called "Changement Organisationnel et Informatisation[3]" COI 1997 which provide information about IT and organisational practices between 1994 and 1997, and an administrative data set called "Déclarations Annuelles de Données Sociales" DADS 1997 which provides information concerning wages.

[1] The notion of informal help network while close, is however different from the notion of virtual team (see Martins et al. 2004) which is popular in IT literature and in Management literature. Broadly speaking a virtual team is a functioning team which relies on technology-mediated communication (e-mail for instance) while crossing boundaries such as geography, time and organisation.

[2] For instance, being friend, brother or sister.

[3] The COI survey (http://www.enquetecoi.net) has been used by several researchers like Acemoglu et al. (2007).

To resume, both firms and workers have a good reason to see workers help each other in the workplace. Nevertheless, we show that workers do not match (in terms of help) randomly; indeed we show that workers who are helped are those who are good enough (in terms of disutility of effort) to be member of an informal help network.

Two papers in the literature are close to ours. The first one is of course Ichniowski and Shaw (2005) who show that employees, by communicating with their colleagues, succeed in resolving the operational problems they encounter, without the aid of a hierarchical superior. The second paper is from Drago and Garvey (1998) who, over an Australian data set, analyse the incentive for helping on the job. Two mains results can be drawn from their paper: The first result which supports the thesis of Lazear (1989) is that helping on the job decreases when the incentive scheme is promotional (tournament, etc…). Secondly, helping on the job increases with task variety. The article of Drago and Garvey (1998) is interesting because it develops and tests a model of how commonly used incentive schemes affect worker's choices to help one another. However these schemes are exogenous to the model.

The rest of our paper goes as follows. Section 2 is devoted to our econometric methodology. We construct in this section a Principal-Multiagents framework in which any task has a describable dimension and an undescribable one. We state also the econometric models (a logistic regression and a PS-matching regression) that we test. We present and discuss in section 3 our empirical results. Finally section 4 concludes.

2. Econometric Models

2.1. Definitions

To the best of our knowledge, the first article which provides a complete formalisation of helping effort is Itoh (1991) which shows that the manager can use help in order to improve the productive performance of his employees. However the main motivation of Itoh (1991) is to find the conditions which allow an endogenous formation of a team or an endogenous labour division within a work collective.

While informal help is an intuitive and widely accepted concept, no definition exists in the economic literature. The purpose of this subsection is firstly to state explicitly our meaning of informal help and secondly to link informal help to the incentive mechanism in the workplace.

Our econometric models are based on a Principal-Agent model in which a number (at least one) of production has to be achieved. Each production requires only one task. If this task is performed by only one Agent then we shall say that the production is an *individual* one, however if the task is performed by at least two Agents then we shall say that the production is a *team work*. The reason to make such a distinction is that it may be the case that the likelihood and the frequency of help are different in individual work and team work.

In any case (individual work or team work), an Agent makes an effort decision unobservable by the Principal. Production, that is the outcome of the task, is a random variable X that can either succeed (X=1) or fail (X=0) giving respectively R^{ind}_{sup} or R^{ind}_{inf} payoffs to the Principal in individual work and R^{team}_{sup} or R^{team}_{inf} payoffs to the Principal in team work. In order to avoid triviality, we suppose that the revenues R^{ind}_{sup} and R^{team}_{sup} are enough high.

A task in our formal framework, is characterised by an infinite countable number of states $s_1, s_2, \ldots, s_n, \ldots$ that can arise during the task. The state space is therefore $S = \{s_1, s_2, \ldots, s_n, \ldots\}$, and each state s_i is itself an infinite sequence of the type $\{s^1_i, s^2_i, \ldots.\}$ where $s^j_i = 1$ (true) or 0 (false). These states imply different *events Z* which can be either *describable* or *undescribable*, where the definition of describability/undescribability is the Al-Najjar, Anderlini and Felli (2006)'s definition[4].

Definition.
Let μ be a probability measure defined by: for any $Z \subset S$, $\mu(Z) = Lim_{N\to\infty} (1/N) \Sigma^N_{n=1} 1_{sn\in Z}$.
Let $j \in \{0,1\}$ and $A(i,j) = \{s_n \in S$ such that $s^i_n = j\}$. Finally, let Ω be the algebra of subsets of S built from the collection of sets of the type A(i,j).
An event Z included in S is undescribable if $\mu(Z) \in]0,1[$ and $\mu(Z|A) = \mu(Z)$, whatever $A \in \Omega$ with $\mu(A) > 0$.

In order to understand this definition, let us remark that A(i,j) is the set of states that have the i-th feature equal to $j \in \{0,1\}$. For instance $A(2,1) = \{s_1, s_5\}$ means $s^2_1 = 1$ and $s^2_5 = 1$: A(2,1) is the set of states whose 2-nd feature is true. Since Ω is an algebra built from the A(i,j), it must be the case that Ω is closed by complements and/or finite intersections and/or finite unions of the A(i,j). As a consequence an element A of Ω can be defined as a finitely definable set, in the sense that it is defined by finitely many elementary statements about the features of the states that it contains. According to the Al-Najjar, Anderlini and Felli (2006)'s definition, an event Z is undescribable if its probability measure (with respect to to μ) in neither 0 nor 1 and if knowing a finitely definable set A does not improve the measure of Z. From this point of view, an event Z is undescribable if it cannot be described using a finite language.

To illustrate, let us take the case of a firm which is recruiting a technician to help his customers. Suppose also that this firm would like to specify *exante*, for each type of problem faced by the consumers, the time that this technician has to spend to solve the problem. It may be the case that there are some problems which are inherently hard to describe *exante* with full details. Such a kind of problems is undescribable according to the Al-Najjar, Anderlini and Felli (2006)'s definition.

Let us summarise by saying that a task has two dimensions: the describable one (*the D dimension*) and the undescribable one (*the UD dimension*). By definition, while the describable dimension of a task can be contractualised by the Principal, the undescribable dimension cannot. Let us assume without loss of generality that the D dimension is known by the Principal and the Agents; and that the UD dimension is known by the Agents *only when they start working*.

Since the D dimension is known by the Principal then it must be the case that he designs the contract in order to recruit Agents who can fit this D dimension. That is to say, in our analysis, Agents are always able to solve by themselves all problems concerning the D dimension of their tasks. However if they face a problem which belongs to the UD dimension of their tasks, then two situations can arise: either they are able to solve by themselves the problem or they ask for help from the other workers.

[4] Even if Al-Najjar, Anderlini and Felli (2006) main concern is complex environment, their analysis is completely different from the one of Crémer, Garicano and Prat (2006). Indeed in the latter the main concern is to construct an optimal organisational language that both facilitates internal communication and permits communication with other organisations. In Al-Najjar, Anderlini and Felli (2006), the language that is used by the individual is rich and the undescribability of an event is not language-dependent. That is, an event is undescribable because it is too complex to be describable by any finite language.

Hence in our analysis, the Principal cannot contractualise help among the employees because it is intrinsically UD.

Let us call *productive communication,* a communication from worker i to worker j, i≠j, which has an impact on the productivity of worker's j. We shall say that a productive communication is *formalised* (by the Principal) if for any event that can arise, the Principal can state who (worker) communicates with who. Hence *formal productive communications* concern only the D-dimension of the task. Likewise, we shall call *informal productive communication*, a productive communication which is not formalised by the Principal[5]. Hence informal productive communication concerns the UD-dimension of the task.

Let us now define an *informal help network* as a collective of at least two workers in which any member *communicates in the sense of informal productive communication* with any other member in the network, either directly or indirectly through other members (formally an informal help network corresponds to the so-called Hamiltonian graph in the graph theory literature).

We assume that there is no money transfer between *informal help network* members, in exchange of help. As a consequence the main rule that drives the behaviour of *informal help network* members is reciprocity. That is, if necessary any member must be helped; and if necessary he has to help another member.

Let ho and hr belonging to the set of effort $\Theta_g = \{0,1,\ldots,e,..,e_g\}$, be respectively the *helping effort from the Agent to other workers* and the *help received from other workers*.

We assume that both ho and hr depend on a vector CH1 of the worker's characteristics out of the workplace (like age, sex, diploma, ethnicity,…), a vector CH2 of the worker's characteristics in the workplace (like the occupation in the workplace, the use of ICT,…) and a vector CH3 of the firm's characteristics (like the industrial sector, the organisational design, the incentive design,…): ho(CH) and hr(CH) where CH = (CH1,CH2,CH3).

As a consequence in our formal framework, firms can influence help among their workers, for instance by increasing the interdependency between workers through the implementation of organisation favoring quality, just-in-time resource management, tighter lead-times, reduction in the numbers of management levels, as well as the diffusion of information technologies.

Since our analysis is static, it is easy to see that, a priori, *informal help network* faces free-riding from its members: when a member has been helped and his UD problem has been solved, he has no incentive to help other members.

Hence help will be higher in teamwork than in individual work, for two reasons. Firstly because the probability to free ride in an informal help network whose members belong to an official team is weaker than the probability to free ride in an informal help network whose

[5] Let us remark that in practice, formal (productive) communication and informal (productive) communication will be correlated because if an employee needs to be helped over on UD aspect of his task, it could be the case that he will ask for help from an employee he usually communicates formally with. Therefore, in our empirical analysis we state the notion of *pure informal communication* which is the part of informal communication which is not correlated with formal communication.

members do not work in an official team. Indeed in official team, the Principal has already constructed some mechanisms to solve the free-riding problem within team.

And secondly because the meaning of helping effort is not the same in teamwork comparing to individual work. Indeed in individual work, the benefit derived by a member of this informal help network from being helped by some members of this network, is (the benefit) only for this member. In teamwork, help has the characteristic of a local public good in the sense that help to any teamworker by his informal help network[6] mates, beneficiates to all team workers.

The Agent's effort K (which is a random variable from the Principal's standpoint) also belongs to the set $\Theta_g = \{0,1,\ldots,e,..,e_g\}$; however the *maximal level of productive effort* that the Principal can legally incite the agent to supply is K = e.

Since we have assumed the revenues (R^{ind}_{sup} and R^{team}_{sup}) to be enough high, it must be the case that the Principal designs the contracts in order that the Agents play the effort "e". As a consequence, ho, the effort provided by an employee to help another, and K, the effort provided by an employee, are not substitute.

Let Pr(X=1|K=k; hr, ho) be the conditional probability of success of the task *in individual work* given that the Agent's level of effort is k; the help received from other workers is hr and the help he provides to other workers is ho.

Likewise, in a *team of d workers*, $Pr(X=1|K_1=k_1, \ldots, K_d=k_d; hr_1,\ldots,hr_d , ho_1,\ldots,ho_d)$ be the conditional probability of success of the task given the Agents' levels of productive effort are respectively $k_1, \ldots,k_d$; the help received from other workers are respectively $hr_1,\ldots,hr_d$ and the help their provide to other workers are respectively $ho_1,\ldots,ho_d$.

We assume these two kinds of probabilities to increase with the levels of effort and help received. Hence we assume that help received from another employee permits to reduce the risk of production failure, risks which are linked to the UD aspects of the task.

We suppose that the Principal is risk-neutral and that the Agents are risk-averse with a utility function U having all the good mathematical properties:

$$U(w, k, ho, hr) = \hat{U}(w, k) + \Lambda_r(hr) - \Lambda_o(ho)$$

Where:
$\hat{U}(w, k) = u(w) - v(k)$;
u and Λ_r are strictly increasing concave functions;
v and Λ_o are strictly increasing convex functions;
$\Lambda_r(0) = \Lambda_o(0) = 0$;
and w is the wage.

Moreover the reservation utility of the Agents is $\bar{U}$.

Since the UD aspects of the task are not contractualised then the Principal calculates the optimal contract under the restriction that hr = ho = 0.

[6] Let us remark that this network may not coincide with the true team.

2.2. The optimal contracts

Let us briefly describe the timing of the contract for any Agent:

1. *The Principal constructs the contract.*
2. *The Agent signs the contract with the Principal.*
3. *Production starts.*
4. *The Agent observes an UD aspect of his task and check if he can solve it or not.*
5. *If he can solve it, then he provides effort, nature plays (X=1 or 0) and payoff are delivered.*
6. *If he cannot then he decides whether or not to join an informal help network:*
   $E[U(w, k, ho, hr)] \geq E[\hat{U}(w,k)]$
   We assume that the Agent knows hr and ho before taking his decision.
7. *If he does not join an informal help network, then he provides effort, nature plays (X=1 or 0) and payoff are delivered.*
8. *If he does join an informal help network, then he provides effort, receives help, provides eventually help to another worker, nature plays (X=1 or 0) and payoff are delivered.*

Obviously by definition, workers who are members of an informal help network are those whose expected utility is increased by membership.

In the case of individual work, the expected profit when hr=ho=0, of the Principal is the following:

$[R^{ind}_{sup} - w_{1I}].Pr(X=1|K=k) + [R^{ind}_{inf} - w_{0I}].[1 - Pr(X=1|K=k)]$

where w_{1I} is the Agent's wage when X=1 and w_{0I} is the Agent's wage when X=0.

And *in the teamwork case*, when hr=ho=0, the expected profit writes:

$[R^{team}_{sup} - d.w_{1T}]. Pr(X=1|K_1=k_1, \ldots, K_d=k_d) +$

$[R^{team}_{inf} - d.w_{0T}].[1 - Pr(X=1|K_1=k_1, \ldots, K_d=k_d)]$

where w_{1T} is the Agent's wage when X=1 and w_{0T} is the Agent's wage when X=0.

Let us take the *individual work case*. The Principal maximizes his expected profit (for an effort k=e), under a participation constraint: $E[\hat{U}(w,k)|k=e] \geq \bar{U}$ and under an incentive constraint: $E[\hat{U}(w,k)|k=e] \geq E[\hat{U}(w,k')|k'=e']$, whatever $e'<e$,
where $E[\hat{U}(w,k)|k=e]$ is the agent's expected utility when ho=hr=0, conditional to the fact that he plays an effort k=e.

The participation constraint writes:

$Pr(X=1|k=e)[u(w_{1I}) - v(e)] + (1 - Pr(X=1|k=e))[u(w_{0I}) - v(e)] \geq \bar{U}$

That is:

$Pr(X=1|k=e)u(w_{1I}) + (1 - Pr(X=1|k=e))u(w_{0I}) \geq \bar{U} + v(e)$

The incentive constraint writes:

$Pr(X=1|k=e)u(w_{1I}) + (1 - Pr(X=1|k=e))u(w_{0I}) - v(e) \geq$

$Pr(X=1|k'=e')u(w_{1I}) + (1 - Pr(X=1|k'=e'))u(w_{0I}) - v(e')$, whatever $e' < e$.

Another way to write the incentive constraint is the following:

$e \equiv \underset{k \in \{0,\ldots,e\}}{ArgMax}\ E[\hat{U}(w,k)|k=e]$

Let us assume that the prerequisites for using the so-called *First Order Condition* method are fulfilled. Hence we can replace the incentive constraint by the first order condition for maximising $E[\hat{U}(w,k)|k=e]$:

$Pr'(X=1|k=e)u(w_{1I}) + (1 - Pr'(X=1|k=e))u(w_{0I}) - v'(e) = 0$

where $Pr'(X=1|k=e)$ and $v'(e)$ are respectively the value at k=e of the derivatives of $Pr(X=1|k=e)$ and $v(e)$ with respect to k.

Let L be the Lagrangian of the problem. $L = [R^{ind}_{sup} - w_{1I}].Pr(X=1|k=e) + [R^{ind}_{inf} - w_{0I}].[1 - Pr(X=1|k=e)] + \lambda[Pr(X=1|k=e)u(w_{1I}) + (1 - Pr(X=1|k=e))u(w_{0I}) - \bar{U} - v(e)] + \mu[Pr'(X=1|k=e)u(w_{1I}) + (1 - Pr'(X=1|k=e))u(w_{0I}) - v'(e)]$

where λ and μ respectively the Lagrange multipliers associated with the participation and the incentive constraints.

Using the Kuhn-Tucker method leads to:

$$w_{1I} = u'^{-1}\left[\frac{\Pr(X=1|k=e)}{\lambda \Pr(X=1|k=e) + \mu \Pr'(X=1|k=e)}\right]$$

$$w_{0I} = u'^{-1}\left[\frac{\Pr(X=0|e)}{\lambda \Pr(X=0|k=e) - \mu \Pr'(X=1|k=e)}\right]$$

Concerning teamwork, similar arguments lead to:

$$w_{1T} = u'^{-1}\left[\frac{d \times \Pr(X=1|k_1=e,\ldots,k_d=e)}{\lambda_2 \Pr(X=1|k_1=e,\ldots,k_d=e) + \mu_2 \Pr'(X=1|k_1=e,\ldots,k_d=e)}\right]$$

$$w_{0T} = u'^{-1}\left[\frac{d \times \Pr(X=0|k_1=e,\ldots,k_d=e)}{\lambda_2 \Pr(X=0|k_1=e,\ldots,k_d=e) - \mu_2 \Pr'(X=1|k_1=e,\ldots,k_d=e)}\right]$$

where λ_2 and μ_2 are respectively the Lagrange multipliers associated with the participation and the incentive constraints.

Of course in the teamwork case, in addition with the optimal contract, the Principal has to use other additional mechanisms (like peer pressure) in order to solve the free-riding problem within team.

2.3. The determinants of informal help network membership

What is important to state about the optimal contracts in individual work and teamwork is that the optimal wages do not depend to help.

Even if the Principal cannot contractualise help among workers (because help is linked to the undescribable part of the task), it will have an influence over his **expected profit** (when hr≠0 or ho≠0) which writes:

- *in the case of individual work*:
  $[R^{ind}_{sup} - w_{1I}].Pr(X=1|K=k; hr, ho) + [R^{ind}_{inf} - w_{0I}].[1 - Pr(X=1|K=k; hr, ho)]$

- *and in the teamwork case*:
  $[R^{team}_{sup} - d.w_{1T}]. Pr(X=1|K_1=k_1, \ldots, K_d=k_d; hr_1,\ldots,hr_d , ho_1,\ldots,ho_d) +$
  $[R^{team}_{inf} - d.w_{0T}].[1 - Pr(X=1|K_1=k_1, \ldots, K_d=k_d; hr_1,\ldots,hr_d , ho_1,\ldots,ho_d)]$

While w_{0I} and w_{1I} do not depend on hr, and while w_{0T} and w_{1T} do not depend on $hr_1,\ldots,hr_d$; the probabilities $Pr(X=1|K=k; hr, ho)$ and $Pr(X=1|K_1=k_1, \ldots, K_d=k_d; hr_1,\ldots,hr_d , ho_1,\ldots,ho_d)$ increase by hypothesis with hr and $hr_1,\ldots,hr_d$ respectively. As a consequence the expected profit of the Principal increases with hr and $hr_1,\ldots,hr_d$ in individual work and teamwork respectively.

Hence in our framework, by designing the organisation of work (thorough CH2 and CH3) in such a way that workers informally help each other, firms increase their expected profit.

In the data set that we use, we do not observe ho. However we observe hr. From hr, we define a variable Net_i which is equal to 1 if the worker i is observed being helped by other employees ($hr \neq 0$) and 0 otherwise. $Net_i = 1$ will also be interpreted as the fact the worker i belongs to an informal help network (as suggested by the point 6. of the timing of contract in subsection 2.2).

Since Net_i is a dummy variable, we use a logistic regression in order to estimate the determinants of informal help network membership. Let us remark that because hr depends on CH1, CH2 and CH3, the probability $Pr(Net_i = 1)$ also depends on CH1, CH2 and CH3. We expect to find empirically that CH2 and CH3 have much more influence over $Pr(Net_i = 1)$ than CH1.

2.4. The selection effects

Showing that CH2 and CH3 have much more influence over $Pr(Net_i = 1)$ than CH1 is an interesting result but it does not permit to fully understand the workers selection effects that are driven by the existence of informal help in the workplace.

2.4.1. Do workers who are helped are low-effort workers?

The answer is clearly negative. Indeed according to our formal framework, there is no direct effect of informal help network membership over the workers' effort. There is however an indirect effect of informal help network membership over workers' effort through a selection effect. The latter means that since informal help network membership is costly with respect to ho then it must be the case that informal help network attracts workers having a low-disutility of effort with respect to v or Λ_o. Hence on average, informal help network workers provide an effort higher than "e" the effort designed by the Principal. In other words, membership to an informal help network depends on workers' ability to help on UD dimension of tasks and this ability is correlated to their individual characteristics.
As a consequence when a worker is not helped, this does not mean that he is a good worker who does not need to be helped. It means instead that he is not enough good to be member an informal help network.

2.4.2. The effect of informal help network membership over workers' wage: a direct effect or a selection effect

Another question which can help to understand the selection effects behind informal help network membership is to know the effects of informal help membership over employees' individual wage.

According to our formal framework, w_{1I} does not depend on hr, and w_{1T} does not depend on $hr_1,\ldots,hr_d$. Hence being member of an informal help network *has no direct effect* of the employees' individual wage.

However according to section 2.4.1, workers who belong to an informal help network have a low-disutility of effort with respect to v or Λ_o. Such workers will provide an effort higher than "e" the effort designed by the Principal. This extra-effort will have a positive impact on the probability of success of the task. Since this probability is also for each employee the probability to get the wage w_{1I} or w_{1T} , it implies that the *expected wage* of individuals who belong to an informal help network is higher than the one of individuals who do not. As a consequence, the wage of individuals who belong to informal help networks is *on average* higher than the wage of those who do not.
This selection effect is reinforced by another effect which is implied by the fact that being helped also positively affects the probability of task success.

2.4.3. Econometric analysis of selection effects

From an econometric standpoint, the last two questions are tantamount to determine the impact of informal help network membership on effort and wage. However we need to control for selection bias. In order to this, we use the PS-matching method (Rosenbaum and Rubin 1983) which allows correcting the selection bias by matching individuals according to their propensity score which represent the probability of receiving the treatment given background characteristics.

The treatment in our paper is a binary variable TT equal to 1 if the employee belongs to an informal help network and 0 otherwise. Moreover, we use the *non parametric kernel matching operator* proposed by Heckman, Ichimura and Todd (1997, 1998) which under some regularity assumptions is convergent and asymptotically normal.

More precisely, let Y = k or w be the variable measuring respectively effort or wage. Three quantities are of interest to us. The first is the average treatment effect over the whole population, denoted C; the second is the average treatment effect over the treated individuals, denoted C_1; and the third is the average treatment effect over the non-treated individuals, denoted C_0. C measures the variation of Y that would be observed if the whole population was treated; C_1 is an evaluation of the effect of the treatment in the usual sense since it concerns the treated population; and C_0 is a prospective evaluation in the sense that it measures what would happen if the non-treated population was treated. We have:
$C = E[Y_1 - Y_0]$
$C_1 = E[Y_1 - Y_0|TT=1]$
$C_0 = E[Y_1 - Y_0|TT=0]$,
where Y_1 is the observed value of Y that results when receiving treatment (that is when being member of an informal help network), Y_0 is the observed value of Y that results when do not receiving treatment, and E[.] denotes expectation.
Finally the so-called *naïve estimate* represents the difference between the average of Y over the treated individuals and its average over the non-treated individuals.

3. Empirical Analysis

We use in this section the French survey on organisational change and computerization (COI) carried out in 1997. This survey includes two sections on “employers” and “employees”. It matches together a detailed description of the way workers communicate on their work-station with rich information on the firm and the personal characteristics of its employees. The field considered is industrial firms with more than 50 stable (i.e. with at least one year of seniority) employees. In our empirical work, we focus on manufacturing firms that hosts the larger part of the interviewed sample (6796 employees and 3019 firms). Moreover, in order to measure wages, we match this sample with the administrative data from the Annual Declaration of Social Data (DADS 1997).

We are going to work with a sub-sample of interviewed employees with close colleagues. It groups 4435 employees attached to 2511 firms.

3.1. The data sets and the variables

3.1.1. The data

The COI (organisational change and computerization) survey has been conducted at the end of 1997 by the French public statistical system[7]. Surveyed firms have been randomly selected from administrative datafiles. The manager being questioned was asked to describe the choices made by the firm in terms of IT and organisational practices between 1994 and 1997, to specify the difficulties encountered in their implementation as well as the general strategy followed by the firm. The lists of surveyed firms have subsequently been matched to the file of the DADS for the year 1996. Small samples of employees have been selected within each firm. The criterion of random selection of employees is “being born in the month of October in an even-numbered year". It guarantees their presence in the population constituted each year in the DADS. Employees were surveyed by telephone and home visits. The survey procedure involved questioning employees one year after being surveyed in the DADS. If they are successfully located and still in the same firm, they have at least one year’s seniority. This means that the employees must be stable. The “employees” questionnaire comprises three parts. The first provides socio-demographic data; the second takes an interest in employees’ work-station characteristics in terms of scope for initiative, communication, working speed, and work evaluation, while the third produces a set of information dealing with the use of IT, telecommunications and modern industrial technologies.
The starting point for our empirical analysis is thus the “employees” section of the C.O.I, from which we measure the help network of employee, the productive and cognitive effort and some technical and organisational characteristics of work stations. As the employees who occupy these posts are stable with 90% of them on a fixed-term contract, it is clear that we can have a particular interest in the design of work stations in the “primary” sector or the firm’s “core activity”. We use the “firms” section of the C.O.I survey to identify the productive context in which employees’ work stations. Finally, the DADS file of 1997 constitutes a basis for the survey in the “employees” section, providing indicator on the wage of the employee.

7 The conception and coordination of the COI survey has been directed by the Center for Labor Studies (Centre d'Etudes de l'Emploi). The survey has been carried out in a consortium involving the Ministry of labour (DARES), the Ministry of Industry (SESSI), the Ministry of Agriculture (SCEES) and the National Institute of Statistics and Economic Studies (INSEE). It benefited from very high response rates: 82% for employers and 75% for the employees.

3.1.2. Informal and formal communications

The "employees" section of the COI survey allows distinguishing formal communication and informal communication. Formal communication characterizes the organisation of the work station from the point of view of its information system. It relates indications given to others and orders received from others; when the employee performs her/his job. These formal flows of information can be considered as routines of communication between employees, given the division of labour and the distribution of authority within the firm.

As regard to our formal framework, the formal communication is associated to the D part of work. At the opposite, informal communication is associated to the UD part of work. It is not possible from our data sets to precisely quantify the UD part of work. However, 99.8% of employees of our sample state that they have to face some unforeseen situations at work. It means that almost all tasks include an UD part for which by definition employees do not receive indication.

Help asked to others represents a proxy of the informal communication that can be measured in the survey. The variable of informal communication we use is based on two questions. The first one is "*If you have a temporary excess workload or if you are uneasy with a difficult or tricky task, are you helped by? : (a) Your supervisor (b) Colleagues you usually work with (c) Other persons or departments in the firm (d) Persons from outside the firm*".
The second question is *"Do the following persons bring you a help, information, in the use of the computing? : (a) Your superiors (b) Your subordinates (c) Colleagues you usually work with (d) Your firm's computing service (e) Other persons in your firm (f) Persons from companies specialized in computing (g) Other persons from outside the firm"*.

From the answer to these questions, we state four dummies. The first one is equal to one if the answer to the first question is a) or the answer to the second question is a) or b). The second dummy is equal to one if the answer to the first question is b) or the answer to the second question is c). The third dummy is equal to one is if the answer to the first question is c) or the answer to the second question is d) or e). Finally the fourth dummy is equal to one if the answer to the first question is d) or the answer to the second question is f) or g).
We then define informal communication as the sum of dummies. It takes values from 0 to 4. A value of 0 means here that the employee does not communicate informally at all.

To measure formal communication within the firm, Greenan and Walkowiak (2006) constructed vector of communication variables (the intensity of communication with managers, close work colleagues, more distant work colleagues, and persons outside the firm) and studied their determinants. Our formal communication variable is more synthetic. It measures from three questions whether employees gives or receives orders or indications. The first question is "*Do you have occasion to modify the nature and quantity of the work which you will have to do, or the manner of proceeding?*"; The second question is : "*Do you have one or more employees under your orders or authority? . If yes, do you give indications to other persons on what they have to do?*; the third question is *"Apart from your superiors, are there other persons that give you indications on what you have to do?"*. Once again, for each question four categories of interlocutors are distinguished : "*(1) Supervisors or subordinates (2) Colleagues the employee usually work with (3) Other persons or departments in the firm (4) Persons from outside the firm*". For each category of interlocutor, the answers are coded as 1 if the employee answers yes to at least one question and 0 otherwise. We then define formal communication as the sum of all

interactions that took place, and once again, variable takes values from 0 to 4. Table 1 below presents the distribution of informal communication and formal communication.

Table 1. Frequency of Formal / Informal communication

	Formal communication		***Informal communication***	
Modality	**Frequency**	**Percent**	**Frequency**	**Percent**
0	466	10.51	432	9.74
1	943	21.26	894	20.16
2	1158	26.11	1195	26.94
3	1085	24.46	1212	27.33
4	783	17.66	702	15.83
Total	4435	100	4435	100

The coefficient of correlation between the formal communication and the informal communication is .441 and is statistically significant at 1% (Pearson test). Both kinds of communication are therefore correlated. A reason could be that if an employee needs to be helped over on UD aspects of his task, he can ask for help from an employee he usually communicates formally with. In order to isolate the *pure informal part of informal communication*, we construct an indicator called *pure informal communication* which represents the predicted positive residuals obtained from the regression of informal communication over formal communication. Broadly speaking, pure informal communication represents the part of informal communication which is not correlated with formal communication. Pure informal communication is a binary variable taking value 1 if the residuals (from the regression of informal communication over formal communication) are strictly positives and 0 otherwise. We will use this variable in order to define *informal help network membership*. From table 2 which presents the distribution of pure informal communication, one can remark that almost 53% of employees belong to an informal help network.

Table 2. Frequency of Pure Informal communication

	Pure Informal communication	
Modality	**Frequency**	**Percent**
0	2086	47.03
1	2,349	52.97
Total	4435	100

3.1.3. Teamwork and individual work

This teamwork measure is constructed from the following two questions. The first question is: *Do you sometimes do your work in group or collectively?"* The answer to this question is either "yes" or "no". The second question is: *If yes "How much of your working time do you work in group or collectively? Almost all time, more than a quarter of your time, less than a quarter of your time"*.

Then teamwork measure is a dummy variable equal to 0 when the answer to the first question is "no" or when the answer to the first question is "yes" and the answer to the second question is less than a quarter of time. It is equal to 1 when the answer to the first question is "yes" and the answer to the second question is almost all time or more than a quarter of time.

Table 3 displays the number of employees who work in teamwork. It presents also mean differences between individual work and teamwork for informal communication and pure informal communication. It seems that (in accordance with our formal framework) there is always more (informal or pure informal) communication in teamwork than individual work.

Table 3. Communication in individual and team works

	Informal communication	***Pure informal communication***	**Number of Observation**
Individual Work	2.083	.500	2945
Team Work	2.407	.587	1490
Mean differences	-.323***	-.087***	

*** = significant at 1%

3.1.4. Effort and Wage

Measures of effort also come from the "employee section" of the COI survey. To distinguish productive and cognitive effort, we follow Diaye, Greenan and Urdanivia (2007), who studied the effects of individual evaluation interviews on effort. Productive effort is measured through two questions indicating if the employee works longer than the usual hours some days or some weeks. Productive effort is considered as very high if the employee sometimes increases hours worked for personal reasons. Indeed, in that case, the effort is not directly required from the firm, but by the employee herself. It is high if the employee increases hours worked in response to the firm's demand and as low if longer hours never happen. According to these three situations, the productive effort indicator respectively takes a value of 2, 1 or 0. The distribution of productive is available in the below table 4.

Table 4. Frequency of Productive Effort

	Individual Work		***Teamwork***	
Modality	**Frequency**	**Percent**	**Frequency**	**Percent**
0	1314	44.61	629	42.21
1	1372	46.58	735	49.32
2	259	8.81	126	8.47
Total	2945	100	1490	100

The cognitive effort indicator is a binary variable indicating if the employee makes propositions to improve his (her) work stations, the production process or the machines. It measures an involvement in collective knowledge building about productive activity, allowing continuous improvement of the production process. Its distribution is in table 5.

Table 5. Frequency of Cognitive Effort

	Individual Work		***Teamwork***	
Modality	**Frequency**	**Percent**	**Frequency**	**Percent**
0	1091	37.04	414	27.78
1	1854	62.96	1076	72.22
Total	2945	100	1490	100

Finally, we measure the employee's annualised net (logarithmic) wage in euros from the DADS (see Appendix 1 for more details).

3.2. The Results

3.2.1. The determinants of informal help in the workplace

We want here to estimate the probability to belong to an informal help network as a function of workers' characteristics out of workplace (CH1), workers' characteristics in the workplace (CH2) and firms' characteristics (CH3).

Our survey includes several such variables; however we were not able to take all such variables because we want to use also this logistic regression as the first step of our PS-matching regression. Let us indeed remind that this first step consists in matching individuals according to their propensity score (which is the individual probability to help other employees, according to the matching variables). The problem is that the propensity score matching models require a sufficiently important common support and the size of the common support depends on the quality of the model. As a consequence, we have chosen the matching variables in order for our econometric model to have the highest quality in terms of common support and bias reduction.

We have take into account individual characteristics of the employees: gender, age, seniority, education level and occupation and also characteristics of his working station such as using a microcomputer and a machine, intensity of industrial and commercial constraints, training for the workstation, training other employees for the workstation, being chief, being evaluated. In order to control for the technology production, we also include in the regression some characteristics of the firms: size, industrial sector, being a rural firm and the number of hierarchical level.

In order to verify the specification of the propensity score, we use a balancing test. It is directly implemented under Stata using the procedure called PSTEST. This procedure calculates for each matching variable a measure of bias reduction. On our sample, the lowest bias reduction is around 30% and the bulk of our matching variables have a reduction bias of about 90%. Hence the quality of our model seems to be good.

Let us go back to our logistic regression which determines the factors influencing employees' probability to be member of an informal network. Results (see Appendix 2) show that for individual work, the only variables with significant and positive influence are being chief and some workstation characteristics. More precisely, the probability of having a pure informal communication increases for workers who use microcomputer, receive training for the workstation, and increases with the intensity of industrial and commercial constraints.
For team workers, we find out that use of microcomputer have the highest (positive) impact on informal help network membership.
On the employer side, team workers from food industry and consumer goods industry have the highest probability to communicate informally. Interestingly, the number of hierarchical level does not seem to play a role, either in individual work or in teamwork. Hence help in the workplace cannot be explained the knowledge based hierarchy model[8] of Garicano (2000).

To conclude it seems that informal help network in the workplace mainly depends on firms' organisational design; indeed workers' characteristics which mainly influence this

[8] This model could be used in order to explain the existence of informal help in the workplace. Indeed it states an economy in which production results from drawing problems and applying production time to them. Agents spend a fraction of their time communicating their knowledge about each question. Hierarchies in this model are knowledge based hierarchies. A result in Garicano (2000) is that the optimal number of hierarchy should be infinite. Of course in real world, the number of hierarchy is finite. The latter is associated with the resolution of a given type of problem. Hence problems which cannot be solved through the formal hierarchical system may be solved through informal help.

probability are linked to the firms' organisational design (and can therefore be manipulated by firms).

3.2.2. Naïve and propensity score matching estimates

According to our PS-matching estimates (see Tables 5, 6 and 7 below), good workers, in terms of effort (cognitive and productive), help good workers, in terms of effort and vice-versa.

Indeed, in teamwork or in individual work, on average employees who are helped provide a productive effort higher than the one, of employees who are not helped (table 6). *It seems therefore that received help and own productive effort are not substitutes*.

Moreover, we can remark from table 5 that when controlling for individual characteristics, the productive effort differential between employees who are helped and employees who are not helped is no more significant in individual work and weaker and less significant (at 10% comparing to 1% for the naïve estimate) in teamwork. The meaning is that in individual work and in teamwork, 100% and 58.51% respectively of the productive effort differential is explained by selection effects.

Concerning cognitive effort, one can see from table 5 that in teamwork or in individual work, on average employees who are helped provide a cognitive effort higher than the one of employees who are not helped. The cognitive effort differential between employees who are helped and employees who are not helped is explained at 100% by selection effects in teamwork and at 75.51% by selection effects in individual work.

Table 6. Effort

	Productive effort		**Cognitive effort**	
	Individual work[(a)]	**Teamwork[(b)]**	**Individual work[(a)]**	**Teamwork[(b)]**
Average productive effort	0.641	0.662	0.629	0.722
Averge difference H/NH	0.160***	0.188***	0.098***	0.109***
Effect of the treated (C1)	0.031	0.078*	0.024**	0.006
Effect on the non-treated (C0)	0.055**	0.083**	-0.012	-0.018
Global effect (C)	0.043*	0.080**	0.005	-0.003

[(a)] Note: Standard errors are calculated by bootstrap methods based on 200 simulations.
The characteristics of the support over 200 simulations are : min= 2643 max= 2824 ; mean=2747.92
[(b)] Note: Standard errors are calculated by bootstrap methods based on 200 simulations.
The characteristics of the support over 200 simulations are : min= 1232; max= 1429 ; mean=1349.92
*** = significant at 1%, ** = significant at 5%, * = significant at 10%

Finally, our PS-matching estimates suggest that the positive effect of informal help network membership on individual wage is mainly due to selection effect.

Indeed (see table 7) in teamwork or in individual work, on average employees who are helped earn more than employees who are not helped. However this effect is stronger in teamwork than in individual work. Moreover, we can remark that in individual work, when controlling for individual characteristics, the wage differential between employees who are helped and employees who are not helped is no more significant (C1). The meaning is that 100% of the wage differential is explained by a selection effect: membership to informal help network is not random and depends to individual characteristics.

We reach the same conclusion concerning teamwork, except that in teamwork the selection effect accounts to about 75% (= 0.263 - 0.064 / 0.263) of the wage differential, while direct effect of help accounts only to about 25%.

Table 7. Wage

	Individual work[(a)]	**Teamwork[(b)]**
Average wage	9.695	9.770
Average difference H/NH	0.153***	0.263***
Effect of the treated (C1)	-0.002	0.064 **
Effect on the non-treated (C0)	-0.011	0.048 **
Global effect (C)	-0.007	0.057***

[(a)] Note: Standard errors are calculated by bootstrap methods based on 200 simulations.
The characteristics of the support over 200 simulations are : min= 2643 max= 2824 ; mean=2747.92
[(b)] Note: Standard errors are calculated by bootstrap methods based on 200 simulations.
The characteristics of the support over 200 simulations are : min= 1232; max= 1429 ; mean=1349.92
*** = significant at 1%, ** = significant at 5%, * = significant at 10%

4. Conclusion

In this paper, we analyze empirically a concept borrowed from industrial sociologists (e.g., Roy 1954, 1959). Indeed the literature in sociology which points out that the official work organisation in the workplace may not match exactly the observed one. For instance, some workers may officially work independently one from the other (individual work) but these workers may actually work in team by developing an informal communication system and an informal help system among them. Likewise, an official team can included some informal sub-teams (for example because some workers specialized themselves informally in one special task, or because of specific social relationship between some workers). The question we ask here is the following: why do workers informally help one another?

The obvious answer is that by helping other employees, workers simply express their free-agency and their (class, gender, ethnic, etc…) solidarity in the workplace. We argue in this paper this story is not the complete one. Indeed we show that informal help in the workplace is mainly a firms' organisational design by-product. Moreover we show that informal help network membership is not random and depends to workers individual characteristics in terms of effort: good workers in terms of effort help good workers in terms of effort.

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Appendix 1: Variables constructed from the COI survey

A. Follow quality norms

QA: Do you personally have to meet precise quantified quality standards (for example: wastage rates, measurable characteristics of the product)? (yes/no)

B. Work intensification

The intensification of work of the employees is a synthesis of two types of work intensity: intensity of industrial constraints and of commercial constraints.

The intensity of industrial constraints synthesizes the answers to the following questions:

QB1 : Is your work rhythm imposed by the following :

a. Automatic moving of a product or a part? (yes/no)
b. Automatic pace of a machine? (yes/no)
c. Immediate dependence of one or more colleagues in the work done? (yes/no)
d. Production norms or deadlines to meet in an hour at most? (yes/no)
e. Production norms or deadlines to meet in a day at most? (yes/no)

The indicator of intensity of industrial constraints is given by the variable IINDUS:
IINDUS=1 if (QB1a=yes or QB1b=yes or QB1c=yes or QB1d=yes or QB1e=yes), 0 otherwise.

To determine the indicator intensity of commercial constraints we have used the following questions:

QB2: Does your work rhythm imposed by the external demand (customers) need an immediate response? (yes/no).

QB3: Are you in direct contact (face to face or by phone) with customers? 1) all the time, 2) regularly, 3) occasionally or 4) never.

The indicator of intensity of commercial constraints is given by the variable IMAR=1 if (QB2=yes or QB3=1 or QB3=2), 0 otherwise.

Finally, we observe an intensification of work when the worker cumulates the industrial and commercial constraints: INTENS=1 if (IINDUS=1 and IMAR=1), 0 otherwise.

C. Measures of monetary incentives

Monetary incentives are captured through annualized net (logarithmic) wage (in Euro). It comes from the annual declarations of social data (DADS) which is an administrative file 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, and unemployment benefit).

The compensation includes base wage, all bonuses, taxed allowances and compensations in kind). Bonuses associated with 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 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 an 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% of employees in our sample declare working part time.

Appendix 2. First step of the PS-matching method

LOGISTIC REGRESSION

DEPENDENT VARIABLE: PURE INFORMAL COMMUNICATION (REF = 0)

Matching Variables	Individual work	Teamwork
Workers Characteristics		
Gender (ref: men)	-0.083	0.015
	(0.102)	(0.150)
Age	-0.000	-0.017
	(0.042)	(0.065)
Age squared	-0.000	0.000
	(0.000)	(0.000)
Level of education (ref: 3 years and more of tertiary education)		
No diploma	-0.093	-0.140
	(0.243)	(0. 387)
Basic education diploma	-0.159	0.194
	(0.242)	(0.398)
High school diploma	-0.168	0.149
	(0.207)	(0.357)
College diploma	-0.026	0.350
	(0.219)	(0.388)
1 or 2 years undergraduate studies	-0.175	0.016
	(0.211)	(0.357)
Professional type (ref : Executives)		
Middle management	-0.019	-0.380
	(0.161)	(0.313)
Clerck	0.253	-0.705
	(0.210)	(0.500)
Skilled blue collar	0.036	-0.688**
	(0.190)	(0.351)
unskilled blue collar	0.167	-0.464
	(0.217)	(0.381)
Seniority	0.002	-0.005
	(0.017)	(0.027)
Seniority squared	0.000	-0.000
	(0.000)	(0.000)
Chief	0.303***	0.053
	(0.114)	(0.155)
Receiving a training for the workstation	0.432***	0.118
	(0.089)	(0.131)
Intensity of industrial and commercial constraints	0.255***	0.236*
	(0.093)	(0.128)
Use of microcomputer	1.548***	1.585***
	(0.104)	(0.156)
Training others employees for the workstation	0.079	0.129
	(0.088)	(0.138)
Use of machine	0.050	-0.145
	(0.100)	(0.130)
Evaluation interview	0.233*	-0.022
	(0.089)	(0.129)

Firms Characteristics		
Firm size (ref : 50 to 99)		
100 to 499	-0.055	0.134
	(0.109)	(0.163)
500 to 999	0.166	0.032
	(0.133)	(0.196)
1000 and more	0.100	0.300
	(0.154)	(0.225)
Number of hiearchical level (ref : 4)		
0 to 2	-0.010	-0.209
	(0.129)	(0.190)
3	-0.170	-0.034
	(0.118)	(0.167)
5 to 9	0.085	0.237
	(0.113)	(0.165)
Industry sector (ref : automobile industry)		
Food industries	0.146	0.892***
	(0.231)	(0.333)
Consumer goods industry	0.015	0.708**
	(0.219)	(0.321)
Equipment goods industry	0.215	0.399
	(0.217)	(0.315)
Intermediary goods industry	-0.065	0.419
	(0.208)	(0.299)
Rural firm	0.045	0.014
	(0.097)	(0.134)
Constant	-0.988	-0.312
	(0.893)	(1.313)
Observations	2945	1490
Pseudo-R2	0.148	0.165

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%