The new economy meets the old: the importance of international ICT knowledge-flows for market share dynamics

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Abstract:

This paper investigates the role of Information and Communication Technologies (ICTs) related knowledge flows for international competitiveness. Using bibliometric data we analyse the relationship between the strength of 12 OECD countries in four ICT related scientific fields and the ability of those countries to maintain and acquire export market shares in the OECD market, across 15 manufacturing sectors over the period 1981-1994. Unit labour costs and “own sector” technological activity are controlled for, while using a dynamic panel data model. We find that both domestic and foreign ICT related knowledge flows have a positive and significant impact on export shares only in high technology sectors.

JEL-classification: C23, F14, O31

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I Introduction

A substantial amount of recent research has been devoted to the analyses of the impact of Information and Communication Technologies on productivity (see for instance, Jorgenson, 2001; van Ark, Inklaar and McGuckin, 2002). Much less research has been devoted to the effect of Information and Communication Technologies on other economic variables, such as variables related to international trade. This paper is concerned with the importance of ICT inter-sectoral knowledge flows for market share dynamics (or “competitiveness”), i.e. the ability of OECD countries to maintain or acquire market shares at the sectoral level. Within the “technology-gap” literature on international trade, Soete initiated the research tradition looking at the role of technology for competitiveness (Fagerberg, 1996, p. 46). Subsequently, a substantial amount of papers have provided more sophisticated econometric analyses on this issue also in a dynamic context (e.g. Fagerberg, 1988; Amendola, Dosi and Papagni, 1993; Magnier and Toujas-Bernate, 1994; Amable and Verspagen, 1995; Verspagen and Wakelin, 1997; for a review, see Fagerberg, 1996). More recently, attempts have been made to incorporate technological inter-sectoral linkages in models of market share dynamics either by looking at embodied R&D flows between sectors (Fagerberg, 1997; Laursen and Meliciani, 2000; Laursen and Meliciani, 2002) or by estimating the effect of national and international knowledge stocks for trade performance (Gustavsson, Hansson and Lundberg, 1999).

Previous research by Laursen and Meliciani (2000) has analysed the role of technology-based inter-sectoral linkages for the ability of OECD countries to maintain or acquire market shares at a 19 sector level. In that work the role of trade-related or embodied knowledge-flows at the national level was examined. Subsequently, Laursen and Meliciani (2002) made an attempt to identify the importance of trade-related knowledge-flows at the international level, while using a combination of R&D data, import data, and input-output data. However, no evidence of an impact from such trade-related knowledge-flows was detected. Therefore, we are in this paper tracing non-trade-related national and international knowledge-flows, using ISI bibliometric data. Since ICTs are generally seen to be pervasive technologies (Freeman and Perez, 1988; Helpman, 1998) which may affect the organisation of production in all sectors of the economy, we have chosen to focus on the effects of ICT creation and diffusion.

The basic idea is to use the science-production relevance matrix, constructed by Laursen and Salter (2002). Based on publications by private business firms, the relevance of four ICT related scientific fields for 15 manufacturing sectors is conjectured. The procedure hinges on the assumption that if firms in particular sectors publish papers in particular fields of science, then they – at least partly – do it because they have, and wish to maintain, an "absorptive capacity" in the relevant scientific fields. Using this relevance scheme, we analyse the relationship between the strength of 12 OECD countries in four ICT related scientific fields and the ability of those countries to maintain and acquire export market shares in the OECD market, across 15 manufacturing sectors over the period 1981-1994. Unit labour costs and "own sector" technological activity are controlled for, while using a dynamic panel data model. The data used for the study are drawn from the ISI National Indicators on Diskette, SPRU BESST, the US Patent Office and from the OECD STAN databases.

However, the idea of the present paper is not only to look at domestic sources of ICT related knowledge (as done by Laursen and Salter, 2002), but also to try to assess the importance of international scientific knowledge in ICTs for the ability of OECD countries to maintain or acquire market shares at the 15 sector level. However, in order to calculate such flows of international scientific knowledge, country-level weights are needed in order to determine the importance of each country as a knowledge source to any of the other countries in the analysis. In this context we are using data given by Tijssen and van Wijk (1998) on international co-publications in "computers and data processing" and in "telecommunications" for 1993-1996 across 23 partner countries. The key assumption here is that the more the scientists of a given country collaborate with scientists of another country, the more is drawn from the science base of the foreign country.

The paper is structured as follows. Section II contains a discussion of the existing theoretical and empirical literature on the role of ICT related spillovers for economic development. Section III describes the data and the variables to be applied, while Section IV depicts the econometric specification used. In Section V our estimations are presented and discussed. Finally, Section VI concludes.

II The role of ICT related spillovers

A. Theory

One of the fundamental insights provided by Schumpeter (1939) is that technological innovations are not evenly distributed over countries, industries and time. Extending on this insight, neo-Schumpeterian authors, using a more or less historical approach, introduced the concept of a *techno-economic paradigm* in the 1980s. The concept has been used to refer to a set of guiding principles, which become managerial and engineering common sense for each major phase of development (Perez, 1983; Freeman and Perez, 1988). A change in paradigm carries with it many clusters of radical and incremental innovations and has pervasive effects throughout the economy, spreading from the initial industries where it takes place to the whole economy. Such characteristics may be found in different waves of development in coal, steel, oil, and nowadays in microelectronics and telecommunications.

More recently, economists have made attempts to formalise the introduction and effects of pervasive technologies, under the label General Purpose Technologies (GPTs) (Bresnahan and Trajtenberg, 1995; Helpman, 1998). The notion of General Purpose Technologies (GPTs) was first coined by Bresnahan and Trajtenberg in a conference contribution from 1991 and later published as Bresnahan and Trajtenberg (1995).[1] GPTs are radical new ideas or techniques that have the potential for important impacts on many sectors of an economy. Bresnahan and Trajtenberg identified three key characteristics: pervasiveness (they are used as inputs by many downstream sectors), technological dynamism (inherent potential for technical improvements), and "innovational complementarities" with other forms of advancement (meaning that the productivity of R&D in downstream sectors increases as a consequence of innovation in the GPT). Thus, as GPTs improve they spread throughout the economy, bringing about generalised productivity gains. In general, the literature focuses on the comparison between the social optimum and the outcome of a decentralised economy in the presence of GPTs which are characterised by innovational complementarities giving rise to increasing returns to scale.

1 It can be noted that the Bresnahan-Trajtenberg model is a partial model, while subsequent contributions (such as Helpman and Trajtenberg, 1998; Jacobs and Nahuis, 2002) have applied explicit general equilibrium frameworks.

The recent ICT "revolution" can be seen to be one such GPT, since today, computers and related equipment are used in most sectors of the economy. ICTs have also displayed a substantial level of technological dynamism spurring not only radical improvement in computational capacity (following Moore's Law), but also a successive wave of new technologies (ranging from the semiconductor to the Internet). Moreover, ICTs have seriously facilitated new ways of organising firms, including the decentralisation of decision making, team production ect. (Milgrom and Roberts, 1990; Brynjolfsson and Hitt, 2000; Bresnahan, Brynjolfsson and Hitt, 2002). Thereby ICTs have clearly exhibited innovational complementarities with other forms of advancement.

One of the main issues analysed within the GPT literature has to do with the attempt to understand why GPTs are most often — if not always — slow in fulfilling their potential for increasing productivity. The "Solow-paradox", in the context of ICT, is a recent and famous example of a slow realisation of a GPT's potential. Bresnahan and Trajtenberg (1995) suggest three possible explanations for the observed paradox. One explanation lies in the possibility that GPT sectors and user sectors face a coordination problem, producing "too little, too late innovation" (p. 94). Moreover, difficulties in forecasting the technological developments of the other side (GPT producers and users) tend to lower technical advance in all sectors of the economy. Finally, Bresnahan and Trajtenberg point to the importance of the match between GPTs and specific institutions which facilitate or hinder GPTs in playing out their roles as engines of growth. If institutions carry more inertia than leading technologies, then an economy with the "wrong" institutions may prove inadequate for supporting GPTs, including the application sectors (p. 104).

While the GPT literature arguably is focussed on general mismatches (such as the Solow-paradox) with respect to GPTs, the arguments can be extended to assist in explaining why some countries have more problems in adopting a GPT as compared to others, since the potential mismatches may be weaker or stronger from country to country. As a consequence countries' ability to achieve low rates of unemployment, high rates of growth and growth in export market shares are likely to be linked to the extent to which they are able to produce and use the new technologies.

B. Empirical analyses on the impact of ICT on countries' performance

Empirical analyses of the impact of ICT on countries' performance have mainly focused on estimating the impact of this technology on the level of total factor productivity of the various sectors of the economy that are users of these technologies. For example, Jorgenson and Stiroh (2000) find that the acceleration in the rate of growth of productivity in USA in the '90s depends on the rate of growth of productivity in ICT. However they find that the sectors that have invested most in ICT have shown less pronounced increases in productivity. This can be explained considering that in the sectors which use more ICT (such as financial services or insurance) it is more difficult to measure the inputs and outputs and therefore to measure the increases in efficiency. Daveri (2000) finds that ICT explain between 20 and 40% of the growth rate in the '90s and that the low performance of countries such as Italy and Spain can be partly explained by the limited diffusion of these technologies. Gambardella and Torrisi (2001) find that investments in information technologies have a positive and significant impact on total factor productivity of Italian firms with a total elasticity of about 30%. They also look at the impact on employment and find that over the period 95-96 to 96-97, in three over four Pavitt sectors (all but science based), ICT-intensive firms have experienced a rate of growth of employment significantly higher than non ICT-intensive firms.

Other studies, with a different theoretical framework not necessarily based on the neo-classical production function, have also stressed the rising importance of ICT in terms of both the innovation rate and the rate of growth of international demand (Freeman, 1987; Freeman, Sharp and Walker, 1991; Guerrieri, 1992; Guerrieri and Milana, 1995) and have linked the rise and diffusion of the new technologies to the success of the Japanese economy and of the NICs (Freeman and Soete, 1994). At the same time great concern has been expressed about the position of most European countries, which have not been able to accumulate strong competencies in the fast-growing fields. Fagerberg, Guerrieri and Verspagen (1999) have argued that the problems that Europe faces in terms of low rates of growth and high rates of unemployment are partly linked to the unsatisfactory performance of European countries in science based industries and in particular in ICT. Over the 1980s European integration appears to have favoured natural resource-based and scale-intensive industries while Europe has experienced significant losses in export shares in R&D based industries.

For what concerns ICT and international trade, only a few studies are available. However, Meliciani (2002) shows that national specialisation in fast-growing technological fields (were ICTs – measured by patent statistics – are *the* fastest growing technologies) is positively associated with the rate of growth of export shares and negatively associated with the rate of growth of import shares. This may be taken as indirect evidence of the existence of national ICT related spillovers. In this paper we aim at estimating not only such spillovers more directly, but also at measuring international ICT related spillovers at the sectoral level.

III The data and variables

The bibliometric data used for the analysis are drawn from the ISI database and from the SPRU BESST database on UK publications (for more information on BESST database see Hicks and Katz, 1997). Based on the SPRU BESST database's data on the publishing activity by UK firms over the period 1981-1994, we conjecture the relevance of 4 ICT related scientific fields (Robotics & Auto Control; Computer Science & Engineering; Electrical & Electronic Engineering; Information Technology & Communication Systems) for 15 manufacturing sectors. This procedure hinges on the assumption that if firms in particular sectors publish papers in particular fields of science, then they — at least partly — do it because they have, and wish to maintain, an "absorptive capacity" in the relevant scientific fields. The ISI database contains publication data for 105 fields of science for 176 countries over the period 1981-1998. The economic data are taken from the OECD STAN database (1998 edition), while patent data are obtained from the US Patent Office. Since the STAN database is very incomplete after 1994, we use data from all sources over the period 1981-1994. Moreover, we use the information for 12 countries.[2]

As argued above, by exploring patterns of publications by firms in an individual sector, it is possible to understand how firms draw and exploit different pools of scientific

2 The 12 countries are: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Spain,

knowledge. In this context, we use a science-production relevance matrix (or concordance table between scientific fields and sectors of production) constructed by Laursen and Salter (2002). They separated out the scientific publications of industrial firms in the UK research system. For the analysis, they used 292 firms, each of which had at least 10 scientific publications. These firms were then divided into 17 industrial sectors (following the STAN classification)[3], drawing from an existing classification developed by Hicks and Katz (1997) and based on the Financial Times list of companies. For each firm, their main line of business was explored, using annual reports and business publications, and thereby placed in the industrial sector that best corresponded to its profile of production. 172 firms were classified according to this method. Those firms where information about their main line of business was unavailable were removed from the analysis. Since the BESST database does not exactly use the ISI classification of scientific disciplines, some disciplines had to be collapsed (aggregated). As a result, 77 scientific disciplines were considered. Out of these 77 disciplines, we focus in this paper on the 4 ICT related scientific fields, and disregard the 73 other rows in the matrix.

Our measure of scientific ICT activity relevant to our 15 industrial sectors gauges the scientific strength (or performance) of the relevant national (or international) knowledge base. However, first we adjust for the unequal size of scientific disciplines by weighing the concordance table is by the size-distribution across the 4 scientific disciplines (based on the cumulated publications from the ISI database for all the relevant years). In this way we obtain an adjusted concordance (or "relevance") table.

In order to obtain the national relevant scientific strength, we calculate the share of publications by a given country (for a given year), in each of the 4 scientific fields from the ISI database and normalise the obtained vector by the total population of the given country. Subsequently, the resulting vector is multiplied (element-wise) by the adjusted relevance matrix (4 ICT related fields of science x 15 industrial sectors). The variable is then calculated by adding up the 4 fields for each of the 15 industrial sectors. In this way we get a single figure measuring the relevant national scientific strength in ICT related fields for each industrial sector ("Domestic ICT Linkages"). The procedure is repeated

Sweden, Great Britain, United States.

3 Due to data availability, we use only 15 of those sectors in this paper.

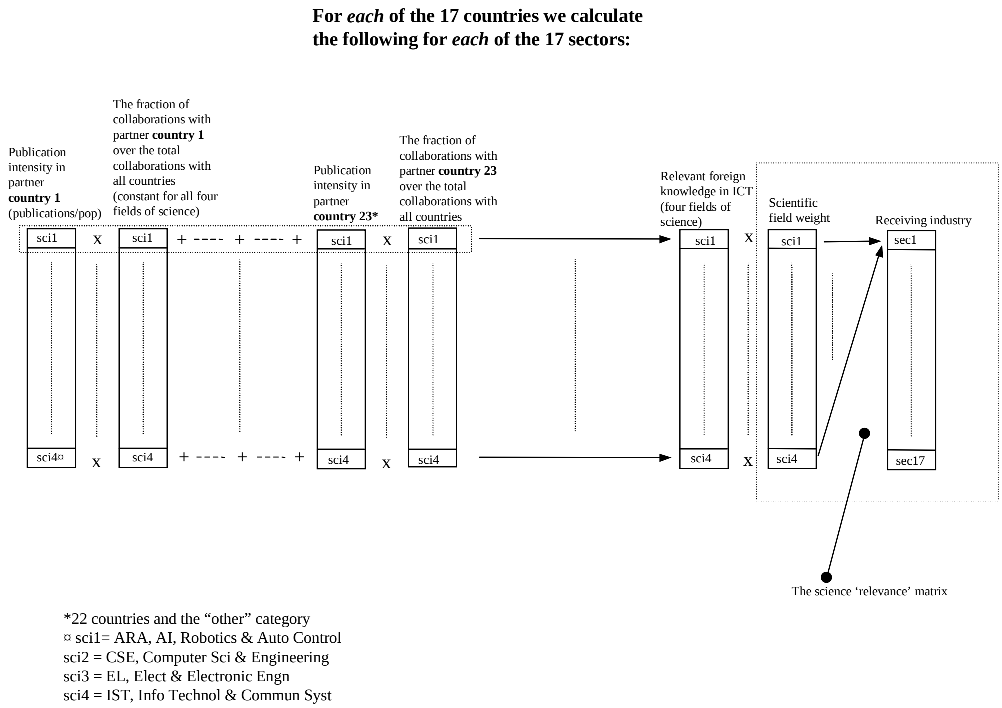

Figure 1: Calculation of international flows of ICT knowledge

for all years (14 years; 1981-1994) and countries (12 countries).

The calculation of the international ICT knowledge variable is illustrated in Figure 1. For a given country, sector and year we consider the following: First, the publication intensity of each of the 23 partner countries in each of the 4 scientific fields is considered. This component is calculated as the as the number of publications by the partner country, in the given scientific fields, divided by the population size of the partner country. The obtained component is then weighted by the fraction of collaborations with the given partner country over the total collaborations of the country under consideration with all countries. In this respect we are using data given by Tijssen and van Wijk (1998) on international co-publications in "computers and data processing" and in "telecommunications" for 1993-1996 across the 23 countries. We use Tijssen and van Wijk's category "computers and data processing" as a weight for "Robotics & Auto Control" and "Computer Science & Engineering", while we use Tijssen and van Wijk's category "telecommunications" to give weight to "Electrical & Electronic Engineering" and "Information Technology & Communication Systems". As stated earlier in this paper, the key assumption here is that the more the scientists of a given country collaborate with scientists of another country, the more is drawn from the science base of the foreign country.[4] The obtained figure is then subsequently added up for each of the four scientific fields, across the 23 partner countries. This vector, containing four elements is then in continuation hereof, weighted by the adjusted science-production relevance table described above. The international ICT spillover variable is then finally — and analogues to the national ICT spillover variable — calculated by adding up the 4 fields for each of the 15 industrial sectors. In this way we get a single figure measuring the relevant international scientific strength in ICT related fields for each industrial sector ("Foreign ICT Linkages"). Like in the case of the national spillovers, the procedure is repeated for all 14 years and 12 countries. In sum, the variable is constructed so that it will take higher values for each industry when the most important international collaborators are citizens of countries with a high number of scientific publications per capita in the relevant (to the particular sector, given by the relevance matrix) ICT scientific fields.

IV The Econometric Model

We estimate a dynamic model with an autoregressive structure in the dependent variable, which is similar to the model developed by Amendola *et al.* (1993). The econometric specification of the model with an autoregressive structure of the dependent variable should capture several cumulative mechanisms that reinforce the competitiveness of firms on international markets. Since the process of learning has sector specificities we distinguish between low, medium and high technology industries, as opposed to the aggregate model (country-level) estimated by Amendola *et al.*[5]

Adopting the autoreggresive representation on the variables we obtain:

4 In Tijssen and van Wijk (1998), the ICT co-publications data are only broken down on all the 23 countries in one dimension. We have obtained the 23x23 matrix on co-publications directly from Robert Tijssen of the University of Leiden, The Netherlands. For more details of the ICT co-publications data see Tijssen and van Wijk (1999).

5 The high-, medium- and low-tech classification is taken from the OECD (1996). High-tech: aerospace; office machines and computers; communication equipment and semiconductors; electrical machinery; pharmaceuticals; instruments. Medium-tech: industrial chemicals; rubber and plastics; non-ferrous metals; non-electrical machinery; motor vehicles; other transport. Low-tech: food, drink and tobacco; iron and steel; fabricated metal products.

$$EXP_{ijt}=\alpha_1 EXP_{ijt-1}+\alpha_2 PAT_{ijt}+\alpha_3 ULC_{ijt}+\alpha_4 DICT_{ijt}+\alpha_5 FICT_{ijt}+\alpha_{6j}+e_{ijt} \quad (1)$$

where EXP_{ijt} is relative exports of country j (exports of country j divided by the average value of exports for the countries in the sample), in sector i, at time t; PAT_{ijt} is relative patents of country j in sector i, at time t; ULC is relative unit labour costs; $DICT$ is relative domestic ICT linkages; $FICT$ is relative foreign ICT linkages, α_{6j} is a country-specific effect, e is the error term. All variables are in logarithms. We assume the intercept and all slope coefficients to vary between high, medium and low technology industries but we impose homogeneity across countries and over time. Future investigations could focus on possible differences in the estimated parameters for countries with different characteristics (e.g. different institutions that might favour or hamper the diffusion of ICT across sectors). We also assume, as it is standard in this literature, weak exogeneity of all explanatory variables. This specification allows obtaining only indirect estimates of long-run multipliers; in order to obtain direct estimates we can reformulate (1) as follows:

$$EXP_{ijt}=\beta_1(EXP_{ijt}-EXP_{ijt-1})+\beta_2 PAT_{ijt}+\beta_3 ULC_{ijt}+\beta_4 DICT_{ijt}+\beta_5 FICT_{ijt}+\beta_{6j}+e_{ijt} \quad (2)$$

where $\beta_1=-\alpha_1/(1-\alpha_1)$, $u=e/(1-\alpha_1)$ and $\beta_k=\alpha_k/(1-\alpha_1)$ with k=2,3,4,5.. In this equation, which can be obtained by deducting $\alpha_1 EXP_{ijt}$ from each side of (1), the coefficients on the independent variables are the long-run multipliers. (2) is estimated by pooled least-squares with dummy variables (LSDV) for country and sector fixed-effects. (2) requires instrumental variables to be estimated. Applying an instrumental variable estimator to a reformulated equation such as (2), with the set of instruments given by all explanatory variables in the original equation, allows obtaining the same long-run estimates which can be computed indirectly from the OLS estimation of (1) (Wickens and Breusch, 1987).

It is well known that the LSDV model with a lagged dependent variable generates biased estimates when the time dimension of the panel is small. Judson and Owen (1999) show that the LSDV bias of the coefficient on the lagged dependent variable can be sizeable even when T=20. In this case they show that a corrected LSDV estimator is the best choice when the panel is balanced, otherwise the Generalised Method of Moments (GMM) or the Anderson-Hsiao (AH) estimators are second best solutions. However, the difference in the Root Mean Square Error (RMSE) of the coefficient of the lagged dependent variable using the GMM, the AH estimator and the LSDV estimator is not large (see Judson and Owen, 1999, Table 2). Moreover the bias of the estimates of the other coefficients is relatively small and cannot be used to distinguish between estimators. Since our interest relies mostly on the sign and significance of these coefficients (and not on the magnitude of the coefficient on the lagged dependent variable) we use LSDV.

V Estimation and discussion

Table 1 reports the results of the estimation of equations (1) and (2). We follow Fagerberg (1997) in allowing the coefficients to vary between low, medium and high technology sectors. In fact, the product-cycle theory (Vernon, 1966) suggests that technology should be of prime importance for international competitiveness in high-tech industries, while cost advantages should matter more in traditional sectors. Moreover the diffusion of ICT is slower in more traditional sectors than in high-tech industries (see for example, Freeman and Soete, 1987), and therefore, the impact of ICT related knowledge flows on international competitiveness might differ across high, medium and low-tech industries.

The results mostly confirm these expectations. Unit labour costs and patents are significant with the expected sign for the three groups of sectors. Moreover, in the long run, unit labour costs have the largest impact in low technology sectors, followed by medium and high technology sectors. On the other hand we do not find patents to play a larger role in high technology sectors than in medium and low-tech sectors. However this result can be partly explained by the fact that we also include two other variables that should capture the technological intensity of the sector, i.e. domestic and foreign ICT related knowledge flows. In fact, both domestic and foreign ICT linkages show a positive and significant impact on export shares in high technology sectors, while they are not significant in medium and low-tech industries. This result shows that only high-technology sectors have benefited directly from ICT related disembodied knowledge flows. This is not surprising since our sample includes countries where the process of diffusion of ICT might not have spread completely to less technology intensive sectors yet.

Overall our results are consistent with those of previous empirical analyses on the determinants of export shares that highlight the crucial role of both cost and technology advantages (Fagerberg, 1988; Magnier and Toujas-Bernate, 1994; Amable and Verspagen, 1995). The results on domestic and foreign knowledge flows are not directly comparable to those of previous studies since, in this paper, we have focussed on disembodied ICT related knowledge flows. Laursen and Meliciani (2000) found that embodied domestic upstream linkages play a positive and significant role on export shares in high-tech industries. Laursen and Meliciani (2002) also found that embodied foreign linkages do not play a significant role on bilateral trade in most industries. The results of this paper suggest that also international knowledge flows matter for international competitiveness, when we focus the attention to ICT, i.e. to those fields of knowledge that can be considered GPTs or technologies that are at the heart of a new technological paradigm.

VI Conclusion

This paper has focussed on the impact of ICT related knowledge flows on international competitiveness. The main result of the paper is that such flows have a positive and significant impact on export shares in high technology sectors. Moreover this result holds for both domestic and foreign knowledge flows. On the other hand, we have not found any impact on medium and low technology sectors. One possible explanation of these results is that our sample includes also countries where the process of diffusion of ICT could not have fully affected all sectors of the economy yet. However, it is also possible that ICT related knowledge flows have played an indirect positive impact on export shares also in medium and low-tech industries by increasing productivity and thus lowering unit labour costs. Overall these results suggest that both the domestic development of scientific knowledge in GPTs and the acquisition of foreign knowledge through scientific collaborations can be crucial for international competitiveness in high technology industries.

The results of the paper also confirm the important role played by both cost and technology advantages in industries with different technological intensity, with a larger role of cost advantages for low technology sectors.

As displayed in previous studies on the impact of GPTs on productivity, the potential of the impact of the new technologies on international competitiveness may not have been fully realised yet. Therefore it is possible that achieving competitiveness in these areas, either domestically or through international co-operations, may in the near future prove important for gaining competitiveness in medium and low technology sectors as well.

In this paper we have focussed on the different impact of ICT related knowledge flows on international competitiveness distinguishing between high, medium and low-tech industries. Further investigations could examine whether ICT flows have a different impact for countries with different institutions or levels of development.

Table 1 – *Regression results: explaining market share dynamics. N=2262*

	Low technology		Medium technology		High technology	
	β	α	β	α	β	α
Unit labour costs						
Coefficient	-3.243	-0.125	-1.551	-0.164	-1.172	-0.084
t-value	(-1.890)	(-2.940)	(-4.850)	(-3.900)	(-2.920)	(-3.270)
Patents						
Coefficient	0.819	0.031	0.324	0.034	0.366	0.026
t-value	(2.330)	(2.240)	(2.260)	(1.750)	(2.100)	(2.040)
Domestic ICT linkages						
Coefficient	0.699	0.027	-0.313	-0.033	0.819	0.058
t-value	(1.040)	(1.090)	(-0.940)	(-0.850)	(1.690)	(1.850)
Foreign ICT linkages						
Coefficient	6.494	0.249	0.554	0.059	4.444	0.317
t-value	(1.290)	(1.540)	(0.270)	(0.270)	(2.160)	(2.130)
Lagged exports						
Coefficient		0.962		0.894		0.929
t-value		(60.950)		(32.070)		(55.920)
Adjusted R^2 (short run)	0.995					
Root MSE (short run)	0.162					
Root MSE (long run)	2.345					

Notes: Critical values are 2.58, 1.96, 1.64 at 1%, 5% and 10% levels of significance respectively; α is the short-run estimate and β is the long-run estimate. MSE denotes the mean square error. The *t*-values are based on heteroscedasticity consistent standard errors (using White's method). Country and sectoral fixed effects not printed for reasons of space.

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