The impact of technological changes on incentives and motivations to work hard

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Abstract: The large diffusion of Information and Communication Technologies (ICT) associated with the diffusion of new work practices during the 1990's has raised concerns about the impact of these changes on productivity. Some recent studies underline a positive impact of ICT and of new work practices on firms' productivity. But as well known, in the principal-agent literature, agents are predisposed to shirking. Thus, in order to obtain productivity gains highlighted in the recent literature and to assure their competitiveness, firms need to provide workers with sufficient incentives (negative and positive) and motivations (intrinsic and extrinsic). In the context of wide technological and organisational changes, our work seeks to focus on the relationships between ICT use and incentives and/or motivations. Using a representative sample of Luxembourg workers surveyed in 2004-2005, we investigate the influence of two ICT use (computer and Internet) on different indicators of incentives and motivations. Our main results indicate that introducing ICT influences incentives schemes, it seems to increase positives incentives, like wage bonus and promotions. Moreover, by offering the access to ICT to its employees, the firm creates an enriching work environment that influences positively intrinsic motivations of workers. These pure intrinsic motivations, associated with the positive incentives can be substitutes for the direct monitoring introduced usually to obtain the optimal effort of employees, but hard to be used in the current context of increasing autonomy and multi-tasking.

Keywords: information and communication technologies, working conditions, incentives and motivations

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1. Introduction

The fast diffusion of Information and Communication Technologies (ICT) in firms, allowed notably by the declining price for its use, seems to favor the productivity of the firm. Several works present evidence supporting a positive effect of ICT on productivity at the firm level (Greenan & Mairesse, 2000; Licht & Moch, 1999; Lichtenberg, 1995). However, the diffusion of ICT has been combined with changes in the organisational structure of firms with the increasing use of so called high performance work organization (Osterman, 2000). As these changes might be another determinant of the increase of productivity, recent empirical studies analyze the joint effects of ICT and workplace reorganization. They underline that ICT combined with workplace organization have positive and significant effects on productivity at the firm level (Askenazy & Gianella, 2000; Bertschek & Kaiser, 2004; Black & Lynch, 2001; Bresnahan, Brynjolfsson & Hitt, 2002; Brynjolfsson & Hitt, 2000).

To obtain these productivity gains and to assure their competitiveness, firms need to provide for workers the proper incentives and motivations. Thanks to these incentives and motivations the firm can solve the problem of shirking and can manage the creation and transfer of knowledge. However, the problem of shirking is complicated in the context of wide technological and organisational changes. The diffusion of ICT associated with workplace reorganization involves a change from a "Tayloristic" work organization, characterized by task specialization, a pyramidal hierarchical structure, and a centralization of responsibilities, to a "Holistic" organization with multi-tasking, job rotation, the decentralization of decision-making, team work, more flexibility for the employer and greater communication between workers. Consequently, the relationships between employers and employees have changed. As workers became more versatile (Lindbeck & Snower, 1996; 2000) and more autonomous (Caroli, Greenan & Guellec, 2001) the contracts became more incomplete and the evaluation of workers performance more difficult.

As well known in the principal-agent literature, since workers know their own ability levels while employers may not, since it is costly to measure their performances, and since they prefer leisure to effort, agents are predisposed to shirking. Consequently, they can choose the actions that are not in the best interest of the employers. The firm exists in a large part to provide the proper incentives to obtain the optimal provision of workers' effort when the information on workers' performance is costly[1]. In order to reduce the agency problem, the principal can use monitoring, compensations and/or promotions. This principal-agent view can be extended with the introduction of the concept of motivations, largely neglected by the economic literature. These motivations widely analyzed by organisational psychologist can be substitutes of incentives and can consequently affect effort. Building on Frey (1997), Minkler (2003, 2004) introduced both incentives and motivations in the analysis of the provision of efforts at work.

In this paper, we seek to provide an analysis of the effects of ICT and of the changes they crystallize on the incentives and motivations the firm need to manage in order to solve the problem of shirking, and in the creation and transfer of knowledge, which are necessary for the firms' competitiveness.

[1] This cost can result from the costly evaluation of performance (Calvo & Wellisz, 1978), the unobservability of worker performance (Holmström, 1982) or the opportunism of team members under revenue-sharing (Alchian & Demsetz, 1972).

We perform our analysis on a representative sample of Luxembourg workers surveyed in 2004-2005. Our dataset comes from the European Social Survey collected by the CEPS/Instead[2]. A first evaluation of the consequence of ICT on different indicators of incentives and motivations to obtain the optimal effort is computed by comparing the average value of the indicator for workers who use ICT (computer, Internet) and for workers who do not. However, this benchmark estimator raises some selection problems induced by workers' and firms' heterogeneity. We choose to perform probit regressions of the different incentives and motivations variables on ICT use, including a number of controls like age, education, seniority and firm's characteristics with proxies of organisational changes. But another problem stems from the fact that the impact of ICT may not be linear. In this case, as Heckman, Ichimura & Todd (1997, 1998) recommend, we use propensity score matching estimators. Our main results highlight, on the one hand, that the introduction of ICT increases the difficulty to control the work of employees. Thus, it drives firms to modify their incentives mechanisms. On the other hand, the results show that ICT use increase positives incentives, like wage bonus and promotions. Moreover, by offering the access to ICT to its employees, the firm creates an enriching work environment that influences positively intrinsic motivations of workers. These pure intrinsic motivations, associated with the positive incentives can be substitutes for the negative incentive mechanism introduced usually to obtain the optimal effort of employees.

The paper is organized as follows. Some theoretical considerations on the relationships between incentives, motivations and the provision of effort in the context of technological and organisational changes are provided in section 2. Section 3 provides a detailed description of the database. Section 4 presents the econometric specifications. Section 5 discusses the results and the last section concludes.

2. Incentives and motivations in the context of technological and organisational changes

2.1. Incentives

Incentives are widely discussed in the agency theory (Prendergast, 1999). Incentives are provided to workers through two options, a negative incentive (monitoring) and another one more positive (wage bonus, promotions). The principal will invest in such incentives in order to induce workers to operate in the firm's interest. An underlying assumption in this literature is that, in the absence of monitoring agents will shirk but they will respond to an incentive in the principal's interest.

The control of productivity can be objective with the pay-for-performance practice included in an explicit contract. Since it is difficult to specify all aspects of the job in an explicit contract and since it is less costly to monitor employees' effort than to measure their marginal product, the subjective monitoring option by superior is generally used (Calvo & Wellisz, 1978). To be effective the monitoring needs to be combined with penalties when it shows that the work is substandard.

The positive incentive option reward workers for effort by means of monetary incentives like salary revision or bonus; or through promotions by acting on the career concerns of workers. Wage increases could act as a positive incentive by increasing the expected reward of effort provision by workers (Minkler, 2004). But, as workers exert effort not just to maximize their

[2] CEPS/Instead: Centre for Population, Poverty and Public Policy Studies/International Networks for Studies in Technology, Environment, Alternatives, Development.

pay but also to affect future contracts, the firm can use career concerns in order to mitigate the agency problem (Fama, 1980; Holmström, 1982).

In the context of technological and organisational changes, the connectivity to Internet of workers is increasing. Consequently, it gives workers more opportunities to shirk like the use of Internet for personal purpose instead of working hard. To obtain optimal effort provision, firms need to provide workers with sufficient incentives, especially in the current context of high churn rates for workers (Bauer & Bender, 2004). As technological changes influence the increase of workers' autonomy (Gollac, Mangematin, Moatty, De Saint-Laurent, 1999), they alter the incentives schemes. The direct supervision becomes more difficult, so firms need to defined innovative modes of monitoring. In the current context of strategies like the just-in-time one, the stress of the time limit can replace the authority of the superior. If monitoring is more difficult, firms can instead still use positive incentives like promotions or wage bonus.

> ***Hypothesis 1.*** *The use of ICT by workers changes the incentives schemes and should decrease the direct supervision of workers.*
>
> ***Hypothesis 2.*** *The use of ICT by workers should influence positively the probability of using positive incentives to obtain optimal effort of workers.*

2.2. Motivations

The standard theory of the firm does not differentiate the different sources of motivation, which are, in the economic view, just the manifestations of underlying preferences (for the reward associated with performing the task). While economists have greatly neglected the psychological effects, the concept of motivation has been already analyzed by organisational psychologist. Research on motivation has distinguished intrinsic and extrinsic motivation. Extrinsic motivation is motivation gained by externally influenced need satisfaction. Intrinsic motivations are influenced by the work itself. Following Deci (1971) *"one is said to be intrinsically motivated to perform an activity when one receives no apparent reward except the activity itself"* (p.105). As shown is the crowding theory (Frey, 1997), incentives (especially monetary) can crowd out the motivations to undertake an activity and the firm does not have to neglect their effects because it will affect effort (Cools, Van Herpen & Van Praag, 2005). The crosspollination by combining social psychology and economics is consequently necessary because the crowding out effect predicts reverse reactions of workers to the one expected in the agency theory.

2.2.1. Intrinsic motivations

In this paragraph, we will analyze both pure intrinsic motivations in the tradition of social psychologists and moral motivations introduced by Minkler (2004).

Pure intrinsic motivation comes from within the person in bond with his job. Workers, who find their work interesting will enjoy it and can consequently choose to do good work for its own sake. So they are supposed to be intrinsically motivated. Following Frey (1997), external interventions, that is to say incentives, can increase or "crowd in" intrinsic motivations or quite the opposite can diminish or "crowd out" these motivations and beyond affect the provision of effort. In the first, if the worker feels that his involvement and competence is appreciated by employers (possibilities of promotions). This acknowledgement permits autonomy of action and may increase intrinsic motivation and strengthen effort. In the second,

the agent perceives that the external intervention like monitoring shifts the locus of control from the agent to the principal. As the worker become a "pawn" to the source of external, he responds by reducing what he has control over, *i.e.* his intrinsic motivation (Deci, 1971; Minkler, 2004). Concerning the effect on effort, if the incentives schemes reduce worker's intrinsic motivation more than they induce him to perform, effort provision will decrease.

As technological and organisational changes are associated with greater freedom in organizing one's own work and in diversifying tasks (Caroli, Greenan & Guellec, 2001; Greenan & Walkowiak, 2005; Lindbeck & Snower, 1996 and 2000), it will increase the interest of the job and it can, consequently, boost employee intrinsic motivation. The crowd in effect will be reinforced by the necessity of promotions to reward the employees with the competencies needed by the firm in the context of skills upgrade in organization and high churn rate. The crowd out effect is more ambiguous. As the introduction of ICT and organisational changes imply more autonomy and self-determination, workers are more subject to control (Bradley, 2000). But the modes of control have changed and the monitoring is no more fulfilled by the supervision of superior, but more by work pressure and job stress, so the feeling of being supervised is less oppressive than the one that induce the traditional crowd out effect.

> ***Hypothesis 3.*** *ICT diffusion should influence positively workers' intrinsic motivations, and thereby their provision of effort.*

More than the work ethic embedded in intrinsic motivations, Minkler (2004) introduce *moral motivations* in the debate on workers willingness to work hard. Workers' choices can be independent of personal welfare considerations, and commitment or duty can motivate moral actions without taking in to account incentives schemes. The integrity of workers can be a reason for moral actions (Minkler & Miceli, 2004). Integrity confers commitments to moral principles like honesty, or "don't lie" principle. It influences both the propensity to make promises and to keep them. People can keep their word even if it is contrary to the self-interest. Experimental repeated games provide some evidence on situations in which the standard self-interest model is refuted. According to Sally's (1995) meta-analysis, *"language may elicit an involuntary commitment to act nonselfishly"* (p.87). If there is a commitment to work hard, as shirking is analogous to dishonesty or lying, workers may choose to provide optimal effort.

The increase of the communications caused by technological changes can drive to more commitment of employees to work hard in links with the concept of external pressure we present in the following subsection. But the agent needs to have moral principles to keep commitments. And even if *"ICT should contribute to the deepening and development of true human qualities and provide time for people to develop themselves as human beings"* (Bradley, 2000, p.856), the link between these changes and moral principles is ambiguous and needs further investigations.

> ***Hypothesis 4.*** *ICT can contribute to the development of human qualities but it is no sure that it will change the honesty of workers or his "don't lie" principle. Therefore, the effect of ICT on moral motivations is quite ambiguous.*

2.2.2. Extrinsic motivations

Following Frey & Jegen (2001) extrinsic motivation comes from outside the person. So, we can include both the concept of external pressure of the group and the concept of fairness (Minkler, 2004) in this definition.

According to Minkler (2004) *"workers who care about the views of other workers are subject to peer pressure"* (p.870). This external pressure (Kandel & Lazear, 1992) most likely appears in firms that use profit sharing like in teams, because each worker's effort affects negatively all other worker's income or well-being (as shirking necessitates increased effort form others). Kandel & Lazear (1992) identify guilt and shame[3] as possible explanations of this external impact. As external pressure can be a substitute for direct monitoring firms need to stimulate the deployment of a team spirit with the formation of groups[4] in which members can identify with one another. If the firm succeeds in infusing this team spirit in the organization, the external penalties for substandard work can be replaced by the feelings of guilt and shame. These feelings arise when shirkers would suffer from letting down their coworkers.

As network technologies contribute to codify tasks, knowledge, and to collect information, they stimulate electronic communications and allow workers to get more easily help from colleagues when it is needed. Moreover, a member of a team can easily relays to other member information concerning substandard work and it can therefore increases the feelings of shame and guilty when the effort is not high. But as the use of ICT may reduce face-to-face interactions and informal contacts, it can consequently reduce the creation of a team spirit and thus workers' provision of effort.

> ***Hypothesis 5.*** *Technological changes stimulate electronic communications. On the one hand ICT uses increase the interdependence of workers, but on the other hand they reduce face-to-face interactions. Consequently, the global impact of ICT changes on the setting up of a team spirit and thus on external pressure is quite ambiguous.*

Another extrinsic motivation comes from the reciprocity between employers and workers. An agent is expected to at least partly determine his level of motivation considering the behaviors of others, particularly the employer. In addition to purely self-interested people, there are a fraction of people who are also motivated by fairness or reciprocity considerations. According to Fehr & Gächter (2000) people cooperate more than predicted by the self-interested model in response to friendly actions and less in response to hostile actions. So, in the context of work, reciprocity implies that a fair worker will be honest with an honest employer and will shirk with a dishonest employer (one that fails to provide a good working environment).

With the introduction of high performance work systems, according to Colvin (2006) firms place greater value on employees and induce a higher degree of fairness in employment relations. However, recent years are characterized by high churn rates for workers (Bauer & Bender, 2004). Consequently, the relationship between employers and employees is characterized by greater dynamics. So, it can influence negatively the degree of fairness and the provision of effort. But ICT can offset this negative influence. The access to ICT can be a sign of trust granted by the employer to his worker. Therefore it can influence positively

[3] *"Shame exists when others observe non performance and then exert external pressure. In contrast, guilt arises as internal pressure even when one's actions are unobservable"*, Minkler (2004, p.870).

[4] Following Minkler (2004), to favor this team spirit firms can, for example, use quality circles, team meetings, inter-company sport leagues, company picnics.

fairness and reciprocity. Thereby, even in a context of high churn rate, the worker can have a greater attachment to his firm because of this token of trust. Furthermore, to obtain optimal effort of workers who develop ICT competences, the firm can choose to provide security of job.

> ***Hypothesis 6.*** *Technological changes should influence positively the relationships between employers and employees.*

3. Data

The data used in this study relates to individuals living in the Grand Duchy of Luxembourg. They were collected within the framework of a European project called: European Social Survey (ESS). This European project was conducted in over 20 countries of the European continent on nationally representative samples of individuals. It contains information on a wide range of attitudinal and socio demographic characteristics of individuals. In Luxembourg, an additional questionnaire was inserted. It provides items on the use of new technologies, both at home and at work. The data were collected, using face to face interviews, by the CEPS/Instead thanks to the financial support from the Luxembourg National Research Fund. The survey[5] was twice realized in 2002-2003 and in 2004-2005, but here, we use the data of the second round. As we want to analyze the links between ICT and motivations at work, we focus our attention on the working population and more specifically to employees who are aged between 16 and 65. The numbers of workers interviewed is 706.

Table 1. Characteristics of ICT users

Variable	**Computer users (401 workers)**	**Internet users (319 workers)**
Man	59.52%	47.44%
Woman	56.98%	41.67%
Education		
0-8 years at school	20.3%	10.95%
9-13 years at school	47.55%	30.05%
High School graduate	69.44%	54.55%
College graduate	90.48%	81.66%
Occupation		
Unskilled workers	15.79%	8.03%
Skilled workers	26.97%	16.3%
Clerks and services workers	55.24%	35.95%
Technicians	83.93%	67.25%
Professionals, high level management	89.47%	80.39%
Firm characteristics		
Industry, construct	37.74%	26.54%
Trade, transport, financial services, property business	61.77%	47.23%
Education, civil services, health services	68.7%	55.56%
Size less than 10 employees	41.23%	34.17%
Size between 10 and 24 employees	47.15%	33.33%
Size between 25 and 99 employees	67.41%	52.55%
Size between 100 and 499 employees	67.31%	55.35%

[5] In Appendix 1 we provide descriptive statistics of the survey data.

500 employees and more	67.12%	48.67%

Note: 67.12% of workers who work in a firm employing more than 499 persons use a computer at work and 48.67% use Internet.

Table 1 displays the characteristics of workers who use a computer and/or Internet at work. In the sample, nearly 50% of the workers use one or the two ICT studied in this article. There are, indeed, 57% of workers who use a computer in the workplace and 45% who use Internet. ICT users stand out from those who do not use, by individual or job characteristics. Qualified workers employ more widely new technologies than others. Thus, 81.66% of workers with college graduate use Internet at work against 10.95% of workers with only 0-8 years spent at school. More than 65% of technicians or professionals use one at least one of the two ICT. It is the case for less than 20% of skilled or unskilled workers. The proportion of individuals who uses ICT in the sectors of industry or construct is less important than in the other sectors. More than 50% of individuals working in firms employing between 25 and 500 persons use at least a technology.

3.1. Dependant variables[6]

To obtain productivity gains and to assure their competitiveness, firms need to provide workers with sufficient incentives and motivations.

To analyse the effect of ICT on firms' incentives and motivations schemes, we constructed proxies of the different incentives and motivations from perception of workers about their working conditions. In order to test our hypothesis 1, we introduce a proxy of monitoring defined by a work closely supervised. To test our hypothesis 2, a variable that measure the use of wage bonus by the firm and a proxy of promotion defined by good opportunities of advancement are used. To study motivations we distinguish intrinsic motivations from extrinsic ones. On the one hand, the intrinsic are caught by a proxy of good job in order to test the hypothesis 3 and a proxy of moral motivations defined by the fact of following rules even when no one is watching in order to test the hypothesis 4. On the other hand, for the extrinsic motivations we test the hypothesis 5 by capturing external pressure with the use of two variables, the need of colleagues' gratitude and a proxy of team spirit. Finally, we test our hypothesis 6, the reciprocity between employers and workers with two dummies, one for the reciprocity of the workers towards his employers (*i.e.* the attachment to the firm) and one for the inverse relationship (*i.e.* the security of the job).

3.2. Independent variables

Our measures of ICT use at work concerns computer and Internet use. They are constructed has dummy variables that takes the value one when the individual use the ICT at the workplace and zero otherwise.

The different control variables introduced in our probit regressions and used in the propensity score matching estimators method concerns numerous aspects of workers, of their job and of the firm.

Even if we have no information on firms' choice of organization and of the possible organisational changes implemented in the last years, we have variables relating to the characteristics of occupied job. Thus, we have information on the diversity of the tasks carried

[6] The details of the ESS questions and the variables constructed from them are contained in Appendix 2.

out in the job (multi-tasking), which gives us an idea of employee's versatility. The data give also us information about the flexibility of the work schedule i.e. the fact that the worker is often informed at short notice before having to work overtime for the needs for the firm, which gives us an idea of flexibility in the organisation of the production (flexibility).

The ESS survey provides information on the worker, that is to say the gender, the age, the nationality, the highest level of education attained. The survey also provides information on each worker's job and on the firm in which he works. More precisely, we have information on the occupation (5 groups: unskilled workers; skilled workers; clerks and services workers; technicians; professionals and high level management), the number of the weekly working hours, the seniority and a dummy for union membership. Concerning the characteristics of the firm, we introduce the sector (3 groups) as well as the size of the firm.

4. Econometric method

A first estimate of the impact of ICT on the different mechanisms of incentives and motivations (*Y*) can be obtained by comparing the average value of *Y* for workers who use the ICT (*T=1*) and for the workers who do not (*T=0*). This benchmark estimator is generally called "naïve". However, this benchmark estimator raises some selection problems induced by workers' heterogeneity (due to age, occupation, education…) and firms' heterogeneity (size, organisation…).

To handle this problem, in a second estimate, we choose to perform probit regressions of the different incentives and motivations variables on ICT use, including a number of controls concerning the worker and the firm. For each incentives and motivations we have a dummy variable (Y_i) which is ascribed the value 1 if the worker announces that his work shows the characteristic, 0 if not. We consider the carrying out of the binary dependent variable as the result from a rule of decision. This rule is a mechanism associating the exogenous variables x_i with the observation of the event $\{Y_i=0\}$ or $\{Y_i=1\}$.

Thus, $Y_i = 1$ if $y_i^* \succ c$ and $y_i = 0$ if $y_i^* \leq c$, with $y_i^* = x_i\beta + \varepsilon_i$ where x_i is the vector containing the exogenous variables and β the vector of parameters that captures the influence of the exogenous variables. We assume that ε_i is distributed as a normal *i.i.d.* variable.

The probability that the work shows a particular characteristic is written as follows:

$$P(Y=1) = P(x_i\beta + \varepsilon_i \succ c) = F(x_i\beta)$$

The likelihood function can be written as:

$$L = \prod_{i=1}^{n} [F(x_i\beta)]^{y_i} [1 - F(x_i\beta)]^{1-y_i}$$

And the log-likelihood function is:

$$LogL = \sum_{i=1}^{n} [y_i F(x_i\beta)][(1-y_i)(1-F(x_i\beta))]$$

But another problem stems from the fact that the impact of ICT may not be linear. The effect, indeed, can be different for different groups of workers.

That's why, in a third estimates, we use propensity score matching estimators, as Heckman, Ichimura & Todd (1997, 1998) recommend. We can formalize the access to ICT in the workplace by a random variable *T*, which takes value 1 if the individual reaches the program

(*i.e.* has the access to an ICT) and 0 if not. The variable of interest (*Y*) which denotes the fact that the worker *i* has such or such incentives or motivations to provide the optimal effort is described by two probabilities ($\hat{P}(Y_i = 1)$; $\hat{P}(Y_i = 0)$) conditional on the access to the "treatment" (*T*). For a worker *i*, we do not observe at the same time the fitted probability of having an incentive or a motivation $\hat{P}_1(Y_i = 1)$ if the worker use the ICT ($T_i=1$) and the fitted probability $\hat{P}_0(Y_i = 1)$ if the worker do not use the ICT ($T_i=0$).
In the data, we only observe:

$$\hat{P}(Y_i = 1) = T_i \hat{P}_1(Y_i = 1) + (1 - T_i)\hat{P}_0(Y_i = 1)$$

For each worker, the "causal effect" (Rubin, 1974) of the treatment Ci is defined by the difference between what would be the situation of the individual if he were treated (*i.e* if he used ICT at work) and what it would be if he were not treated:

$$Ci = \hat{P}_1(Y_i = 1) - \hat{P}_0(Y_i = 1)$$

Given that our data are not experimental, we do not observe simultaneously the two fitted probabilities and consequently this parameter cannot be identified. So, we need to estimate the average effect of treatment on the treated (*ATT*):

$$\begin{aligned} ATT &= E\left(\hat{P}_1(Y = 1) - \hat{P}_0(Y = 1) / T = 1\right) \\ &= E\left(\hat{P}(Y = 1) - \hat{P}_0(Y = 1) / T = 1\right) \\ &= E\left(\hat{P}(Y = 1) - E\left(\hat{P}_0(Y = 1) / X, T = 1\right) / T = 1\right) \\ &= E\left(\hat{P}(Y = 1) - E\left(\hat{P}_0(Y = 1) / X, T = 0\right) / T = 1\right) \\ &= E\left(\hat{P}(Y = 1) - E\left(\hat{P}(Y = 1) / X, T = 0\right) / T = 1\right) \end{aligned}$$

In order to obtain an estimation of the *ATT* we use information available on the workers to build, for each individual using ICT, a "counter-factual" *i.e.* an estimate of what would be his situation if he had not used the ICT.

Following Rosenbaum & Rubin (1983), we can matched individuals who take part in the treatment and those who not, according to the estimation of the probability to be involved in the use of ICT, the propensity score: $S(X) = \Pr(T = 1 / X)$. Furthermore, they show that the propensity score summarizes enough information to compute the estimation of the *ATT*.

The propensity score provides a comparability criterion between the "treated" group and the "untreated" or control one. If the score tends to be high for the people treated and weak for the untreated, it implies that the treated and the untreated people show different individual characteristics. There is, thus, a selection bias in so far as the treated use ICT because of their individual characteristics.

Following Heckman, Ichimura, and Todd (1997; 1998), we can thwart the selection bias, and construct a group of treated and a group of untreated workers comparables in accordance to their propensity score[7]. In practice, it implies that the sample has to be restricted to a common

[7] This methodology is classically used by authors analyzing the impact of organisational change on working conditions or wages. See for example, Askenazy & Caroli (2006); Diaye, Greenan & Urdanivia (2006).

support of the empirical distributions of the scores respectively for observations such as $T_i=1$ and for observations such as $T_i=0$.

Then, we use the following non parametric Kernel matching estimator which under some regularity assumptions is convergent and asymptotically normal:

$$\hat{ATT}_K = \frac{1}{N_1}\sum_{i\in I_1}\left\{\hat{P}_1(Y=1) - \sum_{j\in I_0}\frac{K\left(\frac{S(x_j)-S(x_i)}{h}\right)}{\sum_{j\in I_0}K\left(\frac{S(x_j)-S(x_i)}{h}\right)}\hat{P}_0(Y=1)\right\}$$

Where K is a normal kernel function, h is the bandwidth parameter of the estimation, I_1 denotes the treated group, I_0 the untreated or control group, N_1 the number of individuals in I_1.

As we use the Kernel methodology, the right term inside the brackets is a weighted average of the observations in the control group. Consequently each individual j in the untreated group takes part in the construction of a counter-factual of i in the treated group. And the importance of $j \in I_0$ in this construction varies as the distance between his propensity score and that of $i \in I_1$.

5. Results

In the following subsections, we estimate the correlations between incentives, motivations and ICT use at work using three methods: naïve estimates, probit regressions and the propensity score method. As the uses of computer and of Internet are highly correlated, we choose to make distinct analyses. The computer use is seen here as a tool allowing tasks codification and the transfers of information and knowledge between the different departments of the firm in a short time. The Internet use is seen here as a tool promoting communications with the outside, information research, and consequently can improve tasks execution. But, as the access to Internet can be associated with leisure (personal use of Internet), it can be associated with more shirking.

Column (1) of Tables 3 and 4 reports naïve estimates *i.e.* the difference in the percentage of workers who have such or such incentives or motivations to work hard, between workers who use the ICT and workers who do not[8]. To go further, we estimate probit equations for the probability of being motivated by such or such incentives or motivations. The Column (2) of Tables 3 and 4 presents the marginal effects[9] associated with the coefficient obtained in the probit regressions available in the Appendix 3. Our third analyze concern the use of a propensity score method[10]. The Column (3) of Tables 3 and 4 reports the *ATT* estimated with the Kernel matching method.

[8] Appendix 3 provides details concerning the naïve estimators.
[9] Each Line in the Column (2) corresponds to a different probit.
[10] To match our individuals, we use the same variables as in the probit estimates, that is to say the control variables presented in the subsection 3.2.

5.1. The impact of computer use at work on incentives and motivations

Results from the analysis of computer use on the incentives and motivations to work hard are presented in Table 2.

It seems that heterogeneity biases are quite large. The coefficients estimated either using the probit methodology or using the propensity score method are quite different from the naïve estimates. The effects of the computer on incentives or motivations to work hard are increasingly small when we correct for the heterogeneity of workers and firms. For example, the probability of doing good work for its own sake (*i.e.* "pure intrinsic motivations") is, according to the naïve estimates, 24.54 points higher for workers using a computer than for workers who do not; according a probit estimate 9.1 points higher and according to the propensity score methodology 3.8 points higher. Moreover, for some incentives or motivations (for example, for the test of the hypothesis 1), the impact of computer use is no more associated with a significant coefficient when we introduce more and more corrections of the heterogeneity bias *i.e.* when we use the probit methodology and then the propensity score.

Table 2. The impact of computer use at work

		(1) **Naive estimates**	(2) **Marginal effects of the probit estimates**	(3) **Kernel estimates**
Hypothesis 1	Monitoring	-0.0871**	-0.046	0.002
			(0.052)	(0.018)
Hypothesis 2	Wage bonus	0.0643*	0.085*	0.023*
			(0.044)	(0.013)
	Promotions	0.1692***	0.115**	0.02
			(0.051)	(0.019)
Hypothesis 3	Pure intrinsic motivations	0.2454***	0.092***	0.04***
			(0.035)	(0.011)
Hypothesis 4	Moral motivations	-0.1306***	-0.027	-0.007
			(0.05)	(0.009)
Hypothesis 5	Need of colleagues' gratitude	-0.0507	0.016	0.0001
			(0.053)	(0.015)
	Team spirit	0.1254***	0.022	0.017
			(0.04)	(0.011)
Hypothesis 6	Attachment to the firm	-0.0039	-0.056	-0.001
			(0.051)	(0.015)
	Job security	0.067**	0.046	-0.003
			(0.042)	(0.012)

Note: Standard errors are in parentheses, in the Kernel estimates they are computed using bootstrap. *, **, *** significant at 10%, 5% and 1% respectively.

If we look at the Column (1), the results go overall in the direction of the hypothesis presented above. The use of a computer seems, indeed, to influence the majority of incentives and motivations we analyze. The higher naïve estimates concern the positive incentives, the pure intrinsic motivations, and the team spirit. But as soon as we correct the selection bias (Column (2) and (3)) some effects disappeared, in particular at the level of the extrinsic motivations. Therefore, the use of a computer influences, above all, positively the positives incentives and

the pure intrinsic motivations. The average treatment effect shows that workers using a computer at work have a 3 points higher probability of being motivated by wage bonus than workers who do not use a computer, and a 2 points higher probability of being motivated by an interesting work.

5.2. The impact of Internet use at work on incentives and motivations

Results from the analysis of Internet use on the incentives and motivations to work hard are presented in Table 3.

As for the results concerning computer use, the coefficients estimated either using the probit methodology or using the propensity score method are quite different from the naïve estimates. The weight impacts are smaller when we introduced controls and some significant coefficients disappears in Column (2) or (3).

Table 3. The impact of Internet use at work

		(1) **Naive estimates**	(2) **Marginal effects of the probit estimates**	(3) **Kernel estimates**
Hypothesis 1	Monitoring	-0.1356***	-0.108**	-0.001
			(0.049)	(0.014)
Hypothesis 2	Wage bonus	0.0694**	0.084*	0.019*
			(0.043)	(0.011)
	Promotions	0.1352***	0.099**	0.004
			(0.049)	(0.012)
Hypothesis 3	Pure intrinsic motivations	0.2216***	0.05	0.027***
			(0.034)	(0.008)
Hypothesis 4	Moral motivations	-0.0768**	0.049	-0.008
			(0.047)	(0.08)
Hypothesis 5	Need of colleagues' gratitude	-0.0367	0.029	-0.003
			(0.049)	(0.011)
	Team spirit	0.1059***	0.013	0.013
			(0.038)	(0.009)
Hypothesis 6	Attachment to the firm	0.0117	-0.049	0.002
			(0.048)	(0.012)
	Job security	0.0623**	0.033	0.002
			(0.039)	(0.01)

Note: Standard errors are in parentheses, in the Kernel estimates they are computed using bootstrap. *, **, *** significant at 10%, 5% and 1% respectively.

The results of the naïve estimates are above all identical to the assumed effects apart from moral motivations and external pressure. The integrity of workers seems to decrease with the access to Internet and to more possibilities to shirk. The feelings of guilt and shame seem to be not influenced by Internet, and by the increasing of communication induced, but the team spirit seems to be increased. But these effects are not confirmed by the probit or the Kernel estimates. Naïve and probit estimates highlight a negative impact of Internet on negative incentives and a positive impact on positive incentives. The average treatment effect shows that workers using a computer at work have a 1.9 points higher probability of being motivated

by wage bonus than workers who do not use Internet, and a 2.7 points higher probability of being motivated by an interesting work.

6. Conclusion

The large diffusion of ICT associated with the diffusion of high performance work practices (HPWO) during the 1990's has raised concerns about the impact of the changes on productivity. Some recent studies underline a positive impact of ICT and HPWO on firms' productivity. In this context of wide changes, our work seeks to study how the firm can play on incentives and motivations through workers' access to ICT to obtain optimal amount of effort and to get the productivity effect highlighted in the literature at the firm level.

To do this analysis, we use a representative sample of Luxembourg workers surveyed in 2004-2005. We perform three analyses. A first evaluation of the consequence of ICT on the indicators of incentives and motivations is computed by comparing the average value of the indicator for workers who use ICT (computer, Internet) and for workers who do not. However, this naïve estimator raises some selection problems induced by workers' and firms' heterogeneity. To handle this problem, we choose to perform probit regressions of the different incentives and motivations variables on ICT use, including a number of controls like age, education, seniority and firm's characteristics like proxies of the organisation of work. But another problem stems from the fact that the impact of ICT may not be linear. In this case, as Heckman, Ichimura & Todd (1997, 1998) recommend, we use propensity score matching estimators.

In the context of wide changes associated with more incomplete contracts, there is an increasing difficulty to control the work of employees. Thus, the firm has to modify its incentives mechanisms. Our main results highlight that the introduction of ICT increases positives incentives, like wage bonus and promotions. Moreover, by offering the access to ICT to its employees, the firm creates an enriching work environment that influences positively intrinsic motivations of workers. These intrinsic motivations, associated with the positive incentives can be substitutes for the negative incentive mechanism introduced usually to obtain the optimal effort of employees.

For some motivations, it seems that even if new technologies are put at the service of organisational strategies and their impact on workers motivations mainly determined simultaneously, ICT does not necessarily crystallize all the changes of organisation. For example, the use of computer or Internet cannot by itself measure the possible effect of team work on external pressure while organisational changes can provide an answer. It would be necessary to investigate more the joint effect of ICT and organisational changes. Moreover, further researches should resort to other methods of matching estimators to check the robustness of the results obtained here. An alternative way of Kernel estimates concerning the matching of treated and control units can consist of taking each treated unit and searching for the control individual with the closest propensity score *via* Nearest Neighbor estimates.

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Appendix 1: Descriptive statistics

	Obs.	Mean	Std. Dv.	Min.	Max.
Incentives and Motivations					
Monitoring	702	0.4188	0.4937	0	1
Wage bonus	702	0.2293	0.4207	0	1
Promotions	706	0.4306	0.4955	0	1
Pure intrinsic motivations	701	0.7946	0.4043	0	1
Moral motivations	678	0.6578	0.4748	0	1
Need of colleagues' gratitude	670	0.5970	0.4909	0	1
Team spirit	692	0.8064	0.3954	0	1
Attachment to the firm	688	0.3968	0.4896	0	1
Job security	696	0.7888	0.4085	0	1
ICT use					
Computer	685	0.5854	0.4930	0	1
Internet	706	0.4518	0.4980	0	1
Organisation of work					
Multi-tasking	704	0.7969	0.4026	0	1
Flexibility	689	0.3179	0.466	0	1
Individual characteristics					
Sexe (Male)	706	0.6091	0.4883	0	1
Age	704	38.52	10.58	16	65
Education					
0-8 years at school	706	0.1941	0.3957	0	1
9-13 years at school	706	0.3017	0.4593	0	1
High School graduate	706	0.2649	0.4416	0	1
College Graduate	706	0.2394	0.4270	0	1
Employment					
Working hours	702	40.08	10.55	8	80
Job tenure < 3 years	703	0.2589	0.4383	0	1
Union membership	704	0.4801	0.5000	0	1
Occupation					
Professional, high level management	706	0.2167	0.4123	0	1
Technicians	706	0.2422	0.4287	0	1
Clerks and services workers	706	0.2167	0.4123	0	1
Skilled workers	706	0.1303	0.3369	0	1
Unskilled workers	706	0.1941	0.3957	0	1
Firm characteristics					
Size of the firm	695	3.1295	1.3980	1	5
Education, civil & health services	706	0.3314	0.4711	0	1
Industry, construct	706	0.2295	0.4208	0	1
Trade, transport, financial services, property business	706	0.4348	0.4961	0	1

Appendix 2 - Variable definitions

1. Negative incentives

Monitoring

My work is closely supervised - agree or strongly agree.

2. Positive Incentives

Wage bonus

My wage or salary depends on the amount of effort I put into my work - quite true or very true.

Promotions

My opportunities for advancement are good - agree or strongly agree.

3. Intrinsic motivations

Pure intrinsic motivations: good job

Based on the answers to the following questions.

- My job requires that I keep learning new things;
- I can decide the organization of the daily work independently.

Dichotomous variables were created, with 1 representing quite true or very true. The sum of these two variables is a measure of good job content. A dummy variable was created for workers reporting positive job content for at least one aspect.

Moral motivations

I like following rules even when no-one is watching. The variable is based on the answer of the following question. Choose the description that shows how much each person is or is not like you.

He believes that people should do what they're told, he thinks people should follow rules at all times, even when no-one is watching: somewhat like me, like me, very much like me.

4. Extrinsic motivations

External Pressure

- *Need of colleagues' gratitude*

I want people to admire what I do. The variable is based on the answer of the following question. Choose the description that shows how much each person is or is not like you.

It's important to him to show his abilities, he wants people to admire what he does: somewhat like me, like me, very much like me.

- *Team spirit*

I can get support and help from my co-workers when needed - quite true or very true.

Fairness - reciprocity in the firm

- *Attachment to the firm*

I would turn down another job with higher pay in order to stay with this organisation - agree or strongly agree.

- *Job Security*

My job is secure - quite true or very true.

Appendix 3. Additional tables

Table A.1. Naïves estimates of the impact of computer use at work

		Use	No use	Naïf
Hypothesis 1	**Monitoring**	0.3791 (0.486)	0.4662 (0.500)	-0.0871**
Hypothesis 2	**Wage bonus**	0.2600 (0.439)	0.1957 (0.397)	0.0643*
	Promotions	0.5037 (0.501)	0.3345 (0.473)	0.1692***
Hypothesis 3	**Pure intrinsic motivations**	0.8978 (0.303)	0.6523 (0.477)	0.2454***
Hypothesis 4	**Moral motivations**	0.6010 (0.490)	0.7316 (0.444)	-0.1306***
Hypothesis 5	**Need of colleagues' gratitude**	0.5752 (0.495)	0.6259 (0.485)	-0.0507
	Team spirit	0.8589 (0.349)	0.7336 (0.443)	0.1254***
Hypothesis 6	**Attachment to the firm**	0.3990 (0.490)	0.4029 (0.491)	-0.0039
	Job security	0.8161 (0.388)	0.7491 (0.434)	0.067**

Note: Standard deviations are in parentheses. *, **, *** significant at 10%, 5% and 1% respectively

Table A.2. Naïves estimates of the impact of Internet use at work

		Use	No use	Naïf
Hypothesis 1	**Monitoring**	0.3448 (0.476)	0.4804 (0.500)	-0.1356***
Hypothesis 2	**Wage bonus**	0.2673 (0.443)	0.1979 (0.399)	0.0694**
	Promotions	0.5047 (0.501)	0.3695 (0.483)	0.1352***
Hypothesis 3	**Pure intrinsic motivations**	0.9154 (0.279)	0.6937 (0.462)	0.2216***
Hypothesis 4	**Moral motivations**	0.6161 (0.487)	0.6929 (0.462)	-0.0768**
Hypothesis 5	**Need of colleagues' gratitude**	0.5770 (0.495)	0.6137 (0.488)	-0.0367
	Team spirit	0.8639 (0.343)	0.7580 (0.429)	0.1059***
Hypothesis 6	**Attachment to the firm**	0.4032 (0.491)	0.3915 (0.489)	0.0117
	Job security	0.8228 (0.382)	0.7605 (0.427)	0.0623**

Note: Standard deviations are in parentheses. *, **, *** significant at 10%, 5% and 1% respectively

Table A.3. Probit estimates of the impact of computer use at work [i]

	Monitoring	Wage bonus	Promotions	Pure intrinsic motivations	Moral motivations	Need of colleagues' gratitude[ii]	Team spirit	Attachment to the firm	Job security
Computer	**-0.117**	**0.290**	**0.296**	**0.406**	**-0.073**	**0.040**	**0.086**	**-0.145**	**0.163**
	(0.132)	**(0.150)***	**(0.134)****	**(0.156)*****	**(0.139)**	**(0.137)**	**(0.155)**	**(0.133)**	**(0.149)**
Multi-tasking	-0.159	0.179	0.397	0.899	-0.055	0.199	0.696	0.060	0.396
	(0.134)	(0.155)	(0.140)***	(0.146)***	(0.146)	(0.138)	(0.148)***	(0.139)	(0.147)***
Flexibility	0.259	0.220	0.193	0.197	-0.025	0.066	-0.067	0.036	-0.115
	(0.120)**	(0.130)*	(0.121)	(0.161)	(0.124)	(0.122)	(0.146)	(0.123)	(0.135)
Sexe	0.094	0.199	0.315	0.196	0.329	-0.254	-0.106	0.220	0.144
(Male)	(0.128)	(0.143)	(0.128)**	(0.164)	(0.133)**	(0.128)**	(0.156)	(0.129)*	(0.142)
Age	-0.025	-0.026	0.054	-0.030	0.033	-0.005	-0.152	-0.040	-0.037
	(0.036)	(0.040)	(0.038)	(0.044)	(0.037)	(0.036)	(0.047)***	(0.037)	(0.041)
Age2	0.000	0.000	-0.001	0.000	-0.000	-0.000	0.002	0.001	0.001
	(0.000)	(0.000)	(0.000)**	(0.001)	(0.000)	(0.000)	(0.001)***	(0.000)	(0.001)
High School	-0.228	0.053	-0.066	0.009	-0.347	-0.121	-0.246	0.012	-0.085
Graduate	(0.141)	(0.156)	(0.143)	(0.171)	(0.147)**	(0.145)	(0.168)	(0.144)	(0.160)
College	-0.614	0.162	-0.219	0.407	-0.403	0.047	-0.026	0.222	-0.058
Graduate	(0.189)***	(0.199)	(0.187)	(0.295)	(0.193)**	(0.187)	(0.232)	(0.189)	(0.210)
Working	0.004	0.001	0.003	0.010	0.000	0.011	0.020	-0.002	0.002
hours	(0.006)	(0.007)	(0.006)	(0.008)	(0.006)	(0.006)*	(0.007)***	(0.006)	(0.007)
Job tenure	0.118	0.196	0.215	-0.144	-0.032	-0.003	-0.263	-0.542	-0.224
< 3 years	(0.131)	(0.140)	(0.130)*	(0.168)	(0.135)	(0.133)	(0.157)*	(0.137)***	(0.140)
Union	0.167	-0.094	0.148	0.126	0.052	0.083	0.138	0.057	0.237
Membership	(0.110)	(0.121)	(0.110)	(0.140)	(0.114)	(0.112)	(0.131)	(0.111)	(0.124)*
Professional.	-0.240	-0.278	-0.124	0.982	-0.453	-0.299	0.502	-0.085	-0.023
high level management	(0.230)	(0.249)	(0.234)	(0.340)***	(0.244)*	(0.233)	(0.270)*	(0.233)	(0.258)
Technicians	0.243	-0.471	0.379	0.547	-0.441	-0.455	0.501	0.096	-0.094
	(0.194)	(0.219)**	(0.199)*	(0.231)**	(0.213)**	(0.200)**	(0.226)**	(0.198)	(0.219)
Clerks and	-0.073	-0.320	0.246	0.223	-0.584	-0.184	0.553	0.062	0.160
services workers	(0.179)	(0.203)	(0.185)	(0.197)	(0.198)***	(0.185)	(0.206)***	(0.183)	(0.202)
Skilled	-0.117	-0.200	0.246	-0.111	-0.307	-0.205	0.276	-0.159	-0.183
workers	(0.198)	(0.216)	(0.205)	(0.221)	(0.220)	(0.210)	(0.228)	(0.204)	(0.223)
Size	0.103	0.033	0.047	-0.053	-0.032	-0.056	0.031	-0.092	-0.006
of the firm	(0.041)**	(0.044)	(0.041)	(0.050)	(0.042)	(0.041)	(0.047)	(0.040)**	(0.044)
Education.	0.013	-0.535	0.190	-0.262	0.093	0.034	0.160	0.467	0.458
civil or health services	(0.128)	(0.147)***	(0.130)	(0.165)	(0.134)	(0.130)	(0.153)	(0.129)***	(0.149)***
Industry.	-0.040	-0.082	-0.058	-0.002	-0.264	0.328	0.211	0.006	0.094
construct	(0.159)	(0.165)	(0.158)	(0.198)	(0.166)	(0.163)**	(0.184)	(0.160)	(0.176)
Constant	-0.073	-0.699	-2.024	-0.005	0.184	0.380	2.319	0.612	0.679
	(0.761)	(0.827)	(0.786)**	(0.914)	(0.773)	(0.758)	(0.980)**	(0.780)	(0.838)
Observations	647	645	647	645	623	615	639	635	641
Log likelihood	-409.75	-331.78	-404.38	-248.63	-376.78	-400.77	-276.97	-405.19	-310.57
LR chi2 (18)	60.32	47.8	78.51	153.76	50.59	29.4	80.55	42.7	38.79
Prob > chi2	0.0000	0.0002	0.0000	0.0000	0.0001	0.0437	0.0000	0.0009	0.003
Pseudo R2	0.0686	0.0672	0.0885	0.2362	0.0629	0.0354	0.127	0.05	0.0588

i: Standard errors are in parentheses; *, **, ***significant at 10%, 5% and 1% respectively. ii: Some misspecification of the model (Prob>chi2=0.0437).

Table A.4. Probit estimates of the impact of Internet use at work [i]

	Monitoring	Wage bonus	Promotions	Pure intrinsic motivations	Moral motivations	Need of colleagues' gratitude[ii]	Team spirit	Attachment to the firm	Job security
Internet	**-0.278**	**0.280**	**0.251**	**0.231**	**0.134**	**0.074**	**0.053**	**-0.128**	**0.121**
	(0.126)**	**(0.144)***	**(0.126)****	**(0.160)**	**(0.131)**	**(0.128)**	**(0.150)**	**(0.127)**	**(0.144)**
Multi-tasking	-0.186	0.191	0.444	0.900	-0.068	0.161	0.692	0.111	0.395
	(0.131)	(0.152)	(0.137)***	(0.141)***	(0.143)	(0.134)	(0.144)***	(0.136)	(0.144)***
Flexibility	0.301	0.208	0.130	0.198	-0.050	0.068	-0.029	0.019	-0.098
	(0.118)**	(0.128)	(0.118)	(0.156)	(0.122)	(0.120)	(0.142)	(0.120)	(0.133)
Sexe	0.087	0.191	0.287	0.201	0.259	-0.271	-0.074	0.264	0.112
(Male)	(0.127)	(0.142)	(0.126)**	(0.162)	(0.131)**	(0.127)**	(0.153)	(0.128)**	(0.140)
Age	-0.024	-0.022	0.058	-0.011	0.042	-0.003	-0.155	-0.036	-0.034
	(0.035)	(0.039)	(0.037)	(0.042)	(0.036)	(0.035)	(0.046)***	(0.037)	(0.040)
Age2	0.000	0.000	-0.001	0.000	-0.000	-0.000	0.002	0.000	0.001
	(0.000)	(0.000)	(0.000)**	(0.001)	(0.000)	(0.000)	(0.001)***	(0.000)	(0.001)
High School	-0.173	0.023	-0.085	0.049	-0.352	-0.067	-0.200	0.024	-0.079
Graduate	(0.138)	(0.155)	(0.140)	(0.165)	(0.145)**	(0.142)	(0.163)	(0.141)	(0.157)
College	-0.531	0.129	-0.224	0.437	-0.431	0.082	0.017	0.223	-0.065
Graduate	(0.189)***	(0.201)	(0.187)	(0.295)	(0.194)**	(0.187)	(0.231)	(0.189)	(0.210)
Working	0.001	0.003	0.005	0.013	0.000	0.012	0.017	-0.002	0.000
hours	(0.006)	(0.007)	(0.006)	(0.007)*	(0.006)	(0.006)*	(0.007)**	(0.006)	(0.007)
Job tenure	0.102	0.201	0.190	-0.136	-0.062	-0.015	-0.274	-0.503	-0.237
< 3 years	(0.130)	(0.139)	(0.129)	(0.166)	(0.134)	(0.132)	(0.155)*	(0.136)***	(0.139)*
Union	0.159	-0.107	0.113	0.163	0.072	0.092	0.120	0.061	0.265
Membership	(0.108)	(0.119)	(0.108)	(0.136)	(0.112)	(0.110)	(0.127)	(0.109)	(0.122)**
Professional. high	-0.089	-0.266	-0.076	1.065	-0.570	-0.343	0.519	-0.112	0.037
level management	(0.224)	(0.243)	(0.228)	(0.337)***	(0.237)**	(0.226)	(0.262)**	(0.227)	(0.251)
Technicians	0.360	-0.443	0.414	0.660	-0.586	-0.513	0.525	0.095	-0.039
	(0.185)*	(0.210)**	(0.190)**	(0.221)***	(0.204)***	(0.191)***	(0.216)**	(0.189)	(0.208)
Clerks and	0.037	-0.312	0.296	0.277	-0.645	-0.217	0.550	0.036	0.225
services workers	(0.171)	(0.193)	(0.178)*	(0.189)	(0.191)***	(0.176)	(0.196)***	(0.176)	(0.194)
Skilled	-0.033	-0.156	0.266	-0.071	-0.304	-0.173	0.309	-0.222	-0.168
workers	(0.194)	(0.212)	(0.201)	(0.215)	(0.217)	(0.206)	(0.224)	(0.201)	(0.217)
Size	0.095	0.047	0.061	-0.037	-0.032	-0.056	0.019	-0.101	0.001
of the firm	(0.039)**	(0.043)	(0.039)	(0.048)	(0.041)	(0.040)	(0.046)	(0.039)**	(0.043)
Education. civil or	0.039	-0.524	0.187	-0.276	0.048	0.021	0.161	0.470	0.451
health services	(0.126)	(0.145)***	(0.128)	(0.162)*	(0.132)	(0.128)	(0.149)	(0.127)***	(0.147)***
Industry.	-0.002	-0.116	-0.080	-0.070	-0.279	0.311	0.210	0.028	0.080
construct	(0.156)	(0.163)	(0.156)	(0.193)	(0.164)*	(0.160)*	(0.182)	(0.157)	(0.173)
Constant	0.018	-0.864	-2.159	-0.462	0.073	0.373	2.494	0.478	0.669
	(0.737)	(0.809)	(0.765)***	(0.872)	(0.750)	(0.737)	(0.953)***	(0.767)	(0.813)
Observations	666	665	667	665	642	635	659	653	660
Log likelihood	-422.71	-337.80	-416.83	-259.73	-386.73	-412.71	-287.31	-416.04	-318.94
LR chi2 (18)	61.54	51.28	79.62	157.03	53.19	31.68	82.69	43.35	41.60
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0240	0.0000	0.0007	0.0013
Pseudo R2	0.0679	0.0705	0.0872	0.2321	0.0643	0.0370	0.1258	0.0495	0.0612

[i]: Standard errors are in parentheses; *, **, ***significant at 10%, 5% and 1% respectively. [ii]: Some misspecification of the model (Prob>chi2=0.024).