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The effects of ICT use on employee's motivations: an empirical evaluation

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Abstract

Recent studies underline a positive impact of Information and Communication Technologies (ICT) and new work practices on firms' productivity. In order to obtain productivity gains, firms need to provide workers with sufficient incentives and to encourage motivations. Our econometric results, obtained with data at the individual level collected in Luxembourg in 2004-2005, indicate that Internet use allows for the creation of an enriching work environment that positively influences pure intrinsic motivations of the workers that share the preferences of their firm (insiders). These pure intrinsic motivations are crowded in when the firm provides positive incentives, and crowded out when the firm resorts to monitoring. Moreover, the results show that the virtualization of contact due to the resort of Internet communication instead of face-to-face communication decreases the development of a team spirit between workers. But the magnitude of this effect is smaller than the magnitude of the positive link of Internet use with workers' need of recognition. Concerning workers who think of themselves not as a part of the firm (outsiders), it appears that offering the access to the Internet to those workers does not influence their 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, favors the productivity of the firm as underlined by several works (Greenan and Mairesse, 2000; Licht and Moch, 1999; Lichtenberg, 1995). Moreover, the diffusion of ICT has been combined with workplace reorganizations that involve a change from a “Tayloristic” work organization, characterized by task specialization, pyramidal hierarchical structure and centralization of responsibilities, to a “Holistic” organization with multi-tasking, job rotation, decentralization of decision-making, team work, more flexibility for the employer and greater communication between workers (Lindbeck and Snower, 2000; Osterman, 2000). Recent empirical studies show that ICT combined with workplace reorganization have positive and significant effects on productivity at the firm level (Bertschek and Kaiser, 2004; Black and Lynch, 2001; Bresnahan *et al.*, 2002; Brynjolfsson and Hitt, 2000). However, the effects of technological and organizational changes at the employee level are largely neglected. Only few papers show that ICT use furthers information diffusion in networks of workers and strengthen the productivity of employees (Aral *et al.*, 2007).

Firms need to provide the proper incentives and a motivating work environment to favor the optimal diffusion of information and knowledge that should in turn result in productivity gains. In the principal-agent view, the firm exists for a large part to provide the proper incentives to obtain the optimal provision of workers’ effort. This view can be extended with motivations, largely neglected by the economic literature. These motivations, widely analyzed by organizational psychologists, 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 effort at work. Moreover, Akerlof and Kranton (2005) formalize the impact of incentives and motivations in workers’ utility to provide effort depending on their initial motivations (given their identity) so as to align or not their preferences with those of their employers. So, what are the consequences of ICT use on employees’ motivations, and how can ICT favor productivity at the employee level?

The principal can invest in incentives in order to induce workers to operate in the interest of the firm (Jensen and Meckling, 1976; Prendergast, 1999). Incentives are provided to workers through two options, a *negative incentive* (monitoring) and a *positive incentive* (wage bonus, promotions). To be effective, the monitoring needs to be combined with penalties when it shows that the work is substandard. The positive incentive option rewards workers for effort by means of monetary incentives like salary revision or bonus. As workers exert effort not just to maximize their pay but also to affect future contracts, the firm can also use promotions by acting on the career concerns of workers (Fama, 1980; Holmstrom, 1982).

Research on motivations has distinguished two types: intrinsic and extrinsic. Intrinsic motivations are influenced by the work itself (Deci, 1971), while extrinsic motivations come from outside the person through external pressure exerted by colleagues or the employer (Frey and Jegen, 2001). ‘Pure intrinsic motivations’ come from within the worker 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. As technological and organizational changes seem to be associated with greater freedom in organizing one’s own work and in diversifying tasks (Caroli *et al.*, 2001; Greenan and Walkowiak, 2005; Lindbeck and Snower, 1996, 2000), it may increase the interest of the job and consequently boost employee intrinsic motivation. The crowding theory developed by Frey (1997) and Frey and Jegen (2001) shows that external interventions, through 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 case, workers feel that their involvement and competence

are appreciated by employers (possibilities of promotions). In the second case, agents perceive that the external intervention, like monitoring, shifts the locus of control from the agent to the principal. As workers become “pawns”, they respond by reducing what they have control over, *i.e.* intrinsic motivation (Deci, 1971; Minkler, 2004).

More than the work ethic embedded in intrinsic motivations, Minkler (2004) introduces ‘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 into account incentives schemes. The integrity of workers can be a reason for moral actions (Minkler and Miceli, 2004). Integrity confers commitments to moral principles like honesty or a “don’t lie” principle. According to Bradley (2000) “*ICT should contribute to the deepening and development of true human qualities and provide time for people to develop themselves as human beings*” (p. 856).

According to Minkler (2004), “*workers who care about the views of other workers are subject to peer pressure*” (p. 870). This ‘extrinsic motivation’ most likely appears in firms that use profit sharing like in teams, because a low level of effort by a co-worker negatively affects all other workers’ income or well-being (as shirking requires more effort from others). More broadly, the pressure exerted by colleagues may occur when workers have a preference for cooperation and can explain what encourages workers to provide a high level of effort (Rob and Zemsky, 2002). Kandel and Lazear (1992) identify shame as a possible explanation of this external impact. This feeling arises when shirkers suffer from letting down their co-workers. As network technologies contribute to codify tasks, knowledge and to collect information, they stimulate electronic communications and allow workers to get help more easily from colleagues when it is needed. Moreover, a member of an organization can easily relay to other members’ information and knowledge concerning substandard work and it can, therefore, increase the feelings of shame when the effort is not sufficient. But as the use of ICT may reduce face-to-face interactions and informal contacts (Nie *et al.*, 2002), it can also thwart the creation of team spirit.

The concept of identity developed by Akerlof and Kranton (2005) embodies the extent to which workers identify with their firm and want to achieve its goal. Moreover, a recent issue of *The American Economic Review* gives pride of place to “work incentives, motivation, and identity” in its columns (Akerlof and Kranton, 2008; Besley and Ghatak, 2008; Prendergast, 2008). “Outsiders”, who think of themselves not as a part of the firm, can be distinguished from “insiders”, who share the preferences of their employers. Workers are risk averse and their overall utility is derived from incentives, motivations and identity. Insiders should act in the firm’s best interest, so that their ideal effort is in line with the expectations of the firm, while conversely outsiders do not want to work in the interest of the firm.

In this paper, we seek to provide an analysis of the consequences of Internet use on workers’ motivations given the incentives provided by the firm. Moreover, we introduce workers’ identity in the analysis in order to see how Internet use influences workers’ motivations depending on their identity. The originality of the paper is threefold. First, we give some new insights on workers’ motivations taking into account the recent changes in firms. Second, this paper empirically investigates the role of workers’ identity. Third, the paper provides results about the crowding hypotheses.

We perform our analysis on data from the European Social Survey (ESS) collected in Luxembourg by the CEPS/INSTEAD¹ in 2004-2005. By applying maximum simulated likelihood estimation techniques (Cappellari and Jenkins, 2006), we estimate a multivariate probit

¹CEPS/INSTEAD: Center for Population, Poverty and Public Policy Studies/International Networks for Studies in Technology, Environment, Alternatives, Development.

model that permits to evaluate the effect of Internet use on the probability of workers of being intrinsically or extrinsically motivated, taking into account the potential correlations between workers' motivations.

The rest of the paper is organized as follows. Section 2 provides a detailed description of the dataset and exposes the empirical framework of our analysis. Section 3 discusses the results, and conclusions are given in the fourth section.

2. Data and methodology

The data used in this study relate to individuals working and living in the Grand Duchy of Luxembourg. They were collected within the framework of a European project, the European Social Survey (ESS). This European project was conducted 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 technologies, both at home and at work. The data were collected during the period 2004-2005 by the CEPS/INSTEAD thanks to the financial support from the Luxembourg National Research Fund (FNR). As we want to analyze the links between Internet use at work and motivations, we focus our attention on the working population and more specifically on employees who are aged between 16 and 65. The numbers of individuals in the sample is 706².

Concerning motivations, the pure intrinsic one is caught by a proxy of having an enriching work, the moral one by a proxy defined by the fact of following rules even when no one is watching³. For the extrinsic motivations we capture external pressure with the use of two variables, the need of colleagues' gratitude and a proxy of team spirit.

We jointly estimate the workers' motivation equations, taking into account their potential correlations with the following system of equations:

$$\begin{cases} Y_{pure_intrinsic_motivation_i}^* = \beta'_1 \cdot X_{internet.i} + \gamma'_1 \cdot X_{other_var.i} + \varepsilon_{1i} \\ Y_{moral_motivation_i}^* = \beta'_2 \cdot X_{internet.i} + \gamma'_2 \cdot X_{other_var.i} + \varepsilon_{2i} \\ Y_{extrinsic_motivation_{1i}}^* = \beta'_3 \cdot X_{internet.i} + \gamma'_3 \cdot X_{other_var.i} + \varepsilon_{3i} \\ Y_{extrinsic_motivation_{2i}}^* = \beta'_4 \cdot X_{internet.i} + \gamma'_4 \cdot X_{other_var.i} + \varepsilon_{4i} \end{cases}$$

where i is for the worker (insider or outsider depending on the sub-sample analyzed in the regression), β_j the parameter of Internet use, γ_j the vector of parameters that captures the influence of the control variables and ε_{ji} the error terms (with $j = 1 \dots, 4$).

The control variables can be divided in four main groups: (1) incentives: monitoring, wage bonus, promotions; (2) workplace organization: small team, multi-tasking, flexibility⁴; (3) individual characteristics: sex, marital status, age, education level (three groups: 0-13 years at

²In the Appendix we provide descriptive statistics of the data.

³The details of the ESS questions and the variables constructed concerning incentives, motivations and identity are contained in the Appendix.

⁴Even if we have no information on firms' choice of organization and of the possible organizational changes implemented in the last years, we can construct variables related to the characteristics of occupied job to capture, as far as possible, workplace organizational practices. We have information on the diversity of the tasks carried out in the job to have an idea of employee's versatility ("*Multi-tasking*"). The data also give 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 of the firm, which gives us an idea of flexibility in the organization of the production ("*Flexibility*"). We also include a dummy for "*small team*" if the worker works with less than 9 persons.

school, High School Graduate, College Graduate), number of work hours, tenure and occupation (five groups: unskilled workers; skilled workers; clerks and services workers; technicians; professionals and high level management); and (4) firm characteristics: size, sectors (three groups: education, civil or health services; industry, construct; trade, transport, financial services and property business).

The error terms ε_{ji} are distributed as multivariate normal, each with a mean of zero, and variance-covariance matrix with the value 1 on leading diagonal and correlations $\rho_{kj} = \rho_{jk}$ as off-diagonal elements. When the correlation coefficient is 0 the motivations are independent, otherwise they are interdependent.

As the dependent variables in each equations are dummies, we use a multivariate probit model to estimate the equation system with a maximum simulated likelihood estimation technique (Cappellari and Jenkins, 2006).

Following Akerlof and Kranton (2005), we distinguish two social categories of employees (insiders and outsiders) by using the degree of loyalty of workers towards their firm or how much they are proud to be working for their firm. Despite the shortcomings of the concept because “[...] these responses do not tell us why workers feel this way. Perhaps firms invest in identity. Perhaps workers select organizations that share their values. Perhaps workers adopt their firms’ values to minimize cognitive dissonance” (Akerlof and Kranton (2005), p. 22), it corresponds to the framework they build where identity is a part of workers’ utility. From this point of view, we use the following question: “Thinking about the organization you work for, how much do you agree with the following statement? I would turn down another job with higher pay in order to stay with this organization”. If the employee agrees or strongly agrees with the statement, he or she is considered as an insider, otherwise the employee is considered as an outsider. In our data, nearly 40% of employees can be considered as insiders (278 individuals) and 60% as outsiders (428 individuals).

3. Estimation results

Following Akerlof and Kranton (2005), we analyze the consequences of Internet use on workers’ motivations given the incentives provided by the firm and distinguishing insiders from outsiders. In order to verify that the motivations are not dependent with the identity of the worker, we perform Chi-squared tests. The Chi-squared tests presented in Table 1 show that, except for one of the extrinsic motivation with a test significant at 10% (‘need of colleagues’ gratitude’), there is no difference between insiders and outsiders regarding motivations.

Table 1: Chi-squared tests: motivations and identity

| | Insider | Outsider | χ^2 |
|-------------------------------|------------------|------------------|----------|
| Pure intrinsic motivations | 0.7845 (0.41) | 0.7765 (0.42) | ns |
| Moral motivations | 0.6644 (0.47) | 0.6669 (0.47) | ns |
| Need of colleagues’ gratitude | 0.5610 (0.50) | 0.6256 (0.48) | * |
| Team spirit | 0.8393 (0.37) | 0.8090 (0.39) | ns |

(*) significant at 10%; (ns) not significant.

3.1. The case of insiders

Table 2 presents the results of the estimation conducted on the subsample of insiders.

The results highlight the fact that Internet use promotes the diversification of work and participates in the enrichment of tasks. As shown by Deci (1971) or Minkler (2004), an enriching work shall promote the positive assessment by employees of their work and, therefore, their pure intrinsic motivation. Pure intrinsic motivations imply the delivery of the optimal effort without any financial compensation. An employee intrinsically motivated by an enriching work will obtain a higher utility than an employee not intrinsically motivated and will beyond provide a higher effort.

Table 2: Multivariate probit on the subsample of insiders^a

| | Pure intrinsic motivations | | Moral motivations | | Need of colleagues' gratitude (3) | | Team spirit (4) | |
|--------------------------------------|----------------------------|-----------------|----------------------|-----------------|-----------------------------------|-----------------|----------------------|-----------------|
| | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect |
| Internet | 0.657** (0.285) | 0.1029 | 0.310 (0.237) | ns | 0.664*** (0.233) | 0.2545 | -1.017*** (0.315) | -0.1456 |
| <i>1. Incentives</i> | | | | | | | | |
| Monitoring | -0.593** (0.235) | -0.1014 | 0.001 (0.198) | ns | -0.005 (0.191) | ns | -0.256 (0.247) | ns |
| Wage bonus | 0.786** (0.323) | 0.0957 | -0.261 (0.237) | ns | -0.050 (0.244) | ns | -0.053 (0.282) | ns |
| Promotions | 0.759*** (0.246) | 0.1258 | 0.466** (0.215) | 0.1628 | 0.133 (0.202) | ns | 0.109 (0.246) | ns |
| <i>2. Workplace organization</i> | | | | | | | | |
| Small team | -0.721*** (0.250) | -0.1437 | 0.227 (0.234) | ns | 0.074 (0.226) | ns | -0.296 (0.298) | ns |
| Multi-tasking | 1.622*** (0.271) | 0.4416 | -0.449 (0.282) | ns | 0.164 (0.236) | ns | 1.072*** (0.260) | 0.2140 |
| Flexibility | 0.300 (0.270) | ns | 0.143 (0.229) | ns | -0.317 (0.229) | ns | -0.494* (0.276) | -0.0702 |
| <i>3. Individual characteristics</i> | | | | | | | | |
| Male | 0.962*** (0.293) | 0.1928 | 0.405* (0.236) | 0.1462 | -0.116 (0.252) | ns | -0.928*** (0.338) | -0.0968 |
| Married | 0.080 (0.229) | ns | 0.350* (0.206) | 0.1226 | 0.054 (0.194) | ns | 0.551** (0.274) | 0.0689 |
| Age | 0.035 (0.081) | ns | 0.079 (0.072) | ns | -0.124 (0.085) | ns | -0.310*** (0.081) | -0.0386 |
| Age squared/100 | -0.054 (0.098) | ns | -0.092 (0.087) | ns | 0.108 (0.100) | ns | 0.328*** (0.098) | 0.0408 |
| 0-13 years at school | Ref. | | Ref. | | Ref. | | Ref. | |
| High School | -0.302 (0.298) | ns | -0.140 (0.277) | ns | -0.711*** (0.269) | -0.2777 | 0.007 (0.424) | ns |
| Graduate | 0.723 (0.514) | ns | -0.026 (0.313) | ns | -0.971*** (0.345) | -0.3710 | 0.704 (0.566) | ns |
| # Work hours | -0.024* (0.014) | -0.0039 | -0.004 (0.011) | ns | 0.007 (0.011) | ns | 0.068*** (0.015) | 0.0085 |
| Job tenure | -0.043 (0.040) | ns | 0.061* (0.034) | 0.0216 | -0.010 (0.033) | ns | -0.021 (0.039) | ns |
| Job tenure squared/100 | 0.120 (0.118) | ns | -0.172* (0.095) | -0.0607 | 0.018 (0.096) | ns | 0.102 (0.123) | ns |
| Professional, high level management | 0.314 (0.484) | ns | -1.067*** (0.412) | -0.4007 | -0.074 (0.382) | ns | 0.786 (0.503) | ns |
| Technicians | 0.427 (0.428) | ns | -0.957** (0.377) | -0.3539 | -0.797** (0.341) | -0.3098 | 0.922** (0.401) | 0.0880 |

| | Pure intrinsic motivations | | Moral motivations | | Need of colleagues' gratitude (3) | | Team spirit | |
|--|----------------------------|---------------------|----------------------|-------------------|-----------------------------------|------------------|---------------------|-----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect |
| Clerks and services workers | -0.535 (0.376) | ns | -0.994*** (0.376) | -0.3732 | -0.858*** (0.322) | -0.3312 | 1.576*** (0.401) | 0.1128 |
| Skilled workers | -1.087*** (0.419) | -0.2741 | -0.402 (0.475) | ns | -0.715* (0.377) | -0.2783 | 0.121 (0.424) | ns |
| Unskilled workers | Ref. | | Ref. | | Ref. | | Ref. | |
| <i>4. Firm characteristics</i> | | | | | | | | |
| Less than 10 employees | Ref. | | Ref. | | Ref. | | Ref. | |
| 10-24 employees | -1.369*** (0.413) | -0.3446 | -0.804** (0.312) | -0.3017 | -0.228 (0.334) | ns | 0.329 (0.360) | ns |
| 25-99 employees | -1.617*** (0.394) | -0.4325 | -0.152 (0.309) | ns | 0.173 (0.302) | ns | 0.105 (0.367) | ns |
| 100-499 employees | -0.287 (0.444) | ns | -0.256 (0.313) | ns | 0.422 (0.318) | ns | -0.097 (0.367) | ns |
| 500 employees and more | -1.306*** (0.424) | -0.3298 | -0.414 (0.320) | ns | -0.121 (0.308) | ns | -0.031 (0.419) | ns |
| Trade, transp., fin. and property bus. | Ref. | | Ref. | | Ref. | | Ref. | |
| Education, civil or health services | -0.552** (0.273) | -0.0965 | 0.016 (0.251) | ns | -0.462** (0.225) | -0.1812 | -0.134 (0.281) | ns |
| Industry, construct | -0.129 (0.359) | ns | -0.310 (0.364) | ns | -0.052 (0.297) | ns | 0.090 (0.363) | ns |
| Constant | 0.802 (1.534) | | -0.539 (1.482) | | 3.704** (1.587) | | 4.692*** (1.598) | |
| Observations | 278 | | | | | | | |
| Log Likelihood | -577.6 | | | | | | | |
| Correlation coefficients | rho_12 | rho_13 | rho_14 | rho_23 | rho_24 | rho_34 | | |
| | -0.043 (0.141) | 0.690*** (0.189) | 0.228 (0.151) | 0.216* (0.118) | 0.218 (0.143) | 0.158 (0.125) | | |

^a Robust standard errors in parentheses. Weighted estimations. (*) significant at 10%; (**) significant at 5%; (***) significant at 1%; (ns) not significant.

The results also corroborate the crowding hypotheses (Frey, 1997; Frey and Jegen, 2001). Indeed, the results show that monitoring reduces pure intrinsic motivations, that will decrease the effort provided by insiders. Conversely, monetary rewards and possibilities of promotion crowd in pure intrinsic motivations. In the context of skills acquisition *via* ICT use, the firm can recognize the value of these skills and choose to reward workers in order to retain insiders (and beyond strengthen their pure intrinsic motivations and effort).

Regarding the impact of Internet use on moral motivations, the results do not reveal a significant link between Internet use and the “integrity” to do the work in the interest of the firm.

Concerning extrinsic motivations, the results reveal a positive link between Internet and the shame feeling generated by the need for recognition, that stimulates workers. But, the results also highlight a negative correlation between Internet use and the development of a team spirit. This team spirit can strengthen the feeling of shame recognized by Akerlof and Kranton (2005) as reducing the value of the agent when he (she) fails to give the effort that is attended by the employer. Thus, in the context of less face-to face contacts, it appears that team spirit is less developed (Nie *et al.*, 2002) which can conduct to decrease effort. If we look at the marginal effects of the Internet variable in the estimates of the extrinsic motivations, it appears that the positive effect on the need for recognition is higher than the negative one concerning the development of a team spirit.

The correlation coefficients show that there is a correlation between the pure intrinsic moti-

vations and the need of colleagues gratitude, and also between moral motivations and the need of colleagues gratitude. Such correlations are taken into account through the estimate of the multivariate probit model.

3.2. The case of outsiders

Table 3 presents the results of the estimation conducted on the subsample of outsiders.

Table 3: Multivariate probit on the subsample of outsiders^a

| | Pure intrinsic motivations | | Moral motivations | | Need of colleagues' gratitude | | Team spirit | |
|--------------------------------------|----------------------------|-----------------|---------------------|-----------------|-------------------------------|-----------------|---------------------|-----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect |
| Internet | 0.030 (0.236) | ns | -0.357* (0.194) | -0.1266 | -0.151 (0.193) | ns | 0.212 (0.197) | ns |
| <i>1. Incentives</i> | | | | | | | | |
| Monitoring | -0.005 (0.194) | ns | -0.099 (0.165) | ns | -0.137 (0.165) | ns | 0.087 (0.166) | ns |
| Wage bonus | 0.302 (0.278) | ns | 0.180 (0.190) | ns | -0.199 (0.172) | ns | -0.047 (0.183) | ns |
| Promotions | 0.367* (0.198) | 0.0657 | 0.256 (0.163) | ns | -0.255 (0.163) | ns | 0.240 (0.175) | ns |
| <i>2. Workplace organization</i> | | | | | | | | |
| Small team | -0.132 (0.200) | ns | 0.200 (0.164) | ns | -0.271 (0.172) | ns | -0.087 (0.177) | ns |
| Multi-tasking | 0.896*** (0.207) | 0.2179 | 0.298 (0.194) | ns | -0.031 (0.199) | ns | 0.326* (0.188) | 0.0849 |
| Flexibility | 0.528** (0.228) | 0.0883 | -0.075 (0.180) | ns | 0.345* (0.183) | 0.1265 | 0.142 (0.181) | ns |
| <i>3. Individual characteristics</i> | | | | | | | | |
| Male | -0.021 (0.240) | ns | 0.114 (0.182) | ns | -0.348* (0.200) | -0.1283 | -0.019 (0.195) | ns |
| Married | 0.228 (0.215) | ns | -0.014 (0.166) | ns | 0.039 (0.166) | ns | 0.181 (0.179) | ns |
| Age | -0.062 (0.066) | ns | 0.001 (0.057) | ns | 0.013 (0.054) | ns | -0.162** (0.065) | -0.0389 |
| Age squared /100 | 0.056 (0.088) | ns | 0.021 (0.073) | ns | -0.011 (0.069) | ns | 0.180** (0.085) | 0.0430 |
| 0-13 years at school | Ref. | | Ref. | | Ref. | | Ref. | |
| High School Graduate | 0.494** (0.239) | 0.0794 | -0.483** (0.195) | -0.1771 | -0.164 (0.206) | ns | -0.125 (0.228) | ns |
| College Graduate | 1.128*** (0.385) | 0.1434 | -0.317 (0.263) | ns | 0.405 (0.268) | ns | -0.076 (0.302) | ns |
| # Work hours | 0.020* (0.011) | 0.0036 | 0.007 (0.008) | ns | 0.013 (0.009) | ns | 0.010 (0.009) | ns |
| Job tenure | 0.060* (0.034) | 0.0112 | -0.000 (0.028) | ns | 0.030 (0.027) | ns | -0.003 (0.029) | ns |
| Job tenure squared/100 | -0.122 (0.118) | ns | 0.028 (0.096) | ns | -0.126 (0.087) | ns | 0.022 (0.095) | ns |
| Professional, high level management | 1.048*** (0.392) | 0.1306 | -0.589* (0.332) | -0.2206 | -0.591* (0.313) | -0.2296 | 0.780** (0.366) | 0.1436 |
| Technicians | 0.536 (0.333) | ns | -0.572** (0.279) | -0.2122 | -0.442 (0.275) | ns | 0.366 (0.290) | ns |
| Clerks and services workers | 0.075 (0.272) | ns | -0.606** (0.254) | -0.2253 | -0.028 (0.238) | ns | 0.174 (0.259) | ns |

| | Pure intrinsic motivations | | Moral motivations | | Need of colleagues' gratitude (3) | | Team spirit (4) | |
|--|----------------------------|----------------------------|----------------------------|----------------------------|-----------------------------------|----------------------------|--------------------|-----------------|
| | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect | Coeff. | Marginal effect |
| Skilled workers | 0.210 (0.292) | ns | -0.523* (0.289) | -0.1961 | -0.069 (0.282) | ns | 0.558* (0.299) | 0.1081 |
| Unskilled workers | Ref. | | Ref. | | Ref. | | Ref. | |
| <i>4. Firm characteristics</i> | | | | | | | | |
| Less than 10 employees | Ref. | | Ref. | | Ref. | | Ref. | |
| 10-24 employees | -0.194 (0.303) | ns | 0.103 (0.255) | ns | 0.070 (0.279) | ns | 0.120 (0.269) | ns |
| 25-99 employees | 0.441 (0.323) | ns | 0.182 (0.272) | ns | -0.223 (0.294) | ns | 0.221 (0.274) | ns |
| 100-499 employees | 0.290 (0.315) | ns | -0.182 (0.257) | ns | -0.161 (0.265) | ns | -0.124 (0.265) | ns |
| 500 employees and more | -0.410 (0.309) | ns | -0.106 (0.265) | ns | -0.292 (0.271) | ns | 0.150 (0.257) | ns |
| Trade, transp., fin. and property bus. | Ref. | | Ref. | | Ref. | | Ref. | |
| Education, civil or health services | -0.513** (0.226) | -0.1096 | -0.146 (0.194) | ns | 0.078 (0.194) | ns | 0.093 (0.214) | ns |
| Industry, construct | 0.004 (0.285) | ns | -0.252 (0.226) | ns | 0.297 (0.226) | ns | 0.077 (0.274) | ns |
| Constant | -0.213 (1.152) | | 0.304 (1.123) | | 0.162 (1.007) | | 2.987** (1.228) | |
| Observations | 428 | | | | | | | |
| Log Likelihood | -1023 | | | | | | | |
| Correlation coefficients | rho_12 0.187 (0.122) | rho_13 0.011 (0.114) | rho_14 0.154 (0.123) | rho_23 0.046 (0.095) | rho_24 0.213** (0.103) | rho_34 0.017 (0.103) | | |

^a Robust standard errors in parentheses. Weighted estimations. (*) significant at 10%; (**) significant at 5%; (***) significant at 1%; (ns) not significant.

The results show that Internet use does not have a link with motivations, except with moral motivations. The negative effect of Internet on those moral motivations suggests that Internet enables workers to see external opportunities of work and this way decreases the “integrity” of working hard in the current job.

While Internet does not permit to motivate outsiders, the main results concerning incentives and workplace organization show that promotions opportunities, multi-tasking or flexibility constrained by the firm can favor pure intrinsic motivations. Multi-tasking also strengthens the development of a team spirit, and flexibility the need of recognition. Concerning other explanatory variables, it appears that male outsiders need less than female outsiders the gratitude of colleagues. Educated outsiders with managerial responsibilities seem to be more intrinsically motivated than others.

4. Conclusion

The large diffusion of ICT associated with high performance work practices since the early 1990s has raised concerns about the impact of these changes on productivity. Some recent studies underline a positive impact of ICT and innovative work practices on individuals' and firms' productivity. In this context of wide changes, our work is intended to study how the firm can play on motivations to obtain a high amount of effort and to get the productivity effects highlighted in the literature.

Grounded in the economic literature as well as in works initially developed in organizational psychology, we seek to evaluate empirically, in this article, the links between Internet use and motivations given the incentives provided by the firm. Moreover, we introduce workers' identity in the analysis (Akerlof and Kranton, 2005, 2008; Besley and Ghatak, 2008; Prendergast, 2008) in order to see how Internet use influences workers' motivations depending on their identity. We conduct our analysis on a representative sample of individuals working and living in Luxembourg surveyed in 2004-2005 and we estimate a multivariate probit model that permits to evaluate the effect of Internet use on the probability of workers of being intrinsically or extrinsically motivated, taking into account the potential correlations between workers' motivations.

The results about Internet use and insiders' motivations show that, by giving the possibility to use Internet at the workplace, the firm creates an enriching work environment that positively influences the pure intrinsic motivations of workers. In addition, the use of Internet is positively correlated with the need of colleagues' gratitude that can generate shame if the level of effort is insufficient and should lead to a higher level of employees' effort. It also appears that the virtualization of contact due to the resort of Internet communication instead of face-to-face communication decreases the development of a team spirit between workers. But the magnitude of this effect is less important than the magnitude of the positive link with the need of recognition. The results on the subsample of outsiders show that providing the access to the Internet to those workers does not influence their motivations, except a negative impact on moral motivations. As these workers do not think of themselves as a part of the firm, it seems that Internet use decreases the "integrity" of working hard in their current job since they can see external job opportunities in other firms that match better their values.

Concerning the impacts of incentives on insiders' motivations, our results are in line with the crowding literature. Thus, it appears that both negative and positive incentives impact on the positive assessment of their work. The results reveal a crowd-out effect due to the direct supervision of workers that can badly influence the provision of effort. Conversely, positive incentive mechanisms can, through the crowd-in effect, strengthen pure intrinsic motivations and the level of effort to work, create and transfer knowledge. For outsiders, it appears that only the positive incentive of promotion perspective enhances their pure intrinsic motivation. As the identity of the workers corresponds to their self image, it is not easily observable by the manager. If the manager's objective is to foster the intrinsic motivation of all employees, the promotion system should be preferred. As promotions are related to the recognition of the work made and to the access of potential enjoyable future tasks, they can motivate all workers. If the manager's objective is essentially to motivate and retain insiders, wage bonuses are to be preferred, even if they have no effect on outsiders' motivations. A fruitful extension of this research would be to endogeneize the identity of the worker with a longitudinal database. Recent theoretical articles suggest that firms can invest in motivational capital in order to transform a worker's identity from outsider to insider, by changing, for example, the composition of the team, work environment and develop sponsored activities such as sport teams (Akerlof and Kranton, 2005, 2008).

Finally, we need to notice that we are conscious of the difficulties to disentangle ICT and innovative work practices in studying what can encourage individuals to work in the interest of the firm. For example, it seems that, even if new technologies are put at the service of organizational strategies, the impact on workers' motivations is mainly determined simultaneously by ICT and innovative work practices. A thorough examination of the joint effect of ICT and organizational changes would require more detailed data concerning the changes implemented in firms.

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Appendix

Table 4: Descriptive statistics^a

| | Insider | | Outsider | |
|-------------------------------------|---------|-----------|----------|-----------|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Internet | 0.4373 | 0.50 | 0.4282 | 0.50 |
| Monitoring | 0.4511 | 0.50 | 0.4222 | 0.49 |
| Wage bonus | 0.2128 | 0.41 | 0.2216 | 0.42 |
| Promotions | 0.4990 | 0.50 | 0.4113 | 0.49 |
| Small team | 0.2867 | 0.45 | 0.3733 | 0.48 |
| Multi-tasking | 0.8126 | 0.39 | 0.7712 | 0.42 |
| Flexibility | 0.3346 | 0.47 | 0.3330 | 0.47 |
| Male | 0.6591 | 0.47 | 0.6166 | 0.49 |
| Married | 0.4848 | 0.50 | 0.4989 | 0.50 |
| Age | 37.32 | 11.02 | 36.78 | 10.49 |
| High School graduate | 0.2841 | 0.45 | 0.2625 | 0.44 |
| College Graduate | 0.2294 | 0.42 | 0.2159 | 0.41 |
| # Work hours | 40.47 | 10.31 | 40.32 | 10.51 |
| Job tenure | 10.46 | 9.36 | 8.54 | 8.84 |
| Professional, high level management | 0.1965 | 0.40 | 0.1866 | 0.39 |
| Technicians | 0.2791 | 0.45 | 0.2293 | 0.42 |
| Clerks and services workers | 0.2087 | 0.41 | 0.2310 | 0.42 |
| Skilled workers | 0.1445 | 0.35 | 0.1493 | 0.36 |
| 10-24 employees | 0.2156 | 0.41 | 0.1781 | 0.38 |
| 25-99 employees | 0.2030 | 0.40 | 0.2022 | 0.40 |
| 100-499 employees | 0.1982 | 0.40 | 0.2294 | 0.42 |
| 500 employees and more | 0.1998 | 0.40 | 0.2334 | 0.42 |
| Education, civil or health services | 0.4150 | 0.49 | 0.2709 | 0.44 |
| Industry, construct | 0.2054 | 0.40 | 0.2366 | 0.43 |
| # obs. | 278 | | 428 | |

^a Weighted statistics.

Table 5: Construction of the variables: incentives, motivations and identity

| | Value of the variable | |
|---|--|---|
| | 1 | 0 |
| Negative incentives | | |
| <i>Monitoring</i> | | |
| “Thinking about the organization you work for, how much do you agree or disagree with the following statements? My work is closely supervised.” | Agree, agree strongly | Strongly disagree, disagree, neither agree nor disagree |
| Positive incentives | | |
| <i>Wage bonus</i> | | |
| “Tell me how true each of the following statements is about your current job. My wage or salary depends on the amount of effort I put into my work.” | Quite true, very true | Not at all true, a little true |
| <i>Promotions</i> | | |
| “Still thinking about your current job, how much do you agree or disagree with each of the following statements? My opportunities for advancement are good.” | Agree, agree strongly | Strongly disagree, disagree, neither agree nor disagree |
| Pure intrinsic motivations | | |
| Based on the answers to the following questions: | At least one of the positive aspects | No positive aspects |
| “Tell me how true each of the following statements is about your current job. My job requires that I keep learning new things.” | Quite true, very true | Not at all true, a little true |
| “How much the management at your work allows you to decide how your own daily work is organized?” | “I have no influence” to “I have complete control”: 6-10 | “I have no influence” to “I have complete control”: 0-5 |
| Moral motivations | | |
| “I will briefly describe some people. Please listen to each description and tell me 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” | Very much like me, like me | Somewhat like me, a little like me, not like me, not like me at all |
| Extrinsic motivations | | |
| <i>Need of colleagues’ gratitude</i> | | |
| “I will briefly describe some people. Please listen to each description and tell me 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.” | Very much like me, like me | Somewhat like me, a little like me, not like me, not like me at all |
| <i>Team spirit</i> | | |
| “Tell me how true each of the following statements is about your current job. I can get support and help from my co-workers when needed.” | Quite true, very true | Not at all true, a little true |
| Insider/outsider | | |
| “Thinking about the organization you work for, how much do you agree or disagree with the following statements? I would turn down another job with higher pay in order to stay with this organization” | Agree, agree strongly | Strongly disagree, disagree, neither agree nor disagree |