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Telework Configurations and Labour Productivity: Some Stylized Facts

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Abstract The development of information and communication technologies has led to the rise of new working forms in firms, some of which are temporally and spatially dispersed, such as telework practices. However, 'telework' is a broad concept, including different forms of remote work as well as diverse reasons and performance implications for the separation of work from the firm's premises. Following this consideration, this paper has explored two sides of telework: 1) the main types of telework practises adopted by firms in relation to their technological, organizational and environmental context; 2) the association between the adoption of telework practices and labour productivity. Specifically, analysing data gathered through a survey analysis conducted from 2005 and 2009 on Italian enterprises, we identified two main typologies of telework: 1) firms using forms of home-based telework; 2) firms using mobile forms of telework. Whereas firms prevalently using the first type of telework modality do not exhibit a superior endowment of information systems and do not exhibit higher labour productivity, firms deploying "mobile work" practices are characterized by a higher adoption of information systems, deal with more dynamic business environments and exhibit higher labour productivity with respect to firms that do not use telework practices.

Keywords Telework practices; Home-telework; Mobile telework; TOE framework; Labour productivity.

1. Introduction

The development of information and communication technologies (lCTs) and their tendency to gradually penetrate every sphere of life [1,2] has led to new organizational patterns [3] and working forms in firms, some of which are temporally and spatially dispersed, such as telework.

The literature provides different definitions of telework. They can range from home-based telework to mobile telework. Specifically, home-based telework practices are used in companies where part of employees are allowed to work from home (instead of commuting to a central workplace) at least once a week [4], use a personal computer in the course of their work, use telecommunications links (phone/fax/e-mail) to communicate with their colleagues/supervisor during work at home, and are either in salaried employment or are self-employed [5]. Meanwhile, mobile telework practices are followed by firms with employees who work away from home and from the main place of work,

e.g., on business trips, in the field, travelling or on customers' premises, and using online connections when doing so [5].

Even though ICTs are subject to an increasing commoditization [6], firms' ability to adopt telework practices and achieve the expected benefits may vary, depending on three aspects: their ICT infrastructure, their organizational features and the business environment in which they act. Indeed, these factors may affect the costs and benefits of telework. For example, firms that have underinvested in enterprise information systems and ICT infrastructure resources may face higher costs when adopting telework practices and may need more time to implement them. Likewise, environmental conditions related to the operational complexity of business processes, the dynamism of the market and technological conditions, and the opportunity for business growth, may all affect the requirements of operational flexibility that can explain a firm's decision to adopt telework practices [7].

Therefore, we believe that it is important to understand: 1) whether different telework types are emerging among firms; 2) whether the technological, organizational and environmental conditions are different according to the telework types followed; 3) whether those companies that adopt different types of telework are characterized by significant differences in labour performance, such as productivity. Based on these arguments, this paper examines two research questions: 1) *What types of telework practices are emerging among firms? 2) How are these types associated with labour productivity*? To deal with these questions, we conducted a survey on a sample of 1,134 Italian companies located in the Piedmont region of Italy, gathering data between 2005 and 2009. We chose this region as it is one of the most developed areas in Europe and has an adequate ICT infrastructure for the adoption of telework practices. Indeed, Internet broadband connectivity is well distributed throughout the region and the population's ICT literacy is strong [8].

2. Theoretical background and research framework

The past literature on telework mainly shows two gaps regarding the diffusion patterns of telework. First, there has been a prevalent focus on studying the diffusion of home-based telework, assuming that this work modality could have a greater diffusion than mobile telework [9]. However, nowadays, the number of employees that transfer their work "on the move" is expected to increase as a consequence of two phenomena: first, the redesign of value chains [10,11], whereby firms try to be "closer" to the customer as a response to the need to improve service levels, time-to-market and flexibility. Second, the quest for more flexible organizational forms and labour schema.

The second gap regards the way past studies have looked inside the "black-box" of telework, only taking into consideration the place from which teleworkers work. Given such limitations, we have analysed the types of telework practices that are emerging among firms, not only by looking at the place from which employees conduct their work but also by analysing the penetration level of telework among the workforce (i.e., the percentage of employees that telework).

Specifically, drawing on the Technological-Organizational-Environmental (TOE) framework [12], we identified the main antecedents and consequences (on the performance) of mobile and home-based telework. Figure 1 illustrates the conceptual model that we applied in this research study.

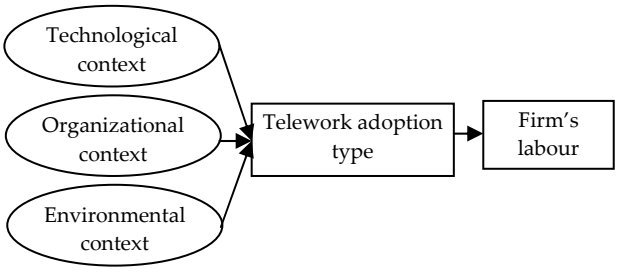

Figure 1. Conceptual framework

2.1 Technological context

To implement teleworking modalities, firms must provide remote workers with access to operative information, applications and knowledge of the various types required to perform their jobs correctly. Firms tend to accumulate these resources gradually, in tandem with the acquisition of new organizational capabilities that will adequately support telework [13].

The adoption of enterprise information systems supports telework and makes many occupations amenable to disaggregation from the firm's premises [14]. Specifically, these technological resources enhance three key attributes of occupations characterized by information or knowledge intensity: codifiability (the extent to which knowledge can be converted into a form suitable for transfer across economic agents); standardizability (the possibility of translating a series of tasks into a common framework and vocabulary so as to define business processes); modularizability (the extent to which the activities in a job can be separated into components, performed independently by separate people and then become integrated).

Given these considerations, we might expect that the implementation of enterprise information systems may favour the adoption of telework practices.

2.2 Organizational context

The notion of an 'organizational context' refers to a firm's resource base and organizational characteristics. Essentially, three factors may influence a firm's need and ability to adopt some forms of telework: 1) the geographical scope of their operations and sales activities; 2) the characteristics of their human capital; 3) the importance of their technical capital (plants and machinery) in their production processes.

Specifically, companies with a local geographical scope are less likely to take advantage of telework practices, as their business is concentrated in a specific area.

With regard to the second factor, knowledge workers have a higher level of human capital and are more likely to be involved in telework practices compared with those employees who are in charge of performing routine administrative tasks [15], as they are characterized by higher skill prerequisites and some of their jobs do not necessarily require their physical presence in the firm's conventional workplace [16,17]. The expected influence of human capital on the use of telework practices is also related to the cognitive prerequisites of telework. In this regard, jobs more amenable to being performed remotely require higher employee autonomy and soft skills related to time management and problem solving [18], as communication with colleagues can be more complicated [19].

Considering the third condition, firms that are more capital intensive are expected to have less interest in telework, as their jobs are more likely to require a physical presence in the place where production or service delivery occurs [20].

2.3 Environmental context

When considering the environmental influence, studies on IT diffusion have emphasized the role of munificence (i.e., the extent to which the environment can support sustained growth, as opposed to mature markets with stagnating demand), dynamism (i.e., the rate of instability in an industry with regard to customer preferences and needs as well as technological conditions) and complexity (i.e., the heterogeneity of the technology incorporated into the product/service) as the main environmental characteristics [21,22] that influence firms' technology management strategies and organizational innovation propensity, such as the adoption of telework practices.

With regard to munificence, this condition may have both a direct and an indirect effect on the adoption of telework. The indirect effect may be related to the influence that munificence has on the availability of the financial resources that firms can use to invest in the adoption of ICT resources that support the use of telework. Indeed, under greater munificence, firms are less likely to experience financial constraints and are more likely to have adopted technologies supporting telework in the earlier stages of their diffusion curve. Meanwhile, its direct effects could refer to the use of forms of telework to increase flexibility in sales, after-sales services and product development processes to achieve business growth.

In considering the expected influence exerted by dynamism on telework adoption, this condition has usually been associated with higher investment in ICT, a higher propensity for innovation and greater levels of competition [23]. Moreover, and similar to the case of high munificence, companies that operate in turbulent environments are more likely to value flexibility and, thus, they may need to decentralize their work to a greater extent. Accordingly, telework can be an instrument to achieve decentralization.

With regard to complexity, two contrasting effects can occur. On the one hand, since the standardizability and codifiability of activities is more difficult in such environments [24], we may expect that firms may be less likely to use telework where there is higher environmental complexity. On the other hand, managing complexity may require a firm to organize itself around differentiated units. As such, the need to disaggregate work activities and use of telework may be greater [25].

2.3 Labour productivity

The relationship between telework and performance is not well established at the theoretical and empirical level. From a theoretical standpoint, there is a general agreement that telework can lead to a series of benefits at the individual level, ranging from increased employee motivation and job satisfaction, and more time left over for individual work. These benefits may be reflected in benefits at the firm level, in terms of a reduction of real estate investments, an increased retention of human resources, a better organizational climate and stronger employee commitment, all of which increase operational flexibility due to having "the right person at the right place and at the right time." These benefits may ultimately result in superior labour productivity with respect to firms that do not adopt telework.

Although the relationship between telework and labour productivity might be evident, telework itself may not have a direct effect on labour productivity. This may happen for two main reasons. First, superior productivity may be the consequence of more qualified human capital and not of telework itself. Second, and in a similar manner, the benefits on productivity may arise from the complementarities between the adoption of new work

practices such as telework, and investments in information systems and ICT infrastructures, thereby enabling organizational and process innovation [26,27]. In other words, when looking to the empirical world, disentangling the effect of telework from other variables related to human capital and innovation can be complicated.

3. Research methodology

3.1 Sample and data collection

The data used for this study is the output of a survey which was carried out every year, from the 2005 to the 2009, on a population of around 6,000 companies located in Piedmont.

We focused the survey on four industry groups: 1) low-tech manufacturing industries; 2) hi- and medium-tech manufacturing industries; 3) material service industries (e.g., retail and wholesale trade, transportation and logistics, production and the distribution of energy and water); 4) information service industries (e.g., software development, consulting services and other business services, telecommunications services).

The population of the firms in the industries surveyed was defined using the Bureau Van Dijk's AIDA database, which includes financial statements for all the firms,, including only those companies with more than 10 employees.

The data collection was organized into three distinct moments in 2006. Every year, around 2,000 companies in the population were randomly selected and contacted by phone to be informed about the research and to identify the appropriate key respondents. We asked as to the existence of a role appointed for the management of information systems (a Chief Information Officer - a CIO - or equivalent). A questionnaire was then delivered to the companies in the sample. An overall sample of 1,134 firms was collected (Table 1).

Size	Large (>250 employees)	Medium (50-249 employees)	Small (10-49 employees)	Total
Number of companies	77 6.79%	320 28.22%	737 64.99%	1,134 100.00%

Table 1. Sample composition

3.1 Measures

3.1.1 Telework adoption

Following the definition of telework used in this study, we determined that an organization was adopting telework practices if it satisfied at least one of the following conditions:

- Having at least one employee who works outside the firm's premises with a certain regularity (at least one day per week). In so doing, this definition of telework resemble those used in previous studies on telework [4] or on dispersed forms of work [28]. Accordingly, our definition of telework include employees who permanently work outside the firm (e.g., sales agents), as well as employees who primarily work outside the firm's premises but who also have their own desk at the firm. This is the case for consultants and technicians who are appointed for the maintenance of the firm infrastructure when it is distributed across the field, like in the case of transportation companies, energy companies and other public utilities firms;
- Having telecommuters who work from their home regularly (e.g., each day) or with a certain periodicity (e.g., one day per week).

These determinations allowed us to discern between "home-based" forms of telework and mobile forms of remote work.

To investigate the different patterns of telework use, we also controlled for the percentage of employees who are regularly involved in telework practices. By using the percentile method on the percentage of teleworkers in the workforce, we identified a cut-off point corresponding to the 10% value. Consequently, we could distinguish among four types of telework:

- a "mobile for many employees" typology, which includes firms that habitually use telework practices for at least 10% of their employees and where the physical setting of telework is anywhere outside of the firm's units;
- a "mobile for few employees" cluster, which includes firms that usually use telework for less than 10% of their workforce and where telework occurs anywhere outside of the firm's units;
- a "home-based telework" group, which includes firms that telework from home;
- a "non-adopters" cluster, which includes companies that do not adopt any telework type.

3.1.2 TOE contexts

Concerning the technological context, we have measured the adoption of enterprise information systems (ERP and CRM) and e-learning platforms using dummy variables (in all cases '1' means that the company adopts the technology and '0' otherwise). The choice of ERP and CRM systems as technological antecedents was motivated by their key role in supporting core and secondary activities in value chains and by their greater diffusion with respect to other suites giving specific support to other departments, such as MRP (for production and inventory management) or PDM (for product design and engineering). In much a similar way, we took e-learning systems into account, as firms using remote work are expected to use online repositories and other systems to share and distribute knowledge within their "dispersed" workforce.

Concerning the organizational context, firm size has been operationalized through the number of employees in logarithmic form. Capital intensity has been considered through the logarithmic form of the book value of property in terms of plants and equipment divided by the number of employees. Finally, the geographical scope has been measured as the percentage of sales made by firms outside the Piedmont region. In this way, sales at the national and international level were considered. Human capital has been considered by taking into account the labour cost per employee ratio. This ratio reflects a proxy of human capital which is often used in economic and strategic management studies to consider human capital. Firms that place higher importance on human capital invest more on this fact and pay higher wages in order to access human resources with more qualified skills and knowledge.

Concerning the environmental context, we followed the approach used by Dale Stoel and Muhanna (2009) [29], which was inspired by Dess and Beard's (1984) [22] work on the influence of environment factors on technology strategies and organization configurations. The dynamism and munificence of each industry were thus assessed using national accounting data from Istat, the Italian Bureau of Statistics. For each industry segment (defined as a 2-digit level of NACE codes), the industry-level total sales for 5 years were regressed on the year variable. The dynamism was operationalized as the variability of annual industry sales and was measured as the standard error of the regression slope coefficient of annual industry sales divided by the industry mean for the 5 year period. The munificence was measured as the growth rate in annual industry sales for 5 years, measured as the regression slope coefficient divided by the average industry sales. We framed industry complexity as the homogeneity-heterogeneity of inputs and outputs and we used input/output concentration as a measure of industry complexity. We used the Istat input/output tables to calculate the complement to 1 of the concentration of each industry's input, measured as $Ci= \sum Ik^2/(\sum Ik)^2$, where Ik is the euro volume of inputs from industry k. For each of the three industry characteristics, we ranked the values by year and split the industries into two sets (high and low), based on the median value for that characteristic.

3.1.3 Labour productivity

Consistent with economic theory, labour productivity was operationalized by referring to the ratio among value added (i.e., sales revenues minus external costs) and the number of employees. This data was taken from the firms' annual reports for the years 2008 and 2009, which were available through the AIDA data set.

3.1.4 Control variables

Three industry dummies were used for discriminating manufacturing companies and the material and information services sectors. The information and material services industries refer to Porat and Rubin's (1978) [30] dichotomy of services according to the physical versus information-based nature of services. These dummies aimed to capture industry's technological characteristics (such as the degree of information intensity in business processes) that the environmental variables could only capture in part.

4. Findings

The empirical analysis occurred at three stages. First, the descriptive statistics were computed. In the second step, differences in the antecedents of telework types were delineated through ANOVA analyses and non-parametric tests. Finally, regression analysis was computed to identify the antecedents of the telework adoption and their effect on labour productivity.

4.1 Descriptive statistics

Table 2 shows the descriptive statistics and highlights two key facts about diffusion levels of telework practices. First, telework adoption increased during the years covered by the survey. Second, the use of technologies enabling telework (i.e., CRM, ERP and e-learning systems) has not increased over time. The diverse trends for the diffusion of telework and the technologies supporting its use suggest that telework adoption is a decision that may come after information systems are adopted and fully assimilated into firms' business processes. Indeed, all of the technologies that support firms' processes (ERP and CRM) and all of the technologies that facilitate employees' access to knowledge (e-learning) can gradually be accumulated by firms over time [13], and once they have been assimilated and routinized in firm's business processes, they may facilitate the use of telework practices.

Variable	Mean		
	2005-2006	2007-2008	2009
Telework adoption	0.19	0.35	0.33
ERP	0.30	0.34	0.33
CRM	0.16	0.15	0.10
E-learning provision	0.18	0.31	0.27
Firm size	3.65	3.70	3.69
Geographical scope	63%	46%	50%
Human capital	33.73	34.67	39.22
Capital intensity	9.84	9.79	10.14
Munificence	0.69	0.67	0.62
Dynamism	0.60	0.50	0.50
Complexity	0.48	0.46	0.44
VA per employee	n.a.	53.76	44.87

Table 2. Descriptive statistics

We also obtained as result that a high percentage of companies provide teleworkers with the possibility of connecting and working from any site or from dedicated work centres. Specifically, approximately 57% of the firms using telework regularly belong to the "mobile for a few" cluster (MF), thus providing mobile telework modalities to less than 10% of their workforce. Furthermore, home-based (HB) forms of telework and mobile-based forms for "many employees" (MM) exhibit comparable rates of diffusion (approximately 19% and 24%, respectively).

4.2 Differences in the diffusion patterns of home and mobile telework

To detect differences in the patterns of diffusion for the four types of telework, we performed Anova analysis, Chi-square test and Scheffe tests (Table 3). Specifically, these tests served to identify significant differences in the contextual variables for the four types of behaviour under analysis (i.e., not adopting any form of telework or adopting one of the three above-mentioned forms).

Considering the technological context, we found that firms using telework practices report, in general, higher adoption rates of the three technologies under analysis (ERP, CRM and e-learning systems). Indeed, all differences between "non-adopters" and the three other clusters are statistically significant (p-value less than 1%). Moreover, with regard to the adoption of CRM systems, firms deploying "mobile for many" types of telework practices tend to report higher adoption rates for these systems with respect to firms where mobile forms of telework are applied to a few employees (i.e., "mobile for few"). This evidence may suggest that when firms involve a larger portion of their workforce in telework practices, telework may greatly involve sales employees and may thus require the use of information systems in standardizing sales activities.

Considering the organizational context, three findings aroused particular interest. First, firms adopting a "mobile for few" model of telework exhibit a higher level of human capital with respect to firms following a "mobile for many" model or with respect to firms that do not use telework at all. Second, high capital-intensive companies are less likely to use telework practices and tend to involve fewer employees in telework, when they adopt this practice. Indeed, firms following a "home-based" approach are more capital intensive than firms using a "mobile for many" approach to telework. The same dynamic occurs when firms in the "mobile for many" group are compared with their counterparts in the "mobile for few" cluster. This evidence is consistent with the notion that more capital-intensive industries tend to be constrained by the physical proximity of their labour force to technical capital. In these settings, only back-office administrative jobs are thus amenable to remote work (from home). Third, the four above-mentioned clusters do not exhibit significant differences in terms of size and geographical scope.

Variable	Non Adopters (NA)	HB	MF	MM	Significant differences
ERP(2)***	26%	56%	60%	44%	NA<HB[1]; NA<MF; NA<MM
CRM(2)***	11%	17%	24%	42%	NA<MF; NA<MM; HF<MM; MF<MM
eLearning(2)***	25%	46%	45%	59%	NA<HF; NA<MF; NA<MM
Human capital(1)***	34	35	36	33	NA<MF; MM<MF
Capital intensity(1)***	100	97	99	85	NA>MM; HF>MM; MF>MM
Geographical scope(1)	52	56	61	46	Not significant differences
Size(1)	3.6	3.8	3.7	3.7	Not significant differences
Munificence(2)	66%	67%	67%	70%	Not significant differences
Dynamism (2)***	51%	56%	58%	73%	NA<MM
Complexity (2)***	49%	42%	41%	24%	NA>MM
Traditional manufacturing (2)***	44%	38%	37%	15%	NA>MM; MF>MM
Hi-tech manufacturing (2)	12%	14%	13%	12%	Not significant differences
Material service(2)***	32%	21%	27%	13%	NA>MM
Information service(2)***	13%	27%	23%	60%	NA<HF; NA<MF; NA<MM; HF<MM; MF<MM
VA per employee(1)***	44	53	57	53	MF>NA

(1) ANOVA, (2) Chi-square test
***p-value < 1%; **p-value < 5%, *p-value < 10%

Table 3. Adopters' features

Finally, considering the environmental context, firms in the three types of telework under analysis generally face the same degree of environmental munificence. With regard to environmental turbulence (dynamism), companies adopting "mobile for many" forms of telework deal with greater turbulence. This relationship may be plausible, as firms operating in turbulent environments may have a greater need for flexibility, and this would explain their need to decentralize work to a greater extent by using a greater percentage of employees

[1] This means that companies that do not adopt telework have a statistically significant lower adoption rate of ERP technology with regard companies that adopt a home-based telework type.

in teleworking roles. Finally, firms using telework report lower level of environmental complexity with respect to firms not adopting these practices. This result may be in line with the fact that, with higher complexity, two prerequisites of telework use are less applicable. Indeed, in complex environments, the standardization of business processes is more problematic, given the higher number of causal relationships among inputs and outputs and the lower predictability of tasks. In much the same way, complexity reduces the codifiability of knowledge [24].
It is also worth noting that firms in information services industries are more likely to adopt "mobile for many" forms of telework than "mobile for few" and home-based teleworking practices, involving a greater share of the workforce in this practice.

4.2 Telework impact on productivity

In order to evaluate the telework adoption impact on firm productivity, we have carried out a treatment regression model and an ordinary least squares (OLS) regression model. The first one was conducted for figuring out the direct impact of telework on firm productivity, while the second one has the aim of evaluating whether the three types of telework identified (home-telework, mobile for few employees and mobile for many employees) impact differently on labour productivity. Treatment regression models allow us to take endogeneity into account. The adoption of telework practices may indeed be correlated with unobserved factors such as the presence of particular managerial practices and abilities that explain superior firm performance. Therefore, a classical OLS regression model would risk overestimating the impact of telework adoption on productivity.

The treatment regression model estimates the impact of telework practices in two steps (Table 4). In the first step, telework adoption (dependent variable) is modelled as a function of the technological, organizational and environmental conditions discussed above. In the second step, the effect on the dependant variable (VA per employee) due to telework practices as predicted in the first step is estimated along with the effect of other full exogenous variables. It is also worth noting that the available data and the model specifications do not allow us to test for a causal relationship going from telework adoption to labour productivity. Causal relationships could be tested if time series were available for each company. In this way, the impact of the adoption of telework practices on productivity could be tested by taking into account a time lag due to the routinization and assimilation of these work practices. The available data allows us, therefore, to test for the presence of an association among the two phenomena.

Second step	
Dependent Variable: VA per employee	**β Coefficient**
Telework	1.019***
Human capital	0.242**
Size	-0.047
Hi-tech manufacturing	-0.058
Material service	0.072
Information service	-0.367**
First step	
Dependent Variable: Telework	**β Coefficient**
ERP	0.441**
CRM	0.864***
eLearning	0.258
Capital intensity	-0.104
Geographical scope	0.009***
Munificence	0.094
Dynamism	-0.242
Size	0.119†
Hi-tech manufacturing	0.012
Material service	-0.069
Information service	1.002***
Year 2009	-0.136
Constant	-0.997†
Rho	-0.484**
Chi square	39.86***

***p-value<0.1%, **p-value<1%, *p-value<5%, †p-value<10%

Table 4. Treatment regression model of telework's impact on productivity

In analysing results of the second step we have found that telework impacts positively and significantly on the value added per employee (β=1.019, p-value<0.1%), as well as after controlling for the positive effects of human capital on labour productivity (β=0.242, p-value<1%). This result confirms our thesis that telework leads to advantages in terms of productivity enhancement in firms that adopt this practice.

The results of the OLS regression model (Table 5) show that the type of telework adopted by firms influences the productivity of the company differently. More specifically, we found that firms using home-based practices of telework do not report higher labour productivity. On the contrary, productivity benefits are observed in companies that adopt the mobile for few employees and mobile for many employees' telework types. In both cases, the impact is positive and significant (β respectively equal to 0.234 and 0.316, with p-value respectively less than 5% and 10%). This result could be the consequence of the fact that firms adopting home-based configurations of telework probably may do so as a response to the individual needs of some of their employees (e.g., an employee requiring telecommuting from home one day per week due to family reasons or for avoiding long commuting times) and not as a consequence of a redesign of their organizational structure or their business processes.

Dependent Variable: VA per employee	β Coefficient
Home-based telework	0.244
Mobile for few employees	0.234*
Mobile for many employees	0.316†
Human capital	0.117**
Capital intensity	0.210***
Size	-0.004
Hi-tech manufacturing	-0.039
Material service	0.023
Information service	0.006
Year 2009	-0.379***
Constant	-1.792***
F	6.010***
Adjust R Square	8.26%

***p-value<0.1%, **p-value<1%, *p-value<5%, †p-value<10%

Table 5. OLS of telework types' impact on productivity

5. Conclusions

This paper provides empirical evidence for the rise of different telework types in companies, analysing data gathered between 2005 and 2009. In so doing, the paper highlights three key findings.

First, despite previous studies that have placed a particular emphasis on "home-based" forms of telework, our work found evidence that this type of telework has limited diffusion and represents a minority with respect to mobile forms of telework. Indeed, the "dominant" model of telework highlighted by the empirical analysis is characterized by a relative restricted number of employees (usually less than 10%) who work occasionally or regularly in a setting that is distant from the firm's premises.

Second, this study looks inside the black box of home-based and mobile telework, highlighting the existence of three different types of telework, thereby responding to the quest for empirical evidence of forms of mobile work [31]. Specifically, companies that adopt the "mobile for many" type of telework have higher CRM adoption levels with regard companies that adopt the "mobile for few" telework type. This fact suggests that the "mobile for many" type of telework places a greater focus on sales activities outside of their local or regional base. Furthermore, high capital-intensive companies are less likely to use telework practices and tend to involve fewer employees in telework whenever they adopt this practice. Indeed, firms following a "home-based for few" approach are more capital intensive than those firms using the "mobile for many" approach to telework. Moreover, environmental features influence the diffusion of telework types in firms: in turbulent environments (high dynamism) companies that adopt "mobile for many" forms of telework are more likely than companies that do not adopt telework, while in complex environments we are less likely to find companies that adopt telework practices.

Third, we have provided empirical evidence as to the influence of telework adoption on firm productivity. Specifically we have seen that telework adoption positively influences firms' productivity, even though this does not occur for all telework types. Specifically, productivity improvements are observable in firms that follow a mobile for few or mobile for many telework type, while companies that regularly allow some of their employees to work from home do not exhibit superior labour productivity. These results suggest that companies that follow home-based telework do not use this practice in order to have a more efficient or effective organizational design, but they may use it only as a response to individual requirements of some of their employees who, by telecommuting, may want to remodel their job-family balance.

Although these results are mainly stylized facts, they highlight the need for further theoretical works and empirical analysis on the antecedents and performance consequences of telework. In particular, our results highlight that the antecedents and the consequences on performance can vary significantly, depending upon the type of telework under analysis. We believe that future studies should study and theorize these differences to a greater extent with respect to the previous literature.

In raising these issues, our study contains two main limitations. First, the paper could not take into consideration the roles that are subject to telework and the reasons for the adoption of this work modality. Studies combining an analysis at the firm level with a study at the individual level could go deeper into this topic. Second, we were not able to determine whether those firms that have implemented formal telework programmes have developed written policies and standards regulating the use of this telework practice. The level of institutionalization of telework practice could be thus another topic for analysis in future studies on telework configurations.

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7. References

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