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THE COMPLEMENTARITIES BETWEEN INFORMATION TECHNOLOGIES USE, NEW ORGANIZATIONAL PRACTICES AND EMPLOYEES' CONTEXTUAL PERFORMANCE: EVIDENCE FROM EUROPE IN 2005 AND 2010

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THE COMPLEMENTARITIES BETWEEN INFORMATION TECHNOLOGIES USE, NEW ORGANIZATIONAL PRACTICES AND EMPLOYEES' CONTEXTUAL PERFORMANCE: EVIDENCE FROM EUROPE IN 2005 AND 2010

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Abstract:
This article investigates the relationship between Internet and computer use, new organizational practices and workers' contextual performance in the European context. Our empirical results are based on data about more than 11,000 employees from 16 European countries in 2005 and more than 16,000 in 2010. First, we find asymmetric effects of IT use. Internet use is, indeed, positively related to all aspects of contextual performance in 2010, while computer use has been positively associated with contextual performance in 2005 but not in 2010. Second, we find that most of the considered new organizational practices have a positive relationship with employees' contextual performance.

Key words: Contextual Performance, Information Technologies, New Organizational Practices, European workers
Codes JEL: J81; M12 ; M54, L23

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1. Introduction

The objective of this article is to propose an economic analysis of IT usage (Internet usage and Computer usage), New Organizational Practices (NOP) and employees' performance in Europe measured by contextual performance as defined by Coleman and Borman (2000). Information Technologies (IT) and NOP are generally viewed as complementary assets impacting firm performance (Ichniowski et al., 1997; Bresnahan et al., 2002; Brynjolfsson and Hitt, 2003; Melville et al., 2004; Garicano and Hubbard, 2009; Garicano and Heaton, 2010; Garicano, 2010 and Askenazy and Caroli, 2010). Since then looking at the impacts of IT on employees' performance needs to consider the adoption of NOP by firms.

Although several empirical researches have analysed the links between IT use, NOP and the performance of the firm, researches at the employee level are scarce[2]. One of the main explanations of this scarcity is related to the lack of individual measures for workers' efforts and performance. Our article contributes to this line of research by focusing on these organizational changes (NOP) adopted simultaneously with IT and their impact on employees' performance.

Our work has three main novelties. Firstly, while most of the related literature focuses on productivity as the main indicator of employees' performance, we propose in this paper an alternative research strategy by focusing on contextual performance of workers as a performance indicator. We argue that IT investments and NOP motivate workers and develop their behavioural performance[3]. IT, for example, mediates relations inside the firm and may induce self-improving behaviours. NOP, such as team work, are the support to interpersonal relations. Since then IT and NOP mainly impacts the behavioural dimension of workers' performance. Secondly, we test two main hypotheses using rich European data including responses of 11,098 European workers from 16 countries in 2005 and 16,354 in 2010. This allows us to control for a very detailed set of workers, job, firms and country characteristics that permit to properly isolate the links between IT investments, NOP and employees' contextual performance. Thirdly, we provide new explanations on how firms have adjusted their organizational structure in order to gain the dividends from changes in IT uses. Behind IT there are several technologies with asymmetric impacts on performance. Our main findings show asymmetric links between IT uses and NOP on workers' contextual performance. While Internet use is, indeed, positively related to all aspects of contextual performance in 2010, computer use has been positively associated with contextual performance in 2005 but the link disappears in 2010.

[2] Barthélémy and Cette (2007) have considered the effects of IT and NOP on the rhythm and intensity of work in France. Their findings suggest a change in the individual worker agenda. Workers are more involved outside their legal working-hours but have more autonomy and flexibility to do their assigned tasks. This leads to reconsider the contractual bases of the working hours.

[3] Although contextual performance is central concern for organizational researchers (e.g. Diefendorff et al., 2002; Smith et al., 1983; Spence et al., 2011), they have mainly investigate individuals ignoring recent organizational changes associated with IT use and NOP.

The article is structured as follows. Section 2 reviews the literature and develops hypotheses related to IT use, NOP and employees' behaviours. Section 3 presents the rich database, the variables and the estimation strategy. Section 4 presents and discusses the results. Finally, Section 5 concludes.

2. Research background

This section discusses the analytical relationships between IT use, NOP and contextual performance. We start by defining the scope and the nature of contextual performance. We move then to an analytical discussion of the relationship between IT uses, NOP and contextual performance.

Contextual Performance

Since two decades, advances have been made in clarifying and extending the concept of employees' job performance.[4] One of the most accepted work is the Borman and Motowidlo (1997) one. According to these authors employee's performance is composed by two components: task performance and contextual performance. Task performance can be considered as an in-role behaviour and contextual performance as an extra-role behaviour (Cichy et al., 2009). Task performance is defined as "the effectiveness with which job incumbent perform activities that contribute to the organization's technical" (Borman and Motowidlo, 1997, p.99). Contextual performance, has behavioural patterns, affecting job performance, job satisfaction, and organizational effectiveness (Motowidlo and Borman, 2000). Contextual performance includes "volunteering to carry out tasks activities that are not formally part of the job and helping and cooperating with others in the organization to get tasks accomplished" (Borman and Motowidlo, 1997, p.99). This multidimensional concept shows the workers' behaviour role at work, which falls outside task performance (Borman and Motowidlo, 1993 and 1997; Organ and Paine, 1999).

Contextual performance measures are widely used nowadays in human resource management policies. They help firms to appreciate the effectiveness of their human resource policies and performances. The most used measure was proposed by Coleman and Borman (2000). It has three dimensions: Interpersonal Citizenship Performance (ICP), Organizational Citizenship Performance (OCP) and Job/Task Conscientiousness (JTC).

ICP consists of helping others by offering suggestions, teaching them useful knowledge or skills, directly performing some of their tasks, and providing emotional support for their personal problems. It also covers cooperation with others by accepting suggestions, informing them of events they should know about and putting team objectives ahead of personal interests. At the same time, it may also refer to showing consideration, courtesy, and tact in relations with others as well as motivating and showing confidence in them. OCP is related to organizational support, to represent the organization favourably by defending and

[4] Viswesvaran (1993) provides an excellent comprehensive review of previous developments in the conceptualization of job performance.

promoting it, as well as expressing satisfaction and showing loyalty by staying with the organization despite temporary hardships, supporting the organization's mission and objectives, complying with organizational rules and procedures, and suggesting improvements. JTC is related to conscientious initiative, consists of persisting with extra effort despite difficult conditions, taking the initiative to do all that is necessary to accomplish objectives even if not normally a part of one's own duties, finding additional productive work to perform when own duties are completed and developing own knowledge and skills by taking advantage of opportunities within the organization and outside the organization using own time and resources.

IT uses, NOP and contextual performance

Many firms have experienced recently a reorganization of their workplace. NOP have been adopted such as job rotation, delayering, self-directed work-team, just-in-time and total quality management (Osterman, 2000; Cappelli and Neumark, 2001; Askenazy et al., 2002 and Bloom and Van Reenen, 2007). These practices are based on workers' involvement. Van Reenen (2011) provides empirical evidence that changing management practices as NOP improve productivity. Moreover, other papers have shown that performance associated with IT use depends strongly on the adoption of new organizational practices (*e.g.* Greenan and Mairesse, 2000; Garicano, 2010).

An important literature has studied the consequences of these organizational changes on firms' performance and skill requirements. Ichniowski et al. (1997) on a small sample of steel finishing lines, Black and Lynch (2001) on a larger panel of US firms, Caroli and Van Reenen (2001) on French and British data, Bertschek and Kaiser (2004) on German business-related services firms, Greenan and Mairesse (2000) on French firms, Arvanitis and Loukis (2009) on Swiss and Greek firms, using either industry or firm-level data, display a positive impact of new work practices upon firms' productivity and performance especially when they are combined with information technologies. Most of this literature assumes productivity as the main measurement of workers' and firms' performance and assess the question at the industry or firm level. But, to our knowledge, no applied empirical research has tried to examine whether the complementarity is also valid with contextual performance at the individual level.

Employees' behaviours within the firm differ from an individual to another. These behaviours depend on the employee and his or her organization's needs and dynamics. Organization's needs are affected by the speed of technological change. So, similar to productivity growth, behavioural performance follows technological and organizational change. Management practices as complementary technologies have modified the organizational practices inside the firms (Van Reenen, 2011). IT and associated NOP are recognized as a major source of improvements inside firms about, among others, communication, collaboration, exchange of information and ideas (Crespin and Austin, 2002; Despres and Hiltrop, 1995; Rubery and Grimshaw, 2001).

More precisely, at least, Internet and Computer use can be related to three main behavioural changes. Firstly, IT use may induce more cooperative behaviour. Secondly, IT use may impact organizational citizenship behaviours within the firms. Thirdly, IT uses may induce self-improving behaviours. The innovative organizational practices of firms covered in our paper are characterized by new models of production such as Just-In-Time, Total Quality Management and Human Resources Management (HRM) practices. HRM practices are recognized to be positively linked with workers' organizational commitment (Bryson and White, 2013). HRM practices enhance worker involvement, make the work design less rigid and permit to decentralize managerial tasks.

3. Method

Data

We used data collected by Eurofound, an EU agency in 2005 and 2010. The aim of the European Working Condition Survey (EWCS) is to provide an overview of the state of quality of work and employment in Europe (Joling and Kraan, 2008). The survey includes a sample of the active population of 27 EU Member States and of some other European countries. The interviews were conducted face-to-face. People in the samples are aged 16 years and more. The basic sample design is a multi-stage, random sampling: in each country, a number of sampling points are drawn with a probability proportional to population size (for a total coverage of the country) and to population density. Weights (used in our analysis) are constructed in order to ensure that the distribution by region, locality size, gender, age, economic activity and occupation is identical to that of the Labour Force Survey (from Eurostat) distribution.

As we aim to analyse the contextual performance of employees within firms, we excluded self-employees, employees in one-person firms and those with less than one year of seniority in the firm. We also restricted the sample to 16 countries with comparable living and working conditions, that is to say, countries that belong to the euro zone in 2005, Nordic countries (Denmark, Sweden, Norway) and the United Kingdom. The numbers of employees in the 2005 sample is 11,098 and 16,354 in the 2010 sample.

Some questions are devoted to IT and in particular to Computer and Internet use for professional purposes. It also contains information about the management practices faced by the worker inside the firm. The EWCS is rich in questions concerning workers' behaviours, which are used to construct our contextual performance indicators.

Construction of the contextual performance indicators

We analyze the links between IT use, new organizational practices at work and workers' contextual performance. As we have several sets of information on workers' behaviours to characterize their contextual performance, a data mining technique (a cluster-analysis based

on a multiple correspondence analysis) is used in order to form groups of workers relative to their behavioural proximity.

Building on Coleman and Borman (2000), three dimensions of workers' contextual performance are distinguished: Interpersonal Citizenship Performance (ICP), Organizational Citizenship Performance (OCP) and Job/Task Conscientiousness (JTC). Eight binary or ordered qualitative variables are used to construct the ICP index, sixteen for the OCP index and three for the JTC index. All of the variables used are described in Appendix 1. To construct the three indexes, we perform a Multiple Correspondence Analysis (MCA) followed by a cluster-analysis. The cluster-analysis permits to regroup individuals in classes that are the most homogeneous according to their similarities with respect to all variables.[5] The hierarchical clustering method we perform uses the Ward index to measure the distance between two classes.[6]

The results of the hierarchical clustering method led to the creation of the three ordered indexes. The ICP index and the OCP index include five groups of workers, and the JTC one, four groups of workers from the lowest "performing" group of worker to the best one. Table 1 provides descriptive statistics of the three indexes.

Table 1. Descriptive statistics of the contextual performance indicators

	2005		**2010**	
	Mean	Std. Dev.	Mean	Std. Dev.
ICP (1-5)				
1	18.15%	0.3854	17.38%	0.3790
2	14.97%	0.3568	19.81%	0.3986
3	30.55%	0.4606	30.07%	0.4586
4	7.71%	0.2667	8.58%	0.2801
5	28.63%	0.4520	24.16%	0.4280
OCP (1-5)				
1	11.05%	0.3135	9.52%	0.2935
2	23.51%	0.4241	32.12%	0.4669
3	52.52%	0.4994	46.67%	0.4989
4	5.08%	0.2196	4.94%	0.2167
5	7.84%	0.2688	6.75%	0.2510
JTC (1-4)				
1	73.49%	0.4414	65.82%	0.4743
2	13.34%	0.3401	19.90%	0.3993
3	4.55%	0.2085	6.16%	0.2404
4	8.61%	0.2805	8.12%	0.2731
# obs.	11098		16354	

Weighted statistics.

[5] The classification is based on the coordinates of individuals on the axis we obtain with a MCA. We retain the maximum number of dimensions related to the included variables.

[6] The choice of the number of classes has been determined according to four rules: pseudo T-squared of Duda and Hart (1973), pseudo-F of Calinski and Harabasz (1974), Cubic Clustering Criterion of Sarle (1983) and the shape of the dendrogram. The number of classes retained gives the maximum number attained by each index.

Measures of IT use and of innovative workplace practices

One group of key variables in our analysis is IT use at work. We retain the frequency of computer and Internet use. We construct ordered variables that capture the individual intensity use of these IT tools at the workplace.[7] As shown in Table 2, the number of non-IT users has decreased between 2005 and 2010. In our sample 38% of workers never used a computer at work in 2005 compared to 32% in 2010, while 21% used a computer all the time in 2005 and 23% in 2010. Concerning Internet use, 47% never used Internet at work in 2005 compared to 40% in 2010, while 20% used Internet almost all the time in 2005 and 25% in 2010.

To characterize the new organizational practices of firms we introduce measures of workplace practices that characterize new models of production and Human Resources Management (HRM) practices.

First, to characterize new models of production organization such as Just-In-Time and Total Quality Management, the following variables are introduced: 'work schedule fixed by employer', 'meeting precise quality standards' and 'information about health and safety risks'. The new models of production can modify the behaviour of workers as they have an impact on the time available to produce and deliver products or services, on the quality of outputs and of worker environment and safety. Moreover, we control for the current quality of workers' environment in order to measure the degree of non-painful working conditions they faced ('Quality of the job environment').

Second, to characterize the HRM practices designed by firms in which the employee works, we introduce variables capturing HRM practices that enhance worker involvement, that make the work design less rigid, and that permit to decentralize managerial tasks. Thus, we introduce a variable that captures the resort to 'formal assessment' used by managers to give feedbacks and rewards. It generates a signal to convince workers of the existence of a team spirit that can improve employees' performance (Diaye et al., 2008). The variables 'job rotation' and 'telework' are introduced to capture a work design that is less rigid and that can strengthen employees' performance. Telework can be seen as a family-friendly workplace practice that can enhance workers' productivity and firms' performance (Bloom et al., 2011). Finally, the variable 'team work' is included to capture a well-developed workplace practice that permits joint decision making. As shown by Jones and Kato (2011), team work is also a way to increase the involvement of workers.

As shown in Table 2, firms implement more of all forms of NOP in 2010 compared to 2005. For example, team work has increased from 61% in 2005 to 65% in 2010.

[7] The use of Internet concerns the professional use of Internet and e-mails whatever the IT support.

Table 2. Descriptive statistics of IT use and of innovative workplace practices

	2005				2010			
	Mean	SD	Min	Max	Mean	SD	Min	Max
IT use								
Frequency of Internet use*	2.45	1.6076	1	5	2.70	1.6523	1	5
1	46.77%	0.4990			39.55%	0.4890		
2	11.33%	0.3170			11.82%	0.3228		
3	12.63%	0.3322			13.12%	0.3376		
4	8.86%	0.2842			10.04%	0.3006		
5	20.41%	0.4030			25.47%	0.4357		
Frequency of computer use**	2.55	1.5673	1	5	2.73	1.5669	1	5
1	38.14%	0.4857			32.01%	0.4665		
2	19.77%	0.3982			20.60%	0.4045		
3	12.05%	0.3255			13.31%	0.3397		
4	8.92%	0.2851			10.70%	0.3091		
5	21.12%	0.4082			23.38%	0.4233		
New organizational practices								
Work schedule fixed by employer	16.79%	0.3738	0	1	22.02%	0.4144	0	1
Meeting precise quality standards	76.01%	0.4270	0	1	76.67%	0.4230	0	1
Information about health and safety risks	2.24	0.6885	1	3	2.35	0.6571	1	3
Quality of the job environment	4.33	1.6127	1	6	4.40	1.5489	1	6
Formal assessment	40.20%	0.4903	0	1	43.42%	0.4957	0	1
Job rotation	48.82%	0.4999	0	1	50.36%	0.5000	0	1
Telework	7.57%	0.2645	0	1	11.02%	0.3131	0	1
Team work	61.24%	0.4872	0	1	64.51%	0.4785	0	1
# obs.		11098				16354		

Weighted statistics.
*: For the intensity of Internet use: 1. Never; 2. Almost never; 3. Around 1/4 of the time; 4. Around half of the time; 5. Almost all of the time or all of the time.
**: For the intensity of computer use: 1. Never; 2. Less than 1/4 of the time; 3. Less than 3/4 of the time; 4. Almost all of the time; 5. All of the time.

Control variables

Different control variables are introduced in our empirical analyses and are related to several characteristics of employees, their job, the firm and country's specificities. These controls allow us to properly isolate the links between IT investments, NOP and workers contextual performance. The table in Appendix 2 shows the characteristics of our sample.

Employee's characteristics

Regarding employee's characteristics, the EWCS survey provides information about gender, age, level of education and marital status. Males comprise 54-55% of our sample. The average age of our sample is 40-41 years. Less than 5% of the considered sample of workers has no or primary education and among them 28% has attained tertiary education in 2005 compared to 32% in 2010.

Job characteristics

The survey also provides information on the job characteristics. We have information on the income, and on the nature of the contract, i.e. whether it is permanent (around 80%) or not, full time (around 50%) or not, on the seniority in the firm (around 10 years), on the occupation (8 groups) and on commuting time between the house and the workplace. It is important to note that during their commuting time employees have, especially in 2010, the possibility to use their Smartphone or Tablets in order to do some tasks related to their work and to use Internet for professional purpose.

Firm's characteristics

As regard the firm's characteristics, we have considered the classification by economic sector (8 sectors) as well as firms' size (4 classes of size). The size of the firm and the economic sector have been largely considered as explanatory variables for Internet and computer diffusion in firms. For example, 15% of the firms are in the service sector in 2005 and 12% in 2010, 7% in transports and telecommunication in 2005 and 9% in 2010, and 20% in the manufacturing sector in 2005 compared to 16% in 2010. Most of the workers (57 % in 2005 and 61%) work in firms with less than 50 employees.

Country characteristics

With respect to the characteristics of the 16 countries, we have considered the country growth rate, the country unemployment rate and the percentage of post-secondary educated people. The average growth rate in the considered countries was 1.76% in 2005 and 2.02% in 2010 (distributed between -3.5% for Greece and 6.1% for Sweden). In 2010, the average of the country unemployment rate was 9.27% (distributed between 3.5% and 20.1%). We expect that the growth rate may have an impact on the intensity of usage of IT and then on the observed behaviours of employees. At the same time, the unemployment rate will have an impact on the behaviour of workers inside the firm, since it affects the outside option of workers. The percentage of post-secondary educated people is about 65% in 2005 and 68% in 2010 (distributed between 32.9% and 78.6%).

Estimation strategy

In order to test our hypotheses about the links between IT use, NOP and the three contextual performance indexes, we estimate ordered probit models characterized by:

$$y_i^* = \alpha + \beta' Z_{IT} + \gamma' W_{NOP} + \delta' X_i + \varepsilon_i \quad (1)$$

with y_i^* the latent utility of the employee *i* that depends on our variables of interest Z_{IT}, and $W_{NOP,}$ on several independent control variables X_i, ε_i being a random error distributed normally. Here y_i^* is an unobserved measure of each dimension of contextual performance, taking values from low y^* for which workers are not 'contextually performing'; to high y^* for which workers are very 'contextually performing'. Our variables of interest (Z_{IT} and W_{NOP})

are the measures of IT use and of new organizational practices. The X_i control variables characterize employees, their job, firms and countries.

4. Results and discussion

Table 3 gives the results of our estimations. We start by summarizing the main findings of the relationships between IT use and contextual performance, before examining the links between new organizational practices and contextual performance.

IT usage and contextual performance

Our results show that IT uses have significantly positive relationships with workers' contextual performance. Nevertheless, these links depend on the nature of the IT considered.

On the one hand, our results show strong evidence that Internet usage is positively associated with all the facets of the contextual performance (except for ICP in 2005). The more the workers use Internet the higher is their Organizational Citizenship Performance (OCP) and Job/Task Conscientiousness (JTC). The link is confirmed in 2005 and in 2010. While in 2005 Internet has no significant link with Interpersonal Citizenship Performance (ICP), the picture changed and we find a positive and significant relationship between Internet use and ICP in 2010. Internet is modifying the way people are working and interacting inside the firm. It is enhancing cooperative behaviours, citizenship behaviours and self-improvement behaviours. Internet is allowing more flexibility in the way the tasks are done by workers. On the other hand, our results show an interesting result for computer usage. In fact, computer usage has a positive link with interpersonal citizenship performance in 2005 but a negative one on job/task conscientiousness. However, these links disappear in 2010. This is the case for all the facets of contextual performance.

Table 3. Ordered probit models

	2005			2010		
	ICP	**OCP**	**JTC**	**ICP**	**OCP**	**JTC**
IT use						
Frequency of Internet use	-0.000456	0.0653***	0.144***	0.0235*	0.0461***	0.0797***
	(0.0237)	(0.00995)	(0.0300)	(0.0136)	(0.0163)	(0.0307)
Frequency of computer use	0.0617***	0.0236	-0.0681***	0.00469	0.0138	-0.000977
	(0.0170)	(0.0242)	(0.0203)	(0.0193)	(0.0162)	(0.0220)
New organizational practices						
Work schedule fixed by employer	-0.0485	-0.0956***	-0.352***	-0.102*	-0.112*	-0.0106
	(0.0572)	(0.0344)	(0.0671)	(0.0617)	(0.0636)	(0.0453)
Meeting precise quality standards	0.0836***	0.108**	0.0176	-0.0316	0.117***	0.0220
	(0.0267)	(0.0500)	(0.0507)	(0.0377)	(0.0269)	(0.0515)
Information about health and safety risks	0.191***	0.342***	-0.0546	0.240***	0.302***	-0.0515***
	(0.0124)	(0.0192)	(0.0369)	(0.0323)	(0.0316)	(0.0177)
Quality of the job	0.0538***	0.0557***	-0.0223	0.0321***	0.0497***	-0.0492***

environment	(0.0154)	(0.0112)	(0.0222)	(0.00680)	(0.00984)	(0.00589)
Formal assessment	0.190***	0.120**	0.0863**	0.0993**	0.0807*	0.105***
	(0.0414)	(0.0527)	(0.0408)	(0.0392)	(0.0414)	(0.0316)
Job rotation	0.246***	0.0581	0.0262	0.128***	0.0296	0.0445
	(0.0440)	(0.0424)	(0.0734)	(0.0126)	(0.0406)	(0.0325)
Telework	-0.0802*	-0.00651	0.677***	0.0850**	0.214***	0.664***
	(0.0482)	(0.0618)	(0.0879)	(0.0382)	(0.0645)	(0.0541)
Team work	0.222***	0.00451	-0.0390	0.189***	0.0749***	0.0828***
	(0.0279)	(0.0395)	(0.0644)	(0.0326)	(0.0184)	(0.0316)
Employee characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firms characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Country characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Cut 1	0.448	0.0155	0.981	0.0783	-0.149	1.045***
	(0.303)	(0.259)	(0.651)	(0.439)	(0.465)	(0.327)
Cut 2	0.967***	0.935***	1.611**	0.733	1.045**	1.847***
	(0.308)	(0.301)	(0.650)	(0.455)	(0.473)	(0.365)
Cut 3	1.829***	2.641***	1.922***	1.552***	2.577***	2.266***
	(0.340)	(0.280)	(0.647)	(0.461)	(0.477)	(0.336)
Cut 4	2.065***	2.958***		1.820***	2.905***	
	(0.350)	(0.284)		(0.452)	(0.476)	
Observations	11,098	11,098	11,098	16,354	16,354	16,354
Pseudo R-squared	0.0530	0.0721	0.164	0.0352	0.0581	0.127
Log Lik.	-20924	-17263	-10349	-32812	-26518	-18738

Robust standard errors adjusted for 16 clusters (countries) in parentheses. Weighted estimations. Coefficients * significant at 10%; ** significant at 5%; *** significant at 1%.

The fact that computer use has no links with "contextual performance" in 2010 is puzzling. One possible explanation is the fact that computer may be considered as a stabilized technology (old technology) and the effects of technology on contextual performance (behavioural performance) depend on the age of information technologies. These findings lead us to the hypothesis that the oldest is the technology the less it has an influence on contextual performance (behavioural changes). This conclusion relies on the non-equilibrium theory of intra-firm diffusion of innovation (Mansfield, 1961). An alternative explanation is that while computer use was very close to Internet use in the past, we observe nowadays several devices allowing access to Internet such as smartphones, Tablets, … In 2005 the computer use effect may be considered as complement to Internet use rather than as a distinct effect. This was not the case in 2010.

IT are evolving by several waves. Their relationships with job performance are asymmetric and depend on the wave of each technology. New technologies need time to provoke changes in the behaviour of the workers while old technologies do not impact them. Computers seem to be well stabilized technologies and may not influence contextual performance nowadays. However Internet links with contextual performance are strengthened over time.

New Organizational Practices (NOP) and contextual performance

Our results are in line with recent researches focusing on HRM and organizational commitment (Bryson and White, 2013). We find that NOP are positively related to workers' contextual performance. All the studied new organizational practices have at least one positive relation with contextual performance – except for the case of the work schedule determined by the employer that has a negative link with employees' contextual performance. At the same time, NOP have asymmetric links with the different facets of contextual performance. Each NOP seems to have differentiated associations with some facets of contextual performance.

Our results show that for some NOP the link with some facets of contextual performance is stable, while for other NOP the link is strengthened from 2005 to 2010. Formal assessment has a significant link with all the facets of contextual performance in 2005 and we find the same conclusion with the data of 2010. Job rotation has only a significant and positive link with ICP (and no relations with OCP and JTC). This is the case in 2005 and 2010. For these two studied practices the links with contextual performance are stable over the years.

Our results also reveal that telework has a significant positive relationship with all the dimensions of contextual performance in 2010. The more the worker is involved in telework the greater is his or her contextual performance. While in 2005 telework had a positive association only with JTC, and a negative one with ICP, in 2010 telework has a positive link with the three dimensions of contextual performance. Team work has a positive link with the three dimensions of contextual performance in 2010. This was not the case in 2005. Team work had a significant positive association with ICP only in 2005. The more the firms use this practice the more they benefit from it in terms of contextual performance. A firm that provides "information about health and safety risks" and non-painful working conditions seem to obtain more performing workers in terms of only ICP and OCP in 2005. In 2010, these NOP are positively related to ICP and OCP but negatively with JTC. The only exception of this trend is 'Meeting precise quality standard'. While this NOP was initially positively associated with two contextual performances (ICP and OCP) in 2005 we find only one positive association with OCP in 2010.

Moreover, our results show that organizational practices which are based on certain rigidity, like a work schedule fixed by the employer, have a negative link with contextual performance. This negative association changes over the years. While, this practice is negatively related to OCP and JTC in 2005, we find that the negative links appear with ICP and OCP in 2010.

Our results have at least three managerial implications. First, by comparing the situation between 2005 and 2010 we show that the considered NOP are provoking different effects on the behaviours of workers and on their contextual performance. Following Milgrom and Roberts (1990), the adoption of a pack of NOP induces that all the facets of contextual

performance will be improved. Firms are encouraged to adopt a set of complementary organizational practices in order to improve the contextual performance of their workers. Second, we show that for most of the NOP considered, their relationships with employees' contextual performance are stable and positive over time or are strengthened. From these findings one can conclude that European firms are benefiting more from NOP nowadays than in the past. From this conclusion one can recommend the necessary implementation of these NOP in order to improve the contextual performance of workers. Third, all the NOP studied have at least one positive link with at least one dimension of workers' contextual performance – except for work schedule fixed by employer that has a negative link with workers' contextual performance.

Our study confirms that information technologies are contributing to the setting of a new productive model associated with higher results in matter of contextual performance. The new organizational model using team work, telework, job rotation and intensive use of Internet induce higher contextual performance of workers. Management of European firms is changing in order to adjust to technology and to improve workers' contextual performance (Van Reenen, 2011).

Sensitivity analysis

We conduct additional sensitivity analyses in order to gauge the robustness of the conclusions concerning IT use.[8] We estimate a trivariate ordered probit model with a maximum simulated likelihood estimation technique developed by Roodman (2011) to take into account the potential correlations between employees' contextual performance. The correlation coefficients between employees' contextual performances show that they are independent except a positive correlation between ICP and OCP in 2005 and in 2010. Despite this correlation, the results are very similar with the ones obtained with our three independent ordered probit models available in Table 3.

Furthermore, in order to take into account as much as possible the potential endogeneity or reverse causality of the frequency of IT use, we choose to regress a system of equations in which we estimate simultaneously the frequency of Internet use (or the frequency of computer use) and one of the indexes of contextual performance. In each case, we estimate a bivariate ordered probit model using the method developed by Roodman (2011). In the estimates of the frequency of IT use, we introduce the new organizational practices and the characteristics of the employee, the firm and the country. Moreover, we introduce two variables that can explain the frequency of IT use (Internet or computer) but not the indexes of employees' contextual performance. These variables are: the average rate of high band Internet connection in firms in the country and the average percent of people in the country able to perform five of six IT activities retained by Eurostat. These statistics are obtained from the statistics of the survey on IT usage and e-commerce in enterprises collected annually by Eurostat for the first variable and from the survey on IT usage by household collected

[8] The results are not reported here but are available upon request from the corresponding author.

annually by Eurostat for the second variable. If we only discuss the cases of significant IT coefficients in our results, it appears, in 2005, that the frequency of computer use is not correlated with ICP but there is a positive correlation with JTC. For the frequency of Internet use, in 2005, there is no correlation with OCP but there is a positive correlation with JTC. In 2010, the frequency of Internet use appears to be correlated with ICP and JTC but not with OCP and it appears that the coefficients concerning Internet use are significant with the same signs as in our regressions of ordered probit models presented in Table 3.

5. Conclusion

Although the literature has analyzed the impact of IT use, NOP on firms' performance (e.g. Ichniowski et al., 1997; Bresnahan et al., 2002; Brynjolfsson and Hitt, 2003), research on employees' performance in this context is scarce. Studying the relationships between IT use, NOP and employees' behaviours inside the firm is important as employees are at the heart of the success of an organization (Grant, 1996; Pfeffer, 1994).

The aim of this article was to analyze the relationships between IT use, NOP and worker's performance. While most of the related literature focuses on productivity as the main indicator of workers' performance, we propose an alternative research strategy by focusing on workers' contextual performance as a performance indicator based on Coleman and Borman (2000). Although contextual performance is central concern for organizational researchers (e.g. Diefendorff et al., 2002; Smith et al., 1983; Spence et al., 2011), research effort were concentrated on individuals characteristics ignoring recent organizational changes associated with IT use and NOP. We argue that employees using IT and working in firms providing NOP may develop behaviours that benefit the organization.
First, the hypothesis of the paper related to IT, namely, that IT are positively associated with contextual performance, is confirmed by our analyses. Our results are in line with previous researches that have shown that IT are positively related with workers' motivation and involvement (e.g. Martin, 2011). Furthermore, our findings contribute to the literature about IT impact by proposing an alternative measurement of performance and rely on the asymmetric effects of IT. The links between IT use and workers' contextual performance underlined in our study depend strongly on the considered technology. In 2010, while Internet use is positively related to all the facets of contextual performance, we find that computer use has no significant link with contextual performance dimensions.

Second, the hypothesis about NPO, for which we argue that they are positively associated with workers' contextual performance, is also confirmed. Our results are consistent with the literature on high-involvement work practices which have been shown to increase labour productivity and worker's organizational commitment (e.g. Bryson and White, 2013; Godard, 2001; Guthrie, 2001, Osterman, 2000). The relationships with workers' contextual performance depend on the considered NOP. Most of the considered NOP have at least one positive link with at least one aspect of contextual performance. Most of them are showing

stable or strengthened links with the different facets of contextual performance between 2005 and 2010.

Our article provides several contributions. First, our article contributes to the debate about the complementarities between IT and NOP and provides an analysis at the employee level that is needed in a literature that is almost limited to the firm level. We show how IT uses are modifying the behaviour of workers, and how managers use NOP as "complementary technologies". A new industrial and organizational model seems present in Europe resulting in higher workers performance. Second, we resort to a rich, recent and large database that permits to control for employees, their job, their firm and countries characteristics to provide a robust test of our two hypotheses. Third, our analysis is based on organizational research, HRM research and industrial organization literature in order to enrich these research areas.

Our paper is, of course, not without limitations. First, the European data were collected at two points in time on two samples of employees. It allows us to find significant associations between variables, but no final conclusions about causality can be drawn. Second, because the survey was not defined specifically for our analysis, deepened richer picture may be obtained by examining other types of IT uses or by decomposing the Internet and computer uses in order to have better understanding of the impact of specifics use on workers' contextual performance. For example, further research could analyze other data that contain information on other well diffused technologies within firms such as Enterprise Resource Planning or social networks.

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Appendices

Annex 1. Dependent variables

ICP (1-5): Interpersonal Citizenship Performance: Behaviours that assist, support, and develop organization members through cooperative and facilitative efforts that go beyond expectations. The clustering methodology is based on eight items: colleagues' assistance[9] (rare, most of the time, always), superior's assistance (never or rare, sometimes, most of the time, always), good friends at work (not really, agree, strongly agree), and binary variables: pace of work dependent on the work done by colleagues, involvement in political or trade union activity, autonomy to choose order, method, speed of work.

OCP (1-5): Organizational Citizenship Performance: citizenship behaviours that demonstrate commitment to the organization through allegiance and loyalty to the organization and organization objectives, and compliance with organizational rules, policies, and procedures. The clustering methodology is based on sixteen items: security to keep the job in the next 6 months (disagree, neither agree nor disagree, agree, strongly agree), job that is well paid for the work done (disagree, neither agree nor disagree, agree, strongly agree), job offering good prospects for career advancement (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree), job satisfaction (not satisfied, satisfied, very satisfied), Work/life balance (not at all well or not very well, well, very well), Being 'at home' in the organisation (disagree, neither agree nor disagree, agree, strongly agree), the job involves learning new things or not, Taking breaks when the worker wish (never, rare, sometimes, often, always), Doing useful work (rare, most of the time, always), having to interrupt a task he is doing in order to take on a non-disruptive task (never, interruption but disruptive, occasionally, often), the worker is able to apply his or her own ideas at work (never or rare, sometimes, most of the time, always), alone assessment of own work quality or not, solving unforeseen problems alone or not, discussion about work-related problems with an employee representative or not, management holds meetings in which the employee can express his or her views about what is happening in the organisation or not[8], training paid for or provided by the employer or on-the-job training to improve his or her skills.

JTC (1-4): Job/Task Conscientiousness: Extra efforts that go beyond role requirements; demonstrating dedication to the job, persistence, and the desire to maximize one's own job performance. The clustering methodology is based on three binary items: working during free time[8], doing extra hours volunteering, paying alone training to improve skills.

[9] question slightly modified in 2010 compared to 2005.

Annex 2. Descriptive statistics of the control variables

	2005				2010			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Employee characteristics								
Male	54.63%	0.4979	0	1	54.29%	0.4982	0	1
Age	40.45	11.1772	15	76	41.40	11.1021	16	77
No or primary education (Ref.)	5.49%	0.2278	0	1	3.84%	0.1922	0	1
Lower secondary or second stage of basic education	16.56%	0.3717	0	1	32.21%	0.4673	0	1
Upper secondary education	42.48%	0.4943	0	1	27.76%	0.4478	0	1
Post-secondary non-tertiary education	7.59%	0.2648	0	1	4.67%	0.2111	0	1
Tertiary education	27.88%	0.4484	0	1	31.52%	0.4646	0	1
In couple	69.48%	0.4605	0	1	74.31%	0.4369	0	1
Job characteristics								
Income band	6.29	2.8159	1	10	5.4140	2.8931	1	10
Permanent contract	82.84%	0.3771	0	1	86.54%	0.3413	0	1
Full time job	51.45%	0.4998	0	1	49.43%	0.5000	0	1
Seniority	10.39	9.2442	1	50	10.67	9.2137	1	52
Commuting time	21.29	16.3393	0	150	21.25	17.1100	0	180
Legislators, senior officials and managers	6.50%	0.2465	0	1	6.72%	0.2504	0	1
Professionals	16.28%	0.3692	0	1	15.12%	0.3583	0	1
Technicians and associate professionals	16.31%	0.3695	0	1	19.37%	0.3952	0	1
Clerks	14.43%	0.3514	0	1	13.92%	0.3462	0	1
Services workers and sales workers (Ref.)	13.27%	0.3393	0	1	13.77%	0.3446	0	1
Skilled agricultural and fishery workers or Craft and related trades	13.94%	0.3464	0	1	13.69%	0.3438	0	1
Plant and machine operators and assemblers	8.71%	0.2821	0	1	8.62%	0.2807	0	1
Elementary occupations	10.55%	0.3072	0	1	8.78%	0.2830	0	1
Firms characteristics								
2-9 employees (Ref.)	24.14%	0.4280	0	1	28.56%	0.4517	0	1
10-49 employees	32.84%	0.4697	0	1	31.80%	0.4657	0	1
50-249	24.48%	0.4300	0	1	23.74%	0.4255	0	1
250+	18.53%	0.3886	0	1	15.90%	0.3657	0	1
Agriculture, mining, energy (Ref.)	4.76%	0.2130	0	1	4.40%	0.2050	0	1
Manufacturing	20.37%	0.4028	0	1	15.97%	0.3663	0	1
Construction	7.09%	0.2567	0	1	7.37%	0.2613	0	1
Trade	17.17%	0.3771	0	1	17.00%	0.3756	0	1
Transports and telecom.	6.56%	0.2476	0	1	8.88%	0.2844	0	1
Finance and insurance	4.13%	0.1989	0	1	4.00%	0.1959	0	1
Services	14.72%	0.3543	0	1	12.27%	0.3281	0	1
Public services	25.20%	0.4342	0	1	29.20%	0.4547	0	1
Country characteristics								
Country growth rate	1.76	0.9928	0.7	5.4	2.02	1.5743	-3.5	6.1
Country unemployment rate	8.27	2.4306	4.4	11.3	9.27	4.0857	3.5	20.1
% of post-secondary educated people	65.35%	11.9474	27.5	83.3	67.96%	11.3208	32.9	78.6
# obs.	11098				16354			

Weighted statistics.

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