A Comparative Empirical Study of the Effect of the ICT, Organizational and Human Capital on Labour Productivity in Greece and Switzerland

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This draft: February 2007

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Abstract

In the modern economy firms, in addition to the 'traditional' production factors - traditional physical capital and labour - increasingly tend to form and use some 'new' types of production factors: information and communication technologies (ICT) capital, human capital and organizational capital. It is therefore necessary to investigate the effect of these new production factors on firm performance in various contexts and also to compare it with the effect of the traditional production factors in various contexts. In this paper is described a comparative empirical study of the effect of the ICT capital, the human capital, the organizational capital (new organizational practices associated with 'employee voice' and new forms of 'work design') and their combination on labour productivity in Greece and Switzerland. This study has been based on firm-level data from both countries, which have been collected through a common questionnaire, from samples of similar composition (concerning firm sizes and sectors). Based on these data econometric models of similar specification have been estimated for both countries based on the framework of firm-level production function. From these models it is concluded that in both countries physical capital, ICT capital, human capital and new "employee voice"-oriented organizational practices have a statistically significant positive effect on labour productivity. Also, some considerable differences between the two countries have been identified: Swiss firms are more efficient and mature in creating, using and combining these 'new' production factors (ICT capital, human capital, organizational capital and knowledge capital) than the Greek ones. These conclusions have interesting policy implications both at the firm and government level.

1.   Introduction

The modern economy is characterised by the emergence of some new types of production factors, which are increasingly adopted and used by firms. In most developed and developing countries firms, in addition to the traditional production factors - traditional physical capital and labour - increasingly tend to invest in some new types of capital: information and communication technologies (ICT) capital, human capital and organizational capital. Taking into account the big investments made by firms for acquiring and using these new production factors it is of critical importance to investigate and understand in depth their impact on firm performance.

In this direction several empirical studies have been conducted in order to investigate the impact of the above three 'new' production factors - ICT capital, human capital and new organizational practices - and their combinations on firm performance (Addison 2005, Wan 2007, Loukis et al 2008a), which are reviewed in section 3 of this paper. These studies have produced some first conclusions on the above critical questions, and provided some first evidence supporting the existence of complementarities between these new production factors. However, we remark that between the conclusions of these studies there are some similarities, but also several differences as well, which might be - at least to some extent - due to differences in sample composition (the samples of these studies are from different sectors and industries), in national context (samples different countries), in variables and models specification and also in the nature of the investigations (cross-sectional versus longitudinal).

Therefore, further empirical research is required concerning the effect of ICT capital, human capital, new organizational practices and their combination on firm performance. More empirical studies need to be conducted, in various sectors and industries and also in various different national contexts, including not only highly developed countries but also less developed countries as well.

In this direction this paper describes a comparative empirical study of the effect of ICT capital, human capital, new organizational practices and their combined use, also controlling for the knowledge capital, on labour productivity in Greece and Switzerland, based on firm-level data from both countries. Its analytical framework is that of a firm-level production function. Both the Greek and the Swiss parts of this study are based on firm-level data collected through the same questionnaire and from samples of similar composition (concerning firm sizes and sectors), and also use the same variables and models specification, so they are comparable.

The contribution of this study to the empirical literature is two-fold:

i) It is the first completely comparative empirical study on the above critical research questions in two quite different countries from an economic viewpoint, so it enables us to draw conclusions as to whether the national context has an impact on the effect of ICT capital,

human capital, new organizational practices and their combination on firm labour productivity.

ii) The Greek part of this study is the first study of this type for Greece, whose economy is quite different from the economies of the highly developed countries, in which most of the empirical studies on these research questions have been conducted (such as USA, Germany, Australia, Switzerland, etc., as described in section 3). In particular, Greece in comparison with the highly developed countries is characterised by lower level of economic development, smaller size of internal market, smaller average firm size and lower level of R&D intensity and innovation.

The main shortcoming of this study is that it is cross-sectional, so it does not allow the test of causal relations, the use of time lags, etc. However, we tested extensively the possibility of endogeneity of the right-hand variables in the compact version of our model.

The paper is structured in eight sections. In the following section 2 the conceptional framework of this study is outlined, while in section 3 the existing empirical literature concerning the effect of ICT capital, human capital, new organizational practices and their combined use on firm-level labour productivity is reviewed and summarized. Then in section 4 the data of both the Greek and the Swiss parts of the study are described. The descriptive statistics of these data, which enable a better understanding of the patterns of use of ICT, new organizational practices and human capital in Greece and Switzerland, are presented and discussed in section 5. In section 6 are described the variable construction and the specification of the econometric models of this study. The econometric models we estimated based on the above data are presented and discussed for both countries in section 7. Finally in section 8 the results are summarized and comparisons between the findings from Greece and Switzerland are made resulting to policy implications

2. Conceptional framework

In the last twenty years important changes are emerging in the production process, such as extensive use of computer-aided production technologies, advances in ICT, new ideas concerning firms organization, changes in the skill requirements of labour and changes in employee preferences toward more flexible working conditions. On this ground, recently many authors even postulated a shift to a new „firm paradigm". Some of them focus their attention mainly to technological changes, some find the introduction of new organizational practices a central characteristic of this „paradigm change", while a third group concentrates primarily on the shift of firm demand to high-skilled labour in the last twenty years and analyzes the determinants of this shift. In this section we briefly review some of the literature dealing these important changes. Milgrom and Roberts (1990), focusing mainly to manufacturing, proclaim the replacement of the "mass production model by the vision of a

flexible multi-product firm that emphasizes quality and speedy response to market conditions while utilizing technologically advanced equipment and new forms of organization" (p. 511). Lindbeck and Snower (2000) analyze the shift from " 'tayloristic' organization (characterized by specialization by tasks) to 'holistic' organization (featuring job rotation, integration of tasks and learning across tasks)" (p. 353); also, in a following paper (Lindbeck and Snower 2003) they elaborate on the idea of the "firm as a pool of factor complementarities". Bresnahan *et al.* (2002) consider the increased use of "complementary systems" of information technologies, workplace organization and product innovation as drivers of a major skill-biased technical change. A basic point in all these studies is the existence of complementarities among several factors, which mutually enhance their impact on firm performance. The role and the impact of ICT, new organizational practices, human capital and their complementarities are discussed in the remaining of this section (2.1 – 2.4), and based on them the research hypotheses are formulated based on the framework of firm-level production function (2.5).

2.1 Information and Communication Technologies (ICT)

The benefits of ICT for a firm include savings of inputs, general cost reductions, higher flexibility and improvement in product quality. The new technology may save labour or some specific labour skills; it may reduce capital needs through, for example, increased utilization of equipment, reduction of inventories or space requirements and so on. It may also lead to higher product quality or better conditions for product development. Moreover, it may increase the flexibility of the production process and allow the exploitation of economies of scale (see e.g. Milgrom and Roberts 1990, 1995). A specific feature of ICT is related to networking and communication. As new technologies reduce the cost of lateral communication, firms use these technologies to facilitate communication among employees and reduce co-ordination costs. Monitoring technologies can also be used to reduce the number of supervisors required in the production process. Thus, the use of ICT has direct implications for firm organization. Though inventions that lead to improvements in ICT are quickly available throughout the economy, complementary organizational changes involve a process of co-invention by individual firms (Bresnahan and Greenstein 1997). Identifying and implementing such organizational changes is difficult and costly, so these adjustment difficulties lead to variation across firms in the use of ICT, its organizational complements and the resulting outcomes.

2.2 New organizational practices

Recently there has been research interest in some new organizational practices, such as 'employee voice' and new forms of 'work design', and their impact on firm performance (e.g. Murphy 2002, Black and Lynch 2004). As 'employee voice' practices are meant new organizational structures that decentralize various competences and give non-managerial workers the opportunity to contribute inputs into the decision-making associated with the

production process and greater autonomy and discretion in their work. The new forms of 'work design' include the use of cross-functional production processes that result in more flexible allocation and re-allocation of labor in the firm, the reduction of hierarchical levels of management within the firm, the diffusion of job rotation, etc. Some theories have been developed in order to explain why these new organizational practices that lead to new high-skill and high-involvement workplaces may be more effective (see e.g. Ichniowski *et al.* 2000). They can be divided, first, into theories that focus on the effort and motivation of workers and work groups and suggest that due to the positive worker incentives created by these new organizational forms the worker performance increases. A second group of theories focuses on changes of the structure of organizations that improve efficiency (see Aghion *et al.* 1999, p. 1650); these theories imply that new arrangements can make organizational structures more efficient. For example, decentralizing decision-making to self-directed teams can reduce the number of supervisors and middle-level managers required and improve communication; also, employee involvement can eliminate or reduce grievances and other sources of conflict within the firm, thus improving performance (Mookherjee 2006). For these new organizational practices there exist interdependencies with other factors and inputs. Some of the changes of work design are associated with the introduction and diffusion of information technologies within the firm. For example, Greenan and Guellec (1994) argue that "whereas the centralized style is more efficient when the technological level is low, the decentralized one becomes more efficient when the technological level is higher" (p. 173).

2.3 Human capital

The shift toward skilled workers appears to have accelerated in the last twenty years. While many factors have contributed to this increase, most authors think that this effect is attributable primarily to skill-biased technical change. The size, breadth and timing of the recent labour demand shift have led many to seek skill-biased technical change in the largest and most widespread new technology of the last years: the ICT (see Bresnahan et al. 2002). On the one hand, high-skilled labour is a precondition for the use of ICT; for example, training in problem-solving, statistical process controls and computer skills can increase the benefits of ICT. On the other hand, highly computerized systems not only systematically substitute computer decision-making for human decision-making in routine work, but also produce a large quantity of data which needs high-skilled workers, managers and professionals to get adequately utilized.

2.4 Complementarities

The use of ICT, new organizational practices and human capital build a "complementary system" of activities (Bresnahan *et al.* 2002, p. 341ff; Milgrom and Roberts 1995, p. 191ff.). According to Milgrom and Roberts (1990, p. 514) "the term 'complement' is used not only in the traditional sense of a specific relation between pairs of inputs, but also in a broader sense as a relation among groups of activities". For example, modern advanced manufacturing

techniques consist of a bundle of technology elements implying considerable complementarities among them. Complementarities are considered also with respect to organization and human capital. Lindbeck and Snower (2003) further elaborate on the idea of factor complementarity, which is identified as a central element for the determination of a firm's boundaries, and identify four types of complementarities: two kinds of inter-factor complementarity (technological and informational complementarity), intra-factor complementarities (leading to increasing returns of scale) and complementarities among factors in the production of additional products (leading to increasing returns to scope). In this study we restrain our analysis to inter-factor complementarities. Recent theoretical developments analyze more in depth the conditions that are necessary for complementarity (a) between ICT and decentralization and (b) between ICT and skill-upgrating. Acemoglu et al. (2006) found that firms which have recently adopted a new technology and therefore are closer to technological frontier, younger firms and firms in more heterogeneous environments are more likely to choose decentralization. Borgans and ter Weel (2006) found that the adoption of computer technology can lead to productivity gains, either directly, e.g. through reduced production time, or indirectly through improved communication possibilities among employees. They also found that direct productivity gains induce skill upgrading, while in firms gaining from improved communication specialization increases and skill requirements fall; so what we can observe if we correlate ICT and skills is the net result of these two opposite effects.

2.5 Research hypotheses - Production function framework

Based on the above discussion of the relevant literature we formulated the following hypotheses with respect to the contribution of ICT, new organizational practices, human capital and their combination to firm performance:

- Hypothesis 1: There are considerable direct positive effects of ICT, organizational and human capital respectively on firm performance;

- Hypothesis 2: There are considerable indirect positive effects of these factors on firm performance which can be traced back to complementarities among them;

- Hypothesis 3: The national context has an impact on the above direct and indirect effects.

For testing empirically these hypotheses we used the framework of a firm-level production function, which enables us to examine the effect on productivity of both the 'classical' production factors, labour and traditional physical capital, and also the 'new ones': ICT capital, organization capital and human capital.

3.   Review of empirical literature

Considerable empirical research has been conducted for assessing and understanding the

impact of ICT investment of firms on their performance (for extensive reviews of this research see Melville et al 2004, Wan et al 2006, Loukis et al 2008). This research initially found very little empirical evidence of a statistically significant positive association between ICT investment and firm performance (e.g. Strassman 1990, Brynjolfsson 1993, Strassman 1997). These counter intuitive results posed to the academic and the business management community critical questions and issues concerning the practical usefulness and the productivity of the big ICT investments made by organizations. This problematic has been referred to as the 'ICT Productivity Paradox' (Brynjolfsson 1993) and is well reflected in R. Solow's statement that 'you can see the computer age everywhere but in the productivity statistics' (Solow 1987). However, the second period of this research, from the mid 1990s until today, produced some empirical evidence of a statistically significant positive contribution of ICT investment to several measures of business performance (e.g. Brynjolfsson and Hitt 1996, Stolarick 1999, OECD 2003, OECD 2004); these more recent positive results reflect the improvements in ICT management, and also the adjustments and the restructuring that had taken place at the firm level between the mid 1980s and the mid 1990s, which enabled a higher level of value and benefits from ICT. Subsequent research on this topic has been produced some evidence that the contribution of ICT investments to business performance can increase significantly if they are combined with the adaptation and modification of existing work practices, business processes, organisational structures, skills, etc., which have been designed mostly in the pre-ICT era, so they do not take into account the capabilities offered by ICT (e.g. Grover et al 1998, Devaraj and Kohli 2000, Brynjolfsson and Hitt 2000, Ramirez 2003, OECD 2003, OECD 2004).

Another research stream investigates empirically simultaneously the impact of ICT, organizational capital and human capital (or at least two of them) on business performance; the main empirical studies of this research stream and their conclusions are shown in Table 1 (the choice of the studies reported in this Table has been based on following criteria: recent date of publication, consideration of at least two of the three variable blocks technology, organization and human capital in the model specification, firm-level analysis, coverage of all sectors of the economy). For a review of this literature see Addison (2005). We can see that most of these studies find a statistically significant positive effect for ICT and organizational capital, and only few of them for human capital; we also remark that most USA studies did not find a statistically significant positive effect for human capital. With respect to these direct effects Swiss firms tend to give more attention to human capital than to organizational in comparison to firms of other countries. Concerning complementarities only two of the USA studies find statistically significant complementarities between ICT and organizational capital, and also between ICT and human capital; also the Australian study shows the existence of complementarities primarily between ICT and human capital and – somewhat weaker – between ICT and organizational capital. In the European studies there is a tendency for complementarities between ICT and human capital and between organizational and human

capital. The results are indicative but not completely comparable because some of the observed differences can be traced back to differences with respect to the sectors and industries covered in the studies, the specification of the independent variables and the nature of the investigations (cross-sectional versus longitudinal).

4. Data

The data used in the Swiss part of this study were collected through a survey among Swiss enterprises, using a questionnaire which included questions on the incidence and within-firm diffusion of several ICT technologies (e-mail, Internet, intranet, extranet) and new organizational practices (team-work, job rotation, decentralization and employees' involvement), employees' vocational education and job-related training, and also on basic economic data for 2004 (sales, value of intermediate inputs, investment expenditure, number of employees, etc.).[1] The survey was based on a disproportionately stratified (with respect to firm size) random sample of firms with at least 20 employees covering all relevant industries of the business sector as well as firm size classes (on the whole 29 industries, and within each industry three industry-specific firm size classes with full coverage of the upper class of large firms)[2]. Answers were received from 1895 firms, i.e. 38.7% of the firms in the underlying sample. The response rates do not vary much across industries and size classes with a few exceptions (over-representation of paper and energy industry, under-representation of hotels, catering and retail trade). In Table A.1 of the Appendix in columns 3 and 4 we can see the structure of the data set we used for the Swiss part of this study by industry and firm size class. The non-response analysis (based on a follow-up survey of a sample of the non-respondents) did not indicate any serious selectivity bias with respect to the use of ICT and new organizational practices (team-work, job rotation). A careful examination of the data of these 1895 firms led to the exclusion of 185 cases with contradictory or non-plausible answers, so the remaining 1710 valid answers were finally used for the analyses and models presented in the following sections. In Table A.2 in the Appendix are shown some descriptive statistics of the basic variables for the Swiss data set (see Table 3 for their specification).

The data used in the Greek part of this study were collected similarly through a survey among Greek enterprises based on the same questionnaire that has been used in the Swiss part. Three samples of 300 Greek firms each were randomly selected from the database of ICAP S.A., which is one of the largest business information and consulting companies of Greece. All these three samples were 'similar' to the sample of the Swiss part of the study, including firms

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[1] The questionnaire was based to a considerable extent on similar questionnaires used in earlier surveys (see EPOC 1997, Francois *et al.* 1999, Vickery and Wurzburg 1998, Canada Statistics 1999).
[2] Table 1 contains only 26 industries; the Swiss sample has „watches", "telecommunication" and "computer services" as separate industries that were put together with "electronics/instruments", "transport" and "other business services" respectively to make the industry classification comparable to that of the Greek data.

from the same industries and sizes with the same proportions of all the industry and size classes. Initially the questionnaire was sent by post to the firms of the first sample; after three weeks the firms who had not responded were contacted by phone. Firms that definitely refused to participate in this survey were replaced by similar firms (i.e. from the same industry and size class) from the second sample, while in a few cases that the firms of the second sample were exhausted we had to proceed to the third sample. Following the above procedure, which aimed to maintain the proportions of the industry and size classes, we finally received responses from 281 firms; after an examination of the returned completed questionnaires we excluded 10 cases with contradictory or non-plausible answers, and the remaining 271 valid responses were used for the analyses and models presented in the following sections. In Table A.1 of the Appendix in columns 1 and 2 we can see the structure of the final data set we used for the Greek part of the by industry and firm size class. A non-response analysis was performed (based on a survey of a sample of non-respondents), which did not indicate any serious selectivity bias with respect to the use of ICT, new organizational practices, vocational education and job-related training. The only difference between the Swiss and the Greek data concerned the 'traditional capital: the Swiss questionnaire collected the 'gross investment expenditure in 2004', as a measure of traditional capital, while in the Greek part of the study from the ICAP database was retrieved the 'assets value at the end of 2004' for this purpose. However, we believe that this is not a problem, since both these variables are good measures of the 'traditional capital' a firm uses. In Table A.2 of the Appendix we can see some descriptive statistics of the basic variables for the Greek data set (see Table 3 for their specification).

5.   Patterns of use of ICT, new organizational practices and human capital in Greece and Switzerland

For both the Greek and the Swiss data initially we calculated the descriptive statistics of the main variables, which enable us to understand the patterns of use of ICT, new organizational practices and human capital in Greece and Switzerland and to make comparisons between them. The most important of them are shown in Table 2, and also in the abovementioned Table A.2 and Tables A3a and A3b of the Appendix.

Concerning the 'inward-looking' component of the ICT capital from Table 2 we remark that there is considerable percentage of firms that do not have an intranet in both countries (24.4% in Greece and 43.5% in Switzerland). Most of the remaining firms having an intranet are characterised by low levels of intra-firm diffusion of it with 1-20% of their employees using the firm intranet (27.4% in Greece and 15.1% in Switzerland). The percentage of the firms with extensive intra-firm diffusion of intranet technology, having more than 60% of their employees using the firm intranet, is slightly lower in Greece 24.3% but higher 22.4% in Switzerland. The comparison between the two countries leads to the conclusion that the share

of firms not having an intranet is higher in Switzerland than in Greece, and that the intensity of intranet usage in the Greek firms is higher than in the Swiss firms (also from Table A.2 we can see the mean of this variable is 2.668 for Switzerland and 3.015 for Greece).

Different are the patterns of usage of the 'outward-looking' component of the ICT capital. As we can see from Table 2, the percentage of firms not using Internet (3.0% in Greece and 3.6% in Switzerland) is very small, while in both countries the class with the highest relative frequency is that of the firms with 1-20% of their employees using the Internet (52.1% in Greece and 37.8% in Switzerland). Much smaller is the percentage of the firms characterised by extensive diffusion of the Internet with more than 60% of their employees using the Internet (16.3% in Greece and 26.4% in Switzerland). A comparison between the two countries leads to the conclusion that while the share of firms using the Internet is almost the same in both countries (97.0% in Greece and 96.4% in Switzerland), the intensity of use of Internet in those Swiss firms that have introduced this technology is higher than in the Greek firms (also from Table A.2 we can see that the mean of this variable is 3.380 for Switzerland and 2.948 for Greece).

Concerning the human capital, in Table 2 we can see that the mean percentage of employees with vocational education at the tertiary level is 26.2% in the Greek firms and 20.8% in the Swiss firms, while the share of employees receiving job-related training is 26.8% in the Swiss firms and 23.3% in the Greek firms. So the comparison between the two countries results in a 'mixed' conclusion: from the two forms of human capital examined, Swiss firms give to their employees more job-related training than the Greek firms, while the later employ more tertiary level personnel than the former.

From the new organizational practices associated with new forms of 'work design' in Tables 2 and A.2 we can see that the most frequently adopted of them is team-work (with 25.9% of the Greek firms and 24.3% of the Swiss firms having extensive diffusion of 'team-work' at the levels of 4 (strongly widespread) or 5 (very strongly widespread)). Much lower is the 'decrease of management levels' (by 9.0% of the Swiss firms and 3.7% of the Greek firms) and of the 'job rotation' (by 7.7% of the Greek firms and 3.6% of the Swiss firms). A comparison between the two countries again gives a 'mixed' conclusion: the percentage of the firms that decreased management levels is much larger in the Swiss firms than in the Greek firms, while the adoption of job rotation is higher in the later than in the former; concerning the level of adoption of team-work by taking into account the results of both Table A.2 and Table 2 we conclude it is higher in the Swiss firms than in the Greek firms (from Table A.2 we can see that the mean of this variable is 2.218 for Switzerland and 1.925 for Greece).

Considerable is the percentage of the firms in which there has been a shift of the overall distribution of competences towards employees since 2000 (in 33.6% of the Swiss firms and 24.0% of the Greek firms). The highest decentralization has been made in the competences of contacting customers (with 25.1% of the Swiss firms and 18.1% of the Greek firms reporting

one of the two higher values (4 or 5) of the ordinate variable measuring how widespread this type of decentralization is inside a firm on a five-point Likert scale), followed by decentralization in deciding the way of performing various tasks (15.2% and 4.8% respectively), the sequence of tasks (13.8% and 2.2% respectively) and the work pace (12.3% and 9.9% respectively). A comparison between the two countries leads to a clear conclusion that Swiss firms adopt the 'employee voice'-related new organizational practices to a much higher extent than the Greek ones.

Finally concerning the knowledge capital, as we can see in Table A.2, the investment per employee in research and development (R&D) in the Swiss firms is much higher than in the Greek firms.

6.   Model specification and variable construction

6.1   'Basic' model

Throughout this study we use the logarithm of annual value added (sales revenue minus value of intermediate inputs) per employee as dependent variable. As independent variables in the "basic models" we used measures of "ICT capital", "organizational capital", "human capital" "physical capital" and "knowledge capital". In particular, as measures for technology input, particularly ICT input ("ICT capital"), we have used the intensity of use of two important ICT, Internet ('outward-looking' linking to the outside world) and intranet ('inward-looking' linking within the firm), quantified by the share of employees using Internet and intranet respectively in their daily work. The firms were asked to report this share not by a precise figure but in a six-level scale: 0%, 1% to 20%, 21% to 40%, 41% to 60%, 61% to 80% and 81% to 100%. Based on these data we constructed two ordinal technology variables, one for Internet and one for intranet, taking the values 0 to 5, thus covering the whole range from 0% to 100% (see Table 3). We expect in general a positive correlation of these technology variables with labour productivity for the reasons explained in 2.1.

The measurement of "organizational capital" is an issue still open to discussion, since there is not yet a definite agreement among applied economists to the exact definition and dimensions of organizational capital (see Black and Lynch 2004 and Lev 2003 for a discussion of this matter; see also Appelbaum *et al* 2000, Ch. 7 for definitions of high-performance work system variables). In order to choose the variables related to the extent of adoption of new organizational practices at the workplace level we draw on the definition offered by Black and Lynch (2004), who distinguish three components of organizational capital: "work design", "employee voice" and "workforce training". The first component "work design" includes practices that involve changing the occupational structure of the workplace, the number of levels of management within the firm, the existence and diffusion of job rotation, the job share arrangements and the level of cross-functional co-operation. The second component

"employee voice" is associated with practices that give employees, especially non-managerial ones, greater autonomy and discretion in the structure of their work, such as individual job enrichment schemes, decentralization of decision competencies that give to employees more decision competences, etc. Based on the above definitions in this study we regard 'organizational capital' as consisting of the first two of these components, "work design" and "employee voice", while we view the third component "workforce training" as part of the human capital of the firm, as explained in the following paragraph. So we constructed the following three- or five-level ordinate variables covering most of the above-discussed aspects of organisational capital:

i) for measuring "work design" practices: intensity of use of team-work (project groups, quality circles, semi-autonomous teams), intensity of use of job rotation, increase/stability/decrease of the number of management levels in the last five years;

ii) for measuring "employee voice": overall shift of decision competencies between managers and employees inside the firm in the last five years (shift towards managers/no shift/shift towards employees), extent of decentralization from managers to employees of particular competences with respect to: (a) work pace, (b) sequence of the tasks to be performed, (c) the assignment of tasks, (d) the way of performing tasks, (e) solving emerging production problem, (f) contacts to customers and (g) solving emerging problems with customers.

The exact specification of these variables is shown in Table 3. We expect in general an overall positive correlation of organizational variables with labour productivity, but we do not have sign expectations for every single variable.

For measuring human capital we have used two variables: the share of employees with vocational education at the tertiary level (universities, business and technical colleges, etc.) and the share of employees receiving job-related training (internal and/or external training courses initialized or supported by the firm). The exact specification of these variables is shown in Table 3. According to standard analysis (see e.g. Barro and Lee 1994) we expect a positive correlation of these variables with labour productivity.

Further, we control for physical capital (measured through the logarithm of annual gross investment expenditure per employee in 2004 in the Swiss part of the study, and the logarithm of assets value per employee at the end of 2004 in the Greek part of it), knowledge capital (measured through the logarithm of annual R&D expenditure per employee), firm size and sector affiliation.

6.2 'Compact' model

In the basic models, as described in 6.1, two variables measuring the use of Internet and intranet serve as proxies for "ICT capital", eleven organizational variables are used to approximate "organizational capital" and two variables are proxies for "human capital". In order to be able to assess the relative significance of each of these three variable blocks for

labour productivity, it is necessary to construct overall measures for these 'new' types of capital. To this end, we constructed four composite indices: one based on the two technology variables (named as variable ICT), one based on the two human capital variables (named as HUMAN), one for the three organizational variables measuring "work design" (named as ORG1) and one for the eight organizational variables measuring "employee voice" (named ORG2). These composite indices were calculated as the sum of the standardized values (i.e. with average 0 and standard deviation 1) of the underlying variables (see Table 3). Then based on them we estimated "compact" models having the logarithm of annual value added per employee as dependent variable, and the above composite indices ICT, HUMAN, ORG1 and ORG2 as independent variables, besides the variables for the physical capital, the R&D intensity and the control variables.

A second reason for specifying this "compact" model was to enable an investigation of the issue of the complementarity between technology, human capital and the two forms of organizational capital; the composite indices are considered as metric variables and interaction terms of these variables can be inserted in the model for investigating the corresponding complementarities (as described in 7.2).

7. Results

7.1 'Basic' model

7.1.1 Greek results

The OLS estimate of the basic model using the Greek data is shown in Table 4, while in Table A.3a of the Appendix we can see the correlation matrix of the model variables. Because of high correlation between the two technological variables measuring the intensity of use of Internet and intranet, when both of them were included in the same model as independent variables, only one had statistically significant coefficient, while the other did not; however, if each of them was removed from the model, the coefficient of the other became statistically significant, since they both are characterised by high correlations with the dependent variable (labour productivity). The same happened with the two human capital variables measuring the share of employees with tertiary education and the share of employees receiving job-related training. The above effects are illustrated in the first four models (1 to 4) of Table 4a. For these reasons we estimated the model 5 of Table 4a having as independent variables only one of the two technological variables (the intensity of intranet use, which is higher correlated with the dependent variable than the intensity of Internet use), also only one of the two human capital variables (the share of employees with tertiary education, which is higher correlated with the dependent variable than the share of employees receiving job-related training), the eleven organizational variables, the knowledge capital variables, the physical capital variable and also the control variables. Since between the organizational variables there are also high

levels of correlation, we also estimated eleven variants of this model, each of them having only one of these organizational variables. In only three of these eleven models the corresponding organizational variable had statistically significant coefficient: in the ones having the extent of decentralization of decision competencies concerning the sequence of tasks to be performed, the way of performing tasks and the work pace, which are shown in Table 4a (as models 6, 7 and 8 respectively).

From the models shown in Table 4a we can see that the coefficients of the two technological variables measuring the intensity of use of Internet and intranet are positive and statistically significant, which means that higher intensity of use of these technologies in a firm results in higher labour productivity. Also both human capital variables have statistically significant positive coefficients. Furthermore, the physical capital variable has statistically significant positive coefficient as well, but the coefficient of the knowledge capital variable is not statistically significant. Concerning the three organizational variables representing "work design" from the models of Table 4a we can see that they do not show a statistically significantly effect on labour productivity. Similarly there is no significant effect for the overall delegation of competences from managers to employees; from the other seven organizational variables representing "employee voice" only three have statistically significantly effect on labour productivity: the ones measuring the extent of decentralization from manages and employees of decision competencies concerning the sequence of tasks to be performed, the way of performing tasks and the work pace.

In conclusion, for Greece we found statistically significant positive effects for the variables of ICT, physical capital, human capital, and for the three above variables measuring aspects of organizational capital.

7.1.2 Swiss results

The results of the OLS estimate of the basic model using the Swiss data are shown in Table 4b, while in Table A.3b of the Appendix we can see the correlation matrix of the model variables. We remark that the coefficients of the two technological variables measuring the intensity of use of internet and intranet are, as expected, positive and statistically significant. This means that the higher the intensity of use of these technologies among the employees of a firm, the higher is also labour productivity, all other things being equal. Also, both proxy variables for human capital have, as expected, statistically significant positive coefficients. Further, we have the expected positive effects for the physical and the knowledge capital. On the contrary we could not find any statistically significant effects for the three organizational variables representing "work design" (with the exception of a weak negative effect of the variable for job rotation in model 2 in Table 4b). Also there was no indication of significant effect for the overall delegation of competences from managers to employees. Finally, in order to exclude the possibility of multi-collinearity the eight "employee voice" variables measuring the extent of decentralization of particular competencies from managers to

employees were inserted separately in the estimation equation, and only two of them have been found to have positive and statistically significant coefficients: the one measuring decentralization of competences for contacting customers and the one measuring decentralization of competences for solving customers' problems; the corresponding models are shown in Table 4b as models 2 and 3 respectively. Therefore we conclude that an overall shift of competences towards employees may prove to be too unspecific to lead to a positive performance impact; it is the clear-targeted delegation of specific competencies from managers to employees, with respect to contacting customer problems and solving customers' problems that could enhance productivity.

In conclusion, for Switzerland we found statistically significant positive effects for all single variables belonging to the variable blocks of technology and human capital, for the physical and knowledge capital variables, and for only two of the eleven variables measuring aspects of the organizational capital.

7.2   'Compact' model

7.2.1 Introductory remarks on the econometric methodology

In the compact versions of our models we tested extensively the possibility of endogeneity of the right-hand variables, using the methodology developed by Rivers & Vuong (1988). We chose this methodology because it allows an explicit test on endogeneity and at the same time a correction of the eventual biases; it should be mentioned that alternatively we also conducted an instrument variables estimation that yielded similar results. For the Swiss case, in a first step we estimated instrument equations for all right-hand variables (ICT, ORG1, ORG2, HUMAN, logCL, LogRDL) and inserted the residuals of these equations alternatively in the productivity equations (see Table A.5 in the Appendix). According to the above Rivers & Vuong test the statistical significance of the coefficients of the residuals indicates that the respective variables correlate with the residuals of the productivity equation; this means that the coefficients of these variables in the estimates without the residuals of the instrument equations are biased and have to be corrected. That was the case for the variables ICT, ORG1, ORG2 and HUMAN. Thus, in Table 5b (as models 1 - 4) we present the estimates of the productivity equation including the residuals of the respective instrument estimates. The same procedure has also been applied for the Greek estimates, but in this case the coefficients of the residuals of the instrument equations inserted in the productivity equation were not statistically significant, thus no correction was needed.

7.2.2 Greek results

In Table 5a we can see the estimate of the "compact" model based on the Greek data (as model 1), while in Table A.4a of the Appendix we can see the correlation matrix of the variables of this model. We remark that the composite indices for information technology

(ICT), human capital (HUMAN) and the organizational variables representing "employee voice" (ORG2), and also the variable of the 'traditional' physical capital have significant positive coefficients; on the contrary the composite indicator representing new forms of "work design" (ORG1) and the variable of the knowledge capital (logarithm of R&D expenditure per employee) do not have statistically significant coefficients. The relative importance of these production factors with respect to labour productivity, as measured by the magnitude of the corresponding standardized regression coefficients (see the second column of model 1 of Table 5a), leads to the following ranking of them: traditional capital in the first position, followed by ICT, then human capital and at the end the 'employee-voice' oriented new organizational practices.

Next we constructed three more models by adding in the above "compact" model interaction terms between the composite variables for technology, organizational and human capital, which are considered as metric variables, in order to examine whether there is complementarity between them. In particular, in the first of these models we added the ICT*ORG1 and ICT*ORG2 terms (model 2 of Table 5a), in the second model we added the term ICT*HUMAN (model 3 of Table 5a), and in the third model we added the terms HUMAN*ORG1 and HUMAN*ORG2 (model 4 of Table 5a). We found that none of these interaction terms has a statistically significant coefficient, with the only exception of the interaction term of the technology variable with the new forms of "work design" variable (ICT*ORG1), which has a weakly negative coefficient (with 8% significance). The above results, in comparison with the corresponding results of the Swiss part of this study presented next in 7.2.3, show that the Greek firms have not yet learnt how to combine effectively these three 'new' production factors (ICT, human capital and new organizational practices).

7.2.3 Swiss results

In Table 5b we can see the estimate of the "compact" model using the Swiss data, while in Table A.4b of the Appendix we can see the correlation matrix of the variables of this model. We can see that the composite indices for technology (ICT), human capital (HUMAN) and the organizational variables representing "employee voice" (ORG2) have significant positive coefficients, while the same happens with the variables representing the 'traditional' capital (logarithm of gross investment expenditure per employee) and the knowledge capital (logarithm of R&D expenditure per employee). Their relative importance with respect to labour productivity, as measured by the magnitude of the standardized regression coefficients of these variables, leads to the following ranking: human capital is at the first position, followed by ICT, then 'employee-voice' oriented new organizational practices, followed by the 'traditional' capital, and at the end the knowledge capital. We also found a negative effect for the composite indicator comprising the three variables measuring "work design" (ORG1) that can be traced back to the negative effect of job rotation (see Table 4b).

In a further step, we inserted in the "compact" model the following interaction terms of the composite variables for technology, organization and human capital which are considered as metric variables: ICT*ORG1 and ICT*ORG2 (model 1 of Table 6), ICT*HUMAN (model 2 of Table 6), HUMAN*ORG1 and HUMAN*ORG2 (model 3 of Table 6). We can see that the coefficients of the interaction term of the technology variable with the human capital variable and the coefficient of the human variable with the organizational variable for decision decentralization are positive and statistically significant. These results can be interpreted as a hint for the existence of complementarity of ICT and human capital and also of human capital and decision decentralization respectively. These results lead to the conclusion that in Switzerland the combined use of ICT and human capital, as well as the combined use of human capital and decision decentralization in a firm would enhance its performance beyond the direct effects of these factors taken alone.

8.   Summary and conclusions

In this section we summarize the empirical results presented in the previous section 7 and discuss similarities and differences between the two countries. For both countries we found statistically significant positive effects for physical capital, ICT, human capital (HUMAN) and "employee voice" oriented organizational practices (ORG2) on labour productivity; no effect (in the Greek case) or even a negative effect (in the Swiss case) has been found for "work design" oriented organizational changes (ORG1). Also for both countries the intranet effect was stronger than the Internet effect, meaning that the use of ICT for the improvement of intra-firm information, communication and coordination processes has a higher payoff, measured in labour productivity gains, than the use of ICT for the improvement of the corresponding inter-firm processes.

There are also three important differences between the two countries:

i) The relative importance of these effects, as measured by the standardized coefficients of the compact model, is not the same in both countries. For the Greek firms we found the following ranking: physical capital > ICT > human capital > "employee voice" practices. For the Swiss firms the respective ranking is: human capital > ICT > "employee voice" practices > physical capital ≈ R&D. We remark that in the Swiss firms the impact of the human capital, the ICT capital and the organizational capital associated with "employee voice" practices is higher than the impact of the 'traditional' physical capital, while on the contrary in Greece these three 'new' production factors have a lower impact on labour productivity than the physical capital. For Greek firms the physical capital (tangible) is still very important, more important than ICT, which has both a tangible component (hardware) and an intangible component (software); also the "intangibles" (human capital, R&D) are less important for achieving a better economic performance in Greece, while the R&D variable shows no effect on productivity. Even though more persons with tertiary level education are employed in Greek

firms than in Swiss firms (see section 5), the human capital is evidently more efficiently utilized in the Swiss firms. Therefore it can be concluded that Swiss firms are more efficient and mature in creating and using these 'new' production factors (ICT capital, human capital, organizational capital and knowledge capital) than the Greek ones.

ii) The "employee voice" effect on labour productivity, which is significantly positive for both countries, is based on different types of employee competences. In Greece this effect is related to the decentralization of competences referring to the working conditions (work pace, work way, work sequence), while in Switzerland to the decentralization of competences having to do with the work content (contact to customers, solving of problems related to customers). These differences can be interpreted as reflecting different management philosophies and different levels of employee autonomy. Co-operation between management and employees with respect to working conditions is required mostly for strongly routine activities and production processes, which is rather a characteristic of Greek firms. On the contrary employee competences and co-operation with management concerning work content is relevant for less routine activities requiring more individual initiative from employees (such as the contact with customers and the management of their problems), as is often the case in Swiss firms.

iii) There are also significant differences between the two countries with respect to the complementarity effects between ICT capital, human capital and organizational capital. We could not find any interaction effects for the Greek firms, while there was evidence for two interaction effects (between human capital and ICT, and also between human capital and "employee voice" oriented organizational practices) for the Swiss firms. Therefore in Greek firms the potential of ICT is not fully utilized because human capital is not efficiently combined with it; similarly, the decentralization of some competences has positive productivity effects, but its potential is also not fully exploited due to inefficient combination of it with the human capital. On the contrary, Swiss firms seem to be able to take a maximum out of the potential of ICT and decentralization through the appropriate combination of them with human skills. In general, it can be concluded that Swiss firms are more efficient and mature in combining these 'new' production factors (ICT capital, human capital, organizational capital and knowledge capital) than the Greek ones.

It is interesting to examine how relevant is the national context for explaining the above-mentioned differences between Greece and Switzerland concerning the effects of these 'new' production factors and their combination on productivity. Even though we can only indirectly infer to the influence of the national context on the effects of these productivity determinants, some implications seem to be quite straightforward. For a high economic performance of firms important is not only the level of investment in hardware ('traditional'' capital and ICT capital), which is comparable in both countries for the type of industries we considered; even more important are a number of characteristics of the national context that influence the

efficiency of the use and exploitation of this hardware, such as the quality of the whole education system (which provides both the initial and the continuous education of the human resources), overall favourable conditions for innovation (flexible factor and product markets, high-quality basic research, efficient technology transfer between universities and industry, low bureaucracy, efficient state administration), and a tradition or mentality of "co-operative" management allowing employees to bear more responsibility as to business matters. With respect to all these things the differences between the two countries are large, so we can argue that they result in differences concerning the efficiency of creating, using and combining ICT capital, human capital, organizational capital and knowledge capital. Moreover, Switzerland is characterised by a higher level of economic development than Greece, so it has a stronger and longer tradition and experience in using advanced technologies of various types, applying sophisticated workplace organization practices, and combining them with appropriate human resources, which affect positively the capability of Swiss firms to adopt, incorporate, use and combine the above 'new' types of capital. In this direction also push the stronger competition and the bigger market size that Swiss firms face due to their higher level of exports and international expansion. For the above reasons it seems to us quite reasonable to argue that the different framework conditions of the national economies and contexts could explain a considerable portion of the differences with respect to the effectiveness of ICT, human capital and organizational practices at firm level that we found in this study between Greece and Switzerland. Therefore this study provides some first evidence that the national context influences the effect of these 'new' production factors and their combination on productivity.

The results of this study have interesting policy implications, first, at the government level, given that a country government wants to exercise an industrial policy, which is rather the case for Greece than for Switzerland. Government organizations should provide to the firms support (e.g. subsidies, low-interest loans, tax reductions and other motivations) for making not only 'hard' investments in ICT and other equipment, but also for making the corresponding 'soft' investments as well, in new human skills (e.g. in employing the required new highly skilled personnel and in training the existing personnel so that they acquire required new knowledge and skills) and new organizational practices (e.g. in designing and starting new organizational structures and work processes). At the same time government organizations (especially the ones of the non highly developed countries) should provide to the firms (and especially to the SMEs) knowledge (e.g. training, guides, best practices both from the same country and from other more advanced countries, etc.) concerning the efficient creation, use and exploitation of ICT capital, human capital, organizational capital and knowledge capital, and also concerning the appropriate combination of them.

Second, at the firm level and from a management science point of view it is necessary to develop appropriate learning and knowledge management mechanisms (e.g. interdisciplinary teams with highly skilled personnel, processes, best practices databases, etc.) targeted at increasing their capabilities, efficiency and maturity in creating, using and combining these

'new' production factors (ICT capital, human capital, organizational capital) that become increasingly important for their success in modern economy. The main mission of these mechanisms should be to identify, gather (from both within the firm and from other firms of the same sector or other sectors), analyze, organize, update and disseminate knowledge concerning the creation, use and combination of these critical 'new' production factors.

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Tables:

Table 1: Summary of the Empirical Literature

Study	ICT	ORG	HC	Complementarity
USA:				
Black/Lynch (2000)				
- cross-section	positive	positive	n.s.	n.s.
- longitudinal	positive	positive	n.s.	n.s.
Capelli/Neumark (2001)				
- cross-section	positive	positive	n.s.	n.s.
- longitudinal	positive	positive	n.c.	n.s.
Bresnahan et al. (2002)				
- cross-section	positive	positive	positive	ORG/ICT; HC/ICT
Brynjolfsson et al. (2002)				
- longitudinal	positive	n.s.	n.c.	ORG/ICT
Australia:				
Gretton et al. (2002)				
- longitudinal	positive	positive	positive	ORG/ICT; HC/ICT
Germany:				
Bertschek/Kaiser (2001)				
- cross-section	positive	positive	n.c.	n.s.
Wolf/Zwick (2002)				
- longitudinal	positive	positive	positive	n.c.
Hempell (2003)				
- longitudinal	positive	n.c.	n.s.	ICT/HC
Bauer (2003)				
- cross-section	n.a.	n.s.	n.a.	n.c.
- longitudinal	n.a.	positive	n.a.	n.c.
France:				
Caroli/Van Reenen (2001)				
- longitudinal	n.s.	positive	n.s.	ORG/HC
Switzerland:				
Arvanitis (2005)				
- cross-section	positive	positive	positive	ICT/HC
UK:				
Crespi et al. (2006)				
- longitudinal	positive	n.s.	n.c.	ICT/ORG

Notes: the dependent variable is average labour productivity; ICT: information and communication technologies; ORG: workplace organization; HC: human capital; „positive": statistically significant (at the test level of 10%) positive coefficient of the variables(s) for ICT, ORG and HC respectively; n.s.: statistically not significant (at the test level of 10%); n.c.: not considered; n.a.: not available (for such cases in which the corresponding variables are included in the models, but the results are not explicitly presented).

Table 2: Patterns of use of ICT and new Organizational Forms in Greece and Switzerland

Variable	Greece	Switzerland
Average value-added per employee in Euro	74,506	106,821
Percentage of firms in which ... % of employees are using *intranet*:		
0	24.4	43.5
1-20	27.4	15.1
21-40	12.5	10.3
41-60	11.4	8.7
61-80	7.0	7.3
81-100	17.3	15.1
Percentage of firms in which ... % of employees are using *internet:*		
0	3.0	3.6
1-20	52.1	37.8
21-40	15.6	18.5
41-60	13.0	13.7
61-80	8.9	9.3
81-100	7.4	17.1
Percentage of employees with tertiary-level education	26.2	20.8
Percentage of employees with job-related training	23.3	26.8
Teamwork (1)	25.9	24.3
Job rotation (1)	7.7	3.6
Change of the number of management levels since 2000:		
- increase	15.6	3.7
- no change	80.7	87.3
- decrease	3.7	9.0
Overall distribution of decision competencies since 2000:		
- shift towards managers	7.4	3.4
- no shift	68.6	63.0
- shift towards employees	24.0	33.6
Distribution of decision competencies with respect to (2):		
work pace	9.9	12.3
sequence of tasks	2.2	13.8
assignment of tasks	0.4	4.8
way of performing tasks	4.8	15.2
solving of production problems	5.9	4.4
contact to customers	18.1	25.1
solving problems with customers	4.8	8.6

(1): percentage of firms reporting the values 4 or 5 of an ordinate variable measuring how widespread is *team-work* and job rotation resp. inside a firm on a five-point Likert scale; (2): percentage of firms reporting the values 4 or 5 of an ordinate variable measuring the distribution of decision competences to determine work *pace, the sequence of tasks etc. inside a firm* an on a five-point Likert scale

Table 3: Definition of model variables

Variable	Definition and measurement
Basic model	
logCL	Logarithm of gross investment expenditure per employee 2004
logASSETN	Logarithm of assets value per employee at the and of 2004
logQUAL	Logarithm of the share of employees with tertiary level education 2004
LogTRAIN	Logarithm of employees participating to internal and/or external training courses initialized or supported by the firm 2004
logRDL	Logarithm of R&D expenditure per employee (average of the period 2003-2005);
INTERNET	Six-level ordinate variable for the intensity of *internet use*: share of employees using internet in daily work: 0: 0%; 1: 1-20%; 2: 21-40%; 3: 41-60%; 4: 61-80%; 5: 81-100%
INTRANET	Six-level ordinate variable for the intensity of i*ntranet use*: share of employees using internet in daily work: 0: 0%; 1: 1-20%; 2: 21-40%; 3: 41-60%; 4: 61-80%; 5: 81-100%
TWORK	Ordinate variable measuring how widespread is *team-work* inside a firm on a five-point Likert scale (1: 'very weakly widespread'; 5: 'very strongly widespread'); team work: project groups, quality circles, semi-autonomous teams, etc.
JROT	Ordinate variable measuring how widespread is *job rotation* inside a firm on a five-point Likert scale (1: 'very weakly widespread'; 5: 'very strongly widespread'); team work: project groups, quality circles, semi-autonomous teams, etc.
LEVELS	Three-level ordinate variable for the change of the number of *managerial levels* in the period 2000-2005: 1: increase; 2: no change; 3: decrease
COMP_OVERALL	Three-level ordinate variable measuring the *change* of the distribution of decision competences between managers and employees inside a firm in the period 2000-2005: 1: shift towards managers; 2. no shift; 3: shift towards employees
COMP_WORKPACE	Ordinate variable measuring the distribution of decision competences to determine work *pace* (1: 'primarily managers'; 5: 'primarily employees')
COMP_WORKSEQ	Ordinate variable measuring the distribution of decision competences to determine the *sequence* of the tasks to be performed (1: 'primarily managers'; 5: 'primarily employees')
COMP_WORKASSIGN	Ordinate variable measuring the distribution of decision *competences to assign tasks* to the employees (1: 'primarily managers'; 5: 'primarily employees')
COMP_WORKWAY	Ordinate variable measuring the distribution of decision competences to determine the *way* of performing tasks (1: 'primarily managers'; 5: 'primarily employees')
COMP_PRODUCTION	Ordinate variable measuring the distribution of decision competences to solve emerging *production problems* (1: 'primarily managers'; 5: 'primarily employees')
COMP_CUSTOMER-CONTACT	Ordinate variable measuring the distribution of decision competences to *contact customers* (1: 'primarily managers'; 5: 'primarily employees')
COMP_CUSTOMER	Ordinate variable measuring the distribution of decision competences to solve emerging *problems with customers* (1: 'primarily managers'; 5: 'primarily employees')
Compact model	

ICT	Sum of the standardized values of the variables INTERNET and INTRANET
ORG1	Sum of the stardardized values of the variables TWORK, JROT and LEVEL
ORG2	Sum of the standardized values of the variables COMP_OVERALL, COMP_PRODUCTION and COMP_CUSTOMER
HUMAN	Sum of the standardized values of the variables logQUAL and logTRAIN
ICT*ORG1	Interaction term of the variables ICT and ORG1
ICT*ORG2	Interaction term of the variables ICT and ORG2
HUMAN*ORG1	Interaction term of the variables HUMAN and ORG1
HUMAN*ORG2	Interaction term of the variables HUMAN and ORG2
ICT*HUMAN	Interaction term of the variables ICT and HUMAN
Middle-sized firms	50 to 249 employees
Large firms	250 employees and more

Table 4a: Basic model: average labour productivity (log (value added per employee)
2004 [1] (OLS estimates); Greece

Explanatory variables	(1)		(2)		(3)		(4)	
	Original coeffi-cient	Standardized coeffi-cient	Original coeffi-cient	Standardized coeffi-cient	Original coeffi-cient	Standardized coeffi-cient	Original coeffi-cient	Standardized coeffi-cient
logASSETN	0.114*** (0.040)	0.174	0.126*** (0.039)	0.194	0.118*** (0.041)	0.181	0.130*** (0.040)	0.202
logQUAL	0.168*** (0.072)	0.160	//		0.206*** (0.071)	0.197	//	
logTRAIN	//		0.089* (0.049)	0.120	//		0.111** (0.049)	0.150
logRDL	0.015 (0.023)	0.040	0.021 (0.023)	0.060	0.009 (0.024)	0.024	0.016 (0.024)	0.043
INTERNET	//		//		0.104* (0.055)	0.127	0.144*** (0.005)	0.176
INTRANET	0.126*** (0.043)	0.202	0.145*** (0.040)	0.233	//		//	
Middle-sized firms	0.035 (0.155)	0.016	0.009 (0.159)	0.004	0.059 (0.156)	0.027	0.027 (0.160)	0.012
Large firms	-0.030 (0.173)	-0.013	-0.127 (0.176)	-0.053	0.013 (0.172)	0.005	-0.084 (0.176)	-0.035
Services firms	0.107 (0.137)	0.049	0.081 (0.138)	0.037	0.141 (0.138)	0.065	0.111 (0.139)	0.051
Constant	8.371*** (0.446)		8.860*** (0.435)		8.606*** (0.457)		8.736*** (0.450)	
N	252		255		251		254	
DF	7		7		7		7	
SER	1.023		1.026		1.030		1.033	
F	5.819***		5.474***		5.055***		4.660***	
R^2adj	0.118		0.109		0.102		0.105	

(1): calculated in full-time equivalents; reference group for sector dummies: manufacturing; reference group for firm size dummies: firms with less than 20 employees; standard errors in brackets; ***, **, * denote statistical significance at the 1%, 5% and 10% level respectively; heteroscedasticity-robust standard errors (White procedure).

Continued

Explanatory variables	(5)		(6)		(7)		(8)	
	Original coefficient	Standardized coefficient	Original coefficient	Original coefficient	Standardized coefficient	Standardized coefficient	Original coefficient	Standardized coefficient
logASSETN	0.114*** (0.041)	0.174	0.118*** (0.040)	0.179	0.112*** (0.040)	0.172	0.111*** (0.040)	0.170
logQUAL	0.125* (0.076)	0.119	0.143* (0.074)	0.136	0.137* (0.073)	0.131	0.148* (0.074)	0.141
logTRAIN	//		//		//		//	
logRDL	0.007 (0.024)	0.018	0.008 (0.024)	0.023	0.009 (0.024)	0.024	0.018 (0.024)	0.032
INTERNET	//		//		//		//	
INTRANET	0.104** (0.045)	0.167	0.116*** (0.043)	0.186	0.108** (0.043)	0.174	0.116*** (0.043)	0.187
TWORK	0.017 (0.040)	0.028	0.020 (0.038)	0.033	0.011 (0.038)	0.018	0.026 (0.039)	0.042
JROT	0.012 (0.047)	0.016	-0.007 (0.045)	-0.010	0.014 (0.046)	0.019	0.003 (0.046)	0.004
LEVELS	0.000 (0.157)	0.000	-0.002 (0.153)	0.001	-0.010 (0.153)	-0.004	-0.020 (0.154)	-0.008
COMP_OVERALL	0.021 (0.130)	0.010	//		//		//	
COMP_WORKPACE	-0.038 (0.077)	-0.037	//		//		0.110* (0.067)	0.105
COMP_WORKSEQ	-0.076 (0.093)	-0.060	0.153* (0.079)	0.120	//		//	
COMP_WORKASSIGN	-0.026 (0.119)	-0.016	//		//		//	
COMP_WORKWAY	-0.121 (0.097)	-0.101	//		0.182** (0.078)	0.152	//	
COMP_PRODUCTION	0.003 (0.082)	0.003	//		//		//	
COMP_CUSTOMER-CONTACT	-0.010 (0.072)	-0.011	//		//		//	
COMP_CUSTOMER	-0.004 (0.091)	-0.004	//		//		//	
Middle-sized firms	0.056 (0.161)	0.025	0.056 (0.157)	0.025	0.040 (0.156)	0.018	0.059 (0.158)	0.027
Large firms	-0.039 (0.178)	-0.016	-0.015 (0.173)	-0.006	-0.062 (0.173)	-0.026	-0.011 (0.174)	-0.005
Services firms	0.125 (0.145)	0.057	0.096 (0.138)	0.044	0.136 (0.138)	0.062	0.122 (0.138)	0.056
Constant	9.926*** (0.900)		8.499*** (0.551)		8.495*** (0.544)		8.570*** (0.547)	
N	252		252		252		252	
DF	18		11		11		11	

SER	1.031	1.023	1.020	1.025
F	2.622***	4.062***	4.247***	3.956***
R^2adj	0.104	0.118	0.124	0.114

Table 4b: Basic model: average labour productivity (log (value added per employee)) 2004 [1] (OLS estimates); Switzerland

Explanatory variables	(1)		(2)		(3)	
	Original coeffi-cient	Standar dized coeffi-cient	Original coeffi-cient	Standar dized coeffi-cient	Original coeffi-cient	Standar dized coeffi-cient
logCL	0.033*** (0.009)	0.123	0.033*** (0.009)	0.122	0.034*** (0.009)	0.127
logQUAL	0.043** (0.013)	0.094	0.041*** (0.013)	0.091	0.040*** (0.013)	0.088
logTRAIN	0.032** (0.010)	0.077	0.031*** (0.010)	0.075	0.034*** (0.010)	0.083
logRDL	0.013** (0.004)	0.097	0.014*** (0.004)	0.106	0.014*** (0.004)	0.104
INTERNET	0.027** (0.011)	0.082	0.023** (0.011)	0.068	0.026** (0.011)	0.076
INTRANET	0.031*** (0.009)	0.112	0.031*** (0.009)	0.115	0.030*** (0.009)	0.109
TWORK	0.002 (0.007)	0.008	0.003 (0.007)	0.008	0.002 (0.007)	0.007
JROT	-0.014 (0.010)	-0.032	-0.016* (0.009)	-0.037	-0.016 (0.010)	-0.036
LEVELS	0.033 (0.035)	0.023	0.032 (0.036)	0.023	0.026 (0.036)	0.018
COMP_OVERALL	0.007 (0.022)	0.007	0.001 (0.022)	0.002	0.008 (0.022)	0.008
COMP_WORKPACE	-0.002 (0.016)	-0.004	//		//	
COMP_WORKSEQ	-0.002 (0.014)	-0.004	//		//	
COMP_WORKASSIGN	-0.005 (0.016)	-0.008	//		//	
COMP_WORKWAY	-0.014 (0.013)	-0.027	//		//	
COMP_PRODUCTION	0.002 (0.015)	0.003	//		//	
COMP_CUSTOMER-CONTACT	0.027** (0.013)	0.065	0.038*** (0.010)	0.090	//	
COMP_CUSTOMER	0.020 (0.016)	0.039	//		0.038*** (0.011)	0.076
Middle-sized firms	0.010 (0.014)	0.019	0.005 (0.014)	0.009	0.006 (0.014)	0.012
Large firms	0.022* (0.013)	0.054	0.021 (0.013)	0.051	0.020 (0.013)	0.049
High-tech manufacturing	0.038 (0.042)	0.033	0.041 (0.042)	0.035	0.045 (0.042)	0.039
Low-tech manufacturing	0.087** (0.039)	0.078	0.087** (0.039)	0.077	0.092** (0.038)	0.082

Modern services	0.187***	0.129	0.188***	0.128	0.202***	0.137
	(0.057)		(0.057)		(0.057)	
Traditional services	0.021	0.018	0.025	0.021	0.041	0.035
	(0.041)		(0.041)		(0.040)	
Constant	10.926***		10.919***		10.914***	
	(0.118)		(0.111)		(0.111)	
N	1710		1710		1710	
DF	23		17		17	
SER	0.449		0.451		0.451	
F	17.9***		24.1***		23.8***	
R^2adj	0.189		0.187		0.185	

(1): calculated in full-time equivalents; reference group for sector dummies: construction; reference group for firm size dummies: firms with less than 20 employees; standard errors in brackets; ***, **, * denote statistical significance at the 1%, 5% and 10% level respectively; heteroscedasticity-robust standard errors (White procedure).

Table 5a: Compact model: average labour productivity (log (value added per employee) 2004 [1] (OLS estimates); Greece

Explanatory variables	(1)		(2)		(3)		(4)	
	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient
logASSETN	0.119*** (0.040)	0.182	0.112*** (0.040)	0.171	0.118*** (0.040)	0.181	0.117*** (0.040)	0.179
logRDL	0.004 (0.024)	0.012	0.003 (0.024)	0.007	0.004 (0.024)	0.011	0.004 (0.024)	0.011
HUMAN	0.093* (0.049)	0.143	0.095* (0.049)	0.145	0.091* (0.049)	0.141	0.101** (0.050)	0.156
ICT	0.098** (0.043)	0.160	0.101** (0.044)	0.166	0.101** (0.045)	0.165	0.095** (0.043)	0.156
ORG1	0.009 (0.036)	0.015	0.013 (0.036)	0.022	0.009 (0.036)	0.016	0.017 (0.037)	0.029
ORG2	0.030* (0.015)	0.130	0.032** (0.016)	0.137	0.030* (0.016)	0.130	0.030* (0.016)	0.129
ICT*ORG1	//		-0.034* (0.019)	-0.105	//		//	
ICT*ORG2	//		0.007 (0.009)	0.047	//		//	
ICT*HUMAN	//		//		-0.005 (0.022)	-0.015	//	
HUMAN*ORG1	//		//		//		-0.022 (0.021)	-0.063
HUMAN*ORG2	//		//		//		0.009 (0.008)	0.065
Middle-sized firms	0.016 (0.159)	0.009	0.008 (0.159)	0.003	0.016 (0.160)	0.007	0.007 (0.160)	0.003
Large firms	-0.079 (0.173)	-0.032	-0.087 (0.173)	-0.036	-0.085 (0.176)	-0.035	-0.092 (0.174)	-0.038
Services firms	0.097 (0.137)	0.044	0.058 (0.139)	0.026	0.099 (0.138)	0.045	0.078 (0.138)	0.036
Constant	9.580*** (0.444)		9.668*** (0.446)		9.599*** (0.452)		9.600*** (0.447)	
N	251		251		251		251	
DF	9		11		10		11	
SER	1.015		1.011		1.017		1.014	
F	5.104***		4.564***		4.581***		4.375***	
R^2adj	0.128		0.135		0.125		0.129	

(1): calculated in full-time equivalents; reference group for sector dummies: manufacturing; reference group for firm size dummies: firms with less than 20 employees; standard errors in brackets; ***, **, * denote statistical significance at the 1%, 5% and 10% level respectively; heteroscedasticity-robust standard errors (White procedure).

Table 5b: Compact model: average labour productivity (log (value added per employee) 2004 [1] (OLS/Rivers-Vuong estimates); Switzerland

Explanatory variables	(1)		(2)		(3)		(4)	
	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient
logCL	0.032*** (0.009)	0.119	0.033*** (0.009)	0.123	0.033*** (0.009)	0.125	0.033*** (0.009)	0.123
logRDL	0.014*** (0.004)	0.103	0.014*** (0.004)	0.101	0.015*** (0.004)	0.108	0.013*** (0.004)	0.096
HUMAN	0.362*** (0.083)	1.179	0.037*** (0.008)	0.122	0.038*** (0.008)	0.123	0.037*** (0.008)	0.120
RES1	-0.327*** (0.083)	0.982	//		//		//	
ICT	0.050*** (0.009)	0.179	0.215*** (0.045)	0.762	0.050*** (0.008)	0.177	0.049*** (0.009)	0.174
RES2	//		-0.167*** 0.046	-0.504	//		//	
ORG1	-0.003 (0.006)	-0.001	-0.000 (0.006)	-0.000	-0.214*** (0.081)	-0.802	-0.001 (0.006)	-0.002
RES3	//		//		0.214*** (0.080)	0.778	//	
ORG2	0.004* (0.002)	0.039	0.004* (0.002)	0.039	0.005** (0.002)	0.047	0.070*** (0.018)	0.655
RES4	//		//		//		-0.066*** (0.018)	-0.594
Middle-sized firms	-0.039** (0.019)	-0.077	-0.024 (0.017)	-0.049	0.057*** (0.021)	0.115	0.003 (0.013)	0.006
Large firms	-0.036* (0.020)	0.088	0.030 (0.020)	-0.073	0.087*** (0.025)	0.212	-0.003 (0.015)	-0.006
High-tech manufacturing	-0.154** (0.063)	-0.135	-0.139** (0.067)	-0.122	0.249*** (0.091)	0.218	-0.084 (0.056)	-0.073
Low-tech manufacturing	0.150*** (0.046)	0.135	0.032 (0.040)	0.029	0.236*** (0.073)	0.211	0.030 (0.041)	0.027
Modern services	-0.166* (0.100)	-0.112	-0.238* (0.131)	-0.162	0.378*** (0.090)	0.256	0.034 (0.070)	0.023
Traditional services	0.038 (0.042)	0.033	-0.087* (0.051)	-0.074	0.112** (0.054)	0.095	-0.122** (0.058)	-0.102
Constant	10.63*** (0.187)		11.52*** (0.099)		11.09*** (0.111)		11.45*** (0.089)	
N	1710		1710		1710		1710	
DF	13		13		13		13	
SER	0.447		0.448		0.449		0.448	
F	28.5***		28.8***		29.6***		28.2***	
R²adj	0.202		0.199		0.195		0.199	

(1): calculated in full-time equivalents; RES1 to RES4: the residuals of the first-step OLS estimates of the variables HUMAN, ICT, ORG1 and ORG2 respectively; reference group for sector dummies: construction; reference group for firm size dummies: firms with less than 20 employees; standard errors in brackets; ***, **, *

denote statistical significance at the 1%, 5% and 10% level respectively; heteroscedasticity-robust standard errors (White procedure).

Table 6: Compact model with interaction terms: average labour productivity
(log (value added per employee) 2004 [1] (OLS estimates); Switzerland

Explanatory variables	(1)		(2)		(3)	
	Original coeffi-cient	Standar dized coeffi-cient	Original coeffi-cient	Standar dized coeffi-cient	Original coeffi-cient	Standar dized coeffi-cient
logCL	0.033*** (0.009)	0.124	0.034*** (0.009)	0.128	0.034*** (0.009)	0.126
logRDL	0.014*** (0.004)	0.100	0.013*** (0.004)	0.097	0.013*** (0.004)	0.097
HUMAN	0.037*** (0.010)	0.119	0.040*** (0.009)	0.131	0.041*** (0.010)	0.134
ICT	0.054*** (0.009)	0.191	0.027* (0.016)	0.096	0.052*** (0.009)	0.184
ORG1	-0.001 (0.006)	-0.004	-0.002 (0.006)	-0.007	-0.011 (0.012)	-0.040
ORG2	0.005** (0.002)	0.047	0.006** (0.003)	0.052	-0.001 (0.004)	-0.011
ICT*ORG1	-0.001 (0.003)	-0.008	//		//	
ICT*ORG2	-0.002 (0.002)	-0.029	//		//	
ICT*HUMAN	//		0.008* (0.004)	0.099	//	
HUMAN*ORG1	//		//		0.003 (0.004)	0.039
HUMAN*ORG2	//		//		0.002* (0.001)	0.071
Middle-sized firms	0.013 (0.013)	0.027	0.016 (0.013)	0.031	0.015 (0.013)	0.030
Large firms	0.028** (0.012)	0.068	0.029** (0.012)	0.071	0.029** (0.012)	0.070
High-tech manufacturing	0.042 (0.043)	0.037	0.047 (0.042)	0.041	0.041 (0.042)	0.036
Low-tech manufacturing	0.081** (0.039)	0.073	0.084** (0.039)	0.075	0.082** (0.039)	0.073
Modern services	0.198*** (0.058)	0.135	0.188*** (0.059)	0.128	0.190*** (0.057)	0.129
Traditional services	0.026 (0.041)	0.022	0.030 (0.041)	0.025	0.028 (0.041)	0.023
Constant	11.32*** (0.079)		11.29*** (0.079)		11.29*** (0.079)	
N	1710		1710		1710	
DF	14		13		14	
SER	0.450		0.450		0.450	
F	28.3***		30.6***		28.5***	
R^2adj	0.186		0.187		0.187	

(1): calculated in full-time equivalents; reference group for sector dummies: construction; reference group for firm size dummies: firms with less than 20 employees; standard errors in brackets; ***, **, * denote statistical

significance at the 1%, 5% and 10% level respectively; heteroscedasticity-robust standard errors (White procedure).

APPENDIX:

Table A.1: Composition of the data sets by industries and firm size classes

	Greeece		Switzerland	
	N	Percentage	N	Percentage
Industry:				
Food, beverage	25	9.2	77	4.5
Textiles	6	2.2	24	1.4
Clothing, leather	7	2.6	6	0.3
Wood processing	3	1.1	27	1.6
Paper	3	1.1	24	1.4
Printing	12	4.4	52	3.0
Chemicals	12	4.4	66	3.8
Plastics, rubber	6	2.2	38	2.2
Glass, stone, clay	9	3.3	28	1.7
Metal	4	1.5	24	1.4
Metal working	7	2.6	106	6.2
Machinery	1	0.4	165	9.7
Electrical machinery	2	0.7	50	2.9
Electronics, instruments	3	1.1	122	7.1
Vehicles	2	0.7	20	1.1
Other manufacturing	5	1.8	30	1.8
Energy	3	1.1	33	1.9
Construction	14	5.2	179	10.5
Wholesale trade	52	19.2	142	8.3
Retail trade	21	7.7	102	6.0
Hotels, catering	27	10.0	56	3.3
Transport, Telecommunication	15	5.2	91	5.3
Banks, insurances	5	1.8	73	4.3
Real estate, leasing	2	0.7	11	0.6
Business services	16	5.9	151	8.8
Personal services	10	3.7	11	0.6
Firm size:				
20-49 employees	88	32.5	474	27.7
50-249 employees	105	38.7	875	51.2
250 employees and more	78	28.8	361	21.1
Total	281	100.0	1710	100.0

Table A.2: Descriptive statistics

	Greece		Switzerland	
Variable	Mean	Standard deviation	Mean	Standard deviation
Log (value added per employee)	10.833	1.088	11.834	0.515
LogASSETN (logCL)	10.084	1.660	8.699	1.856
logQUAL	2.869	1.040	2.534	1.099
LogTRAIN	2.386	1.454	2.725	1.212
logRDL	1.798	2.961	3.936	3.702
INTERNET	2.948	1.340	3.380	1.491
INTRANET	3.015	1.793	2.668	1.877
TWORK	1.915	1.775	2.218	1.677
JROT	0.945	1.493	0.505	1.145
LEVEL	1.881	0.423	2.053	0.350
COMP_OVERALL	2.166	0.536	2.304	0.529
COMP_WORKPACE	2.196	1.045	2.743	0.703
COMP_WORKSEQ	1.834	0.864	2.540	0.870
COMP_WORKASSIGN	1.483	0.654	2.038	0.686
COMP_WORKWAY	2.081	0.921	2.509	0.910
COMP_PRODUCTION	1.985	0.950	2.103	0.698
COMP_CUSTOMER-CONTACT	2.426	1.201	2.650	1.414
COMP_CUSTOMER	1.970	0.977	2.155	0.975

Table A.3a: Correlation matrix: basic model Greece

	Log ASSETN	Log QUAL	Log TRAIN	Log RDL	INTER NET	INTRA NET	TWOR K	JROT	LEVEL	COMP_ OVERA LL	COMP_ WORK PACE	COMP_ WORK SEQ	COMP_ WORK ASSIG N	COMP_ WORK WAY	COMP_ PROD UCTIO N	COMP_ CUSTO MER-CONTA CT
logQUAL	0.122	1														
LogTRAIN	0.060	0.402	1													
logRDL	0.114	0.132	0.057	1												
INTERNET	-0.035	0.437	0.248	0.091	1											
INTRANET	-0.019	0.483	0.358	0.103	0.641	1										
TWORK	0.081	0.109	0.112	0.157	0.073	0.069	1									
JROT	0.021	-0.019	0.176	0.129	-0.026	0.054	0.241	1								
LEVEL	-0.015	0.013	-0.025	-0.043	0.063	-0.017	-0.020	-0.057	1							
COMP_OVERALL	0.016	0.074	0.067	0.053	0.105	0.117	0.003	-0.012	-0.046	1						
COMP_WORKPACE	0.046	0.209	0.127	0.074	0.164	0.206	-0.119	-0.143	0.062	0.167	1					
COMP_WORKSEQ	-0.016	0.242	0.222	0.102	0.237	0.226	0.020	-0.004	-0.015	0.164	0.364	1				
COMP_WORKASSIGN	0.022	0.123	0.141	0.020	0.118	0.038	0.102	-0.041	-0.100	0.129	0.186	0.352	1			
COMP_WORKWAY	0.059	0.266	0.123	0.145	0.235	0.264	0.091	-0.132	0.034	0.124	0.509	0.457	0.390	1		
COMP_PRODUCTION	0.022	0.301	0.218	0.154	0.291	0.289	0.131	0.020	-0.049	0.107	0.320	0.344	0.291	0.366	1	
COMP_CUSTOMER-CONTACT	-0.002	0.232	0.331	0.058	0.205	0.237	-0.019	-0.002	-0.067	0.091	0.213	0.275	0.143	0.156	0.252	1
COMP_CUSTOMER	0.000	0.199	0.222	0.096	0.189	0.286	0.048	0.029	-0.073	0.116	0.183	0.200	0.260	0.210	0.370	0.589

Table A.3b: Correlation matrix: basic model Switzerland

	logCL	Log QUAL	Log TRAIN	logRDL	INTER NET	INTRA NET	TWOR K	JROT	LEVEL	COMP_ OVERA LL	COMP_ WORK PACE	COMP_ WORK SEQ	COMP_ WORK ASSIG N	COMP_ WORK WAY	COMP_ PROD UCTIO N	COMP_ CUSTO MER- CONTA CT
logQUAL	0.126	1														
LogTRAIN	0.142	0.211	1													
logRDL	0.175	0.259	0.117	1												
INTERNET	0.046	0.386	0.270	0.197	1											
INTRANET	0.111	0.323	0.273	0.262	0.598	1										
TWORK	0.100	0.222	0.244	0.265	0.205	0.288	1									
JROT	0.060	-0.002	0.084	0.103	-0.032	0.020	0.175	1								
LEVEL	-0.042	-0.003	0.032	-0.003	-0.050	0.028	0.024	0.040	1							
COMP_OVERALL	0.068	0.083	0.120	0.112	0.023	0.065	0.146	0.092	0.093	1						
COMP_WORKPACE	-0.004	0.067	0.090	0.047	0.157	0.152	0.066	-0.025	0.009	0.101	1					
COMP_WORKSEQ	0.053	0.163	0.130	0.123	0.159	0.188	0.126	-0.057	0.029	0.170	0.410	1				
COMP_WORKASSIGN	0.001	0.072	0.087	0.069	0.123	0.109	0.087	0.001	0.053	0.125	0.266	0.369	1			
COMP_WORKWAY	0.057	0.178	0.103	0.119	0.175	0.186	0.127	-0.039	0.002	0.107	0.301	0.370	0.292	1		
COMP_PRODUCTION	0.091	0.15	0.126	0.082	0.103	0.131	0.118	-0.007	0.036	0.101	0.203	0.266	0.233	0.320	1	
COMP_CUSTOMER-CONTACT	0.092	0.083	0.163	0.095	0.235	0.222	0.125	-0.059	0.036	0.131	0.250	0.326	0.256	0.227	0.271	1
COMP_CUSTOMER	0.051	0.118	0.064	0.132	0.201	0.199	0.108	-0.075	0.058	0.074	0.211	0.264	0.262	0.222	0.304	0.642

Table A.4a: Correlation matrix: compact model Greece

	logASSETN	logRDL	ICT	HUMAN	ORG1
logRDL	0.114	1			
ICT	-0.030	0.108	1		
HUMAN	0.111	0.116	0.504	1	
ORG1	0.047	0.134	0.066	0.121	1
ORG2	0.025	0.145	0.375	0.393	-0.035

Table A.4b: Correlation matrix: compact model Switzerland

	logCL	logRDL	ICT	HUMAN	ORG1
logRDL	0.175	1			
ICT	0.088	0.257	1		
HUMAN	0.147	0.233	0.446	1	
ORG1	0.066	0.192	0.148	0.206	1
ORG2	0.096	0.172	0.288	0.245	0.121

Table A.5: 1-step instrumental estimates; Switzerland

Explanatory variables	logCL	logRDL	ICT	ORG1	ORG2	HUMAN
EXP_IND	-0.011***	//	-0.009***	//	-0.035***	-0.011***
	(0.003)		(0.002)		(0.007)	(0.003)
JOBR_IND	-0.016*	0.045***	-0.020***	0.024***	//	//
	(0.008)	(0.010)	(0.006)	(0.007)		
COMP_WORKSEQ_IND	-0.056***	0.084***	0.025**	//	0.082**	//
	(0.016)	(0.019)	(0.012)		(0.038)	
COMP_CUSTOMER_CONTACT_IND	0.017*	//	0.023***	//	0.053**	//
	(0.009)		0.008		(0.021)	
Middle-sized firms	0.198***	0.458***	0.248***	0.195***	0.201	0.164***
	(0.045)	(0.069)	(0.033)	(0.050)	(0.130)	(0.044)
Large firms	0.275***	0.732***	0.352***	0.266***	0.466***	0.192***
	(0.036)	(0.058)	(0.031)	(0.040)	(0.102)	(0.034)
High-tech manufacturing	1.528***	4.063***	2.183***	0.636***	4.984***	1.491***
	(0.299)	(0.252)	(0.217)	(0.176)	(0.695)	(0.237)
Low-tech manufacturing	1.423***	1.292***	1.196****	0.318*	2.880***	0.378**
	(0.242)	(0.253)	(0.171)	(0.184)	(0.548)	(0.182)
Modern services	0.865***	1.806***	3.169***	0.639***	3.935***	1.747***
	(0.183)	(0.243)	(0.137)	(0.168)	(0.489)	(0.153)
Traditional services	0.642***	-0.360*	1.068**	0.159	3.000***	0.234*
	(0.185)	(0.204)	(0.139)	(0.155)	(0.469)	(0.140)
Constant	8.229***	0.063	-1.388***	-1.158***	-2.756***	-2.312***
	(0.165)	(0.176)	(0.103)	(0.134)	(0.481)	(0.119)
N	1710	1710	1710	1710	1710	1710
DF	10	8	10	7	9	7
SER	2.083	3.082	1.517	1.813	4.529	1.493
F	12.8***	157.2***	102.8***	18.2***	16.7***	43.4***
R^2adj	0.044	0.286	0.283	0.061	0.073	0.149

EXP_IND: mean of export shares at the 2-digit industry level; JROT_IND: share of firms in a 2-digit industry with the values 4 and 5 of the variable JROT (see Table 3); COMP_WORKSEQ_IND: share of firms in a 2-digit industry with the values 4 and 5 of the variable COMP_WORKSQ (see Table 3); COMP_CUSTOMER_CONTACT_IND: share of firms in a 2-digit industry with the values 4 and 5 of the variable COMP_CUSTOMER_CONTACT (see Table 3); reference group for sector dummies: construction; reference group for firm size dummies: firms with more than 20 and less than 250 employees; standard errors in brackets; ***, **, * denote statistical significance at the 1%, 5% and 10% level respectively; heteroscedasticity-robust standard errors (White procedure).