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ICT Spatial Concentration and Growth Among European Regions

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Abstract
Since the mid of the 80's more prosperous European regions have growing faster than less prosperous ones, determining a widening of the gap between them. A possible explanation for the increasing gap relates to the effects of producing and/or using the information and communication technologies. In this case the increasing gap can be related to both the lower concentration of ICT industries and the lower use of ICT goods in less prosperous regions. For example, as both economies of scope as well as externalities due to geographical proximity characterise ICT industries, agglomeration economies could determine a cumulative process of concentration of ICT sectors in wealthier areas. In this paper we describe the distribution of ICT among European regions and we investigate empirically some effects of the use of ICT on European regional growth. We have found a positive correlation between ICT concentration and human capital as well as between regional growth and an index of the use of ICT in Europe.

Keywords
ICT, human capital, externalities

1. Introduction

Several studies have investigated the relationship between innovation in Information and Communication Technologies (ICT) and growth.[1] In particular, the contribution of ICT to the overall growth rate of an economy has been decomposed into the contribution of using ICT and the contribution of producing ICT. In general it has been found that the production of ICT goods and services is an important factor of economic growth, while mixed results have been reached with respect to the effect of the use of ICT. Oliver and Sichel, for example, have estimated that during 1996-99 ICT capital contributed to growth rate of output in US for 22.8% and that productivity increments in the production of computers and semiconductors was 13.48%. At the same time, Gordon found that the productivity contribution of computers, and in particular of internet, was mainly due to the manufacturing of computers and semiconductors. On the contrary, the effect of using ICT has been very poor.

As the production of ICT contribute significantly to economic growth it could be interesting to shed lights on the factors that affect the location of the ICT industries. At the same time, given the mixed results on the effect of the use of ICT on growth we further investigate this relationship. In particular, differently from most of the studies on this topic we propose to analyse previous relationships at regional level. The paper is organised as follows. In section 2 we discuss the mechanism through which spatial ICT concentration could increase the gap between rich and poor regions. In section 3 we present the data and analyse the spatial distribution of ICT among European regions. Section 4 reviews the factors that affect the ICT location while section 5 presents results of an empirical investigation on the relationship between the regional growth and the use of ICT. Section VI concludes.

2 The vicious circle of ICT spatial concentration

Since the 80s NIT industries were highly concentrated in national metropolitan regions (for example, Greater London, Greater Paris, and Greater Milan). Forces that push toward agglomeration, arising from increasing returns to scale and externalities deriving from local complementarities between different industries, have been determining a further concentration (of ICT industries) in core regions. As richest regions are also highly populated a large number of ICT users live therein. When economies of scope can be exploited and externalities arise from geographical proximity, as in the case of ICT industries, clustering is a plausible outcome which, in turn, implies that production costs of ICT products will be lower in regions where such cluster of ICT industries exists than elsewhere.

A first kind of externality arises in the labour market. In regions where ICT is well developed firms of different ICT industries benefit from a large market of skilled and experienced people and therefore search, recruitment, and training costs are greatly reduced. ICT firms face a high fluctuating demand both for cyclical factors and because there is a very fast substitution of old products with new ones. If there is an outside pool of skilled labour in the geographical area around the firms, these are released from a commitment to a large internal work force that must be laid off or called back as demand fluctuates. When firms require highly specialized skills to solve occasional esoteric problems that go beyond the capabilities of their regulars staff they could easily turn to outside specialists if they are located near the firms.

Another kind of externality could arise because geographical proximity facilitates and intensifies transmission of information. ICT industries are both vertically and horizontally

[1] Oliner and Sichel 2000; Daveri, 2001; Roeger, 2001; Von Ark, 2001 and Pilat and Lee, 2001, among others.

linked and therefore share a lot of common knowledge. Information exchange and knowledge spillovers are distinguished features of many technological high tech clusters such as Silicon Valley[2]. Patent ideas that might yield low returns hardly justify the setting-up of production lines in large companies, which exploit blueprints valuable million of dollars, whereas they could give easily rise to new firms when outside atmosphere is favourable.

Finally, an externality could arise from the reduction of transaction costs. In ICT industries the vertical proximity of suppliers and customers could decrease transaction and transport costs (Scott-Angel, 1985; Saxenian, 1989; Del Monte, 1991). In high tech industries transactions costs caused by uncertainty about the evolution of technological progress are very high and such uncertainty could be reduced by proximity between downstream and upstream firms[3].

The mechanism through which the growth of ICT production in richer regions and agglomeration economies could determine a cumulative process of concentration of ICT sectors in wealthier areas is described in Figure 1. In wealthy regions labour productivity is high. Furthermore such regions enjoy large externalities that induce massive investments in ICT sectors. In such regions there is a high innovative potential due to the abundance of skilled labour and human capital. Such capital encourages the location of ICT industries in such regions. The start-up of new firms in ICT sectors is therefore favoured by the abundance of skilled human capital and by the greater opportunities existing in wealthier areas. Therefore the spatial concentration of ICT industry, which rate of growth of productivity is higher than in other industries, in wealthier regions causes an increasing gap between these regions and the other ones.

3. The diffusion of ICT employment among European regions

A starting point to assess the impact of ICT on growth is to build a map of ICT industries. We consider as part of the ICT sector all areas of economic activity where information is a strategic element. On this point, Porat (1977) allocates the information activities of an economy into the primary and secondary information sectors. The primary information sector includes all industries that produce information goods or market information services as a commodity; the secondary information sector includes all information services produced by the government and by non-informational firms. However, as such distinction could include in the secondary information sector almost anything, it is necessary to have a narrower approach to define information industries. Houghton (1999) propose a two dimensional map drawn with a product-service dimension and a transport-content dimension that opens up the possibility of exploring convergence in terms of economies of scope. He divides the ICT sector in four main industries: - *communication services, information services, information and communication equipment, information content* .

[2] One of the pioneer of Silicon Valley, Nolan Bushnell illustrated this point: There is a tremendous amount of networking here in Silicon Valley, unmatched anywhere else. I recently visited a group of engineers in London who were working on a new product in competition with a group here in Silicon Valley. Both started at the same time, but the Silicon Valley team got the jump by six months. Our group included an engineer that had a friend worked at Intel. He smuggled out a couple of prototypes of a new chip that was just what they needed. The chip was soon to be on the market, but it was not yet in the catalog. "Reported by J.K.Larsen -E.M.Rogers" Silicon Valley fever Unwin paperback 1984.

[3] The spectacular growth of software goods by Ireland and Israel could in part be the consequence of an already developed ICT equipment industry.

In this paper we will use data on employment to measure the diffusion of the ICT sectors in European regions[4]. We will consider only sectors D30 and D32 in the *information and communication equipment* sector and K72 in the *information services* sector. We will not consider the *communication services* sector because we have not homogeneous data for the countries we consider. This narrow definition of ICT sector includes about the 50% of total employment in the ICT sector in 1997. In 1998 the total employment in ICT sector (narrow definition) was about two millions. The minimum number of employees was in Denmark (15000) and the maximum one in Great Britain, more than half million. The share of employment in ICT sector on total employment reaches the highest values among European Northern countries. The average value in the UE is 2,3%; Italy has a share very similar to the UE average while Spain a very low share. There are large differences between countries in the relative size of manufacturing ICT (D30 and D32) and services (K72). The higher share of employment in manufacturing sector is that of Ireland (3.34% of total employment), followed by Sweden and Finland. The lower is the Spanish one (0.43%).

A conventional measure of the degree of ICT regional diffusion (columns 1 and 2 of Table 2) within a country is the ratio between the weighted standard deviation of the share of employees in the ICT sector in each region and the mean,

$$\sigma/\mu = \frac{\sqrt{\sum_r \frac{[(L_{Set}/L_{Tot})_r - (L_{Set}/L_{Tot})_p]^2 (L_{Tot})_r}{(L_{Tot})_p}}}{(L_{Set}/L_{Tot})_p},$$

where L_{Set} denotes the employees in ICT sector, L_{Tot} is the total number of employees; r is the region and p is the country. The lower is the value of the index the lower is the regional ICT concentration. We have considered the eight countries for which data were available: German (NUTS-1), France (NUTS-2), Italy (NUTS-2), UK (NUTS-1), Austria (NUTS-1), Portugal (NUTS-2), Finland (NUTS-2). Results are shown in Table 2. Portugal and Sweden appear to be the countries where ICT employment is more concentrated. When the index is

[4] ICT industry is measured according to International Standard Industrial classification (ISIC).Following such classification sectors belonging to ICT industry are.

D30- Office accounting and computing machinery
D313-Insulated wires and cable
D32 –Communication equipment
- D321-Electronic valves and tubes and other electronic components
- D322 Television and radio transmitters and apparatus for line telephony and line telegraphy
- D323 Television and radio receivers ,sound or vieorecording or reproducing apparatus and associated goods

D3312 Instruments and appliances for measuring,checking,testing,navigating and other purposes ,except industrial process equipment
D3313 Industrial process control equipment

G515- Wholesing of Machinery,equipment and supplies
I642-Telecommunications
K7123 Renting of office machinery and equipment(includingcomputers)
K72 Computer services
- 721 Hardware consultancy
- 722 Software consultancy and supply
- 723 Data processing
- 724 Data base activities
- 725 Manteinance repair of office accounting and computing machinery
- 729 Other computer related activities

▪

computed using residential population Finland appears the country where ICT employment is more concentrated.

Country	Employee		Population	
	σ/μ	σ	σ/μ	σ
Portugal	0.685	0.728	0.812	0.00245
Sweden	0.546	2.974	0.677	0.00930
Austria	0.470	1.165	0.453	0.00304
France	0.453	1.156	0.776	0.00503
Finland	0.444	1.728	1.207	0.01291
Germany	0.386	0.657	0.472	0.00238
Italy	0.275	0.624	0.529	0.00301
UK	0.174	0.568	0.513	0.00145

*Table 1 Index of the degree of regional diffusion of employment of the ICT sector in some European countries**
**The year considered is 1998. Only for Italy and UK the year considered is 1997.*

We have also computed the index of ICT diffusion for the Computer service sector (K72). Results shown in Table 3 are very similar to those of Table 2.

Country	Employee		Population	
	σ/μ	σ	σ/μ	σ
Portugal	0.651	0.282	0.893	0.00110
Sweden	0.647	0.964	1.055	0.00400
Austria	0.520	0.987	1.587	0.00696
France	0.499	1.623	0.635	0.00521
Finland	0.444	0.499	0.454	0.00139
Germany	0.317	0.290	0.429	0.00116
Italy	0.277	0.389	0.528	0.00186
UK	0.223	0.459	0.487	0.00087

Table 2 Index of the degree of regional diffusion of employment of the Computer service sector in some European countries.*
** The year considered is 1998. Only for Italy and UK the year considered is 1997.*

4. ICT concentration and human capital supply

We have seen that the size of the ICT sector shows an high variability in Europe between countries and regions .In this paragraph we will try to understand what are the factors that cause such differences

Two main conclusions emerge from the descriptive analysis performed in previous sections: (i) the distribution of the ICT sectors among European regions is widely dispersed; (ii) in the recent past, industries producing ICT goods have beneficiated of high rates of technological progress. On a general perspective, the latter would imply that the regional distribution of the production of ICT sector, as emerging at the end of the 90's, should not be taken as a reliable proxy for the steady state distribution and, in turn, that any inference or policy recommendation which rests upon sample data should be made with care. The main characteristic of the ICT sector, however, determines that the current distribution is a matter of importance. In particular, by recognizing the presence of complementarities among ICT producing industries and of substantial linkages between ICT producing, and ICT using firms, a distribution characterised by high dispersion, or eventually by clusters of homogeneous regions, becomes of extreme interest. As under the assumption of local

complementarities new firms will tend to start up somewhere other firms are already grown up, this process can determine a strengthening of the actual dispersion confirming the club convergence hypothesis. Therefore the actual distribution becomes a reliable piece of information and it seems of substantial interest to shed light on the factors which have contributed to it. On this premise, we have performed an explorative analysis regarding the level of employment within the ICT producing industries, highlighting some facts which we believe of interests. We considered data at regional level for five large European countries, that is France (NUTS-2), Germany (NUTS-1), Italy (NUTS-2), Spain (NUTS-1), and United Kingdom (NUTS-1). The total sample contains 74 observations (regions).

We start by investigating an hypothesis which is in common with other authors, namely that in order to have a large number of ICT producing firms an important prerequisite is the supply of qualified labor in the region of interest[5]. In this sense, any constraint to the supply of human capital in a given region would refrain the development of the ICT sector and any element of the local labor market becomes a matter of importance. Thus we should expect a positive relationship between the size of the ICT-producing sector in a region and a proxy for the supply of skilled workers.

To concentrate on the role of human capital in the development of the ICT sector a practical difficulty relates to the definition of the variable of interest and, in turn, to the construction of a reliable proxy. A region's human capital endowment is reflected in formal education, work experience, and technical competency of its labour force. We try to measure approximately, for each region, the working age population able to be employed in ICT producing sector at the end of the 90's. To this end, we start considering the number of people enrolled in secondary school and universities at 1995, *HC*. This variable proxies the human capital investment in the form of education at the mid of the 90's and should be correlated with the stock of human capital at the end of the 90's. We then divide *HC* by the level of working-age population that is either of school age or of university age (aged 15 to 24) at 1995, *P*. The ratio, which is clearly imperfect, should measure approximately the fraction of population that at the end of the 90's will posses a level of education capable to be spent in the ICT sector. Finally, we multiply this rate for either the level of labor force or the level population at 1998 deriving our variable of interest, *HC*. Table 4 shows the values at country level for the share of ICT employment at 1998 and the index of human capital investment at 1995, both in percentage. United Kingdom and Spain have , respectively, the highest and the lowest values for the two variables.

	Employees in ICT, 1998 (%)*	Investment in human capital 1995 (%)
Spain	0,4	40
Germany	1,7	55
Italy	2,3	45
France	2,5	42
UK	3,3	56

Table 3 - ICT employees and human capital investment

[5] It has been recognised that workplace reorganization and skilled workers are a precondition to adopt the new technologies. In fact, for an efficient use of information technology and computers the labour force has to be able to use, or to learn how to use, ICT equipment, which in turn requires a well educated labour force. The latter is reflected in stronger demand for skilled workers than before.

*The share is computed on employees in industrial and non government services.

** Investment in human capital is the ratio between the number of registered students in technical high-school and in the university in 1995 and the share of population in the age 15-24.

To test the hypothesis that human capital can, at least in part, explain the actual distribution of the ICT sector among European regions, we regress the log of the employment share in the ICT sector at 1998 on the log of the proxy for education, *HC*, and country dummies to allow for structural differences among countries. We estimate a positive and statistically significant relationship, whatever proxy we use. The estimated elasticity is 0,36 (t ratio 6,44)[6]. Thus, as a first instance human capital cannot be rejected as one of the factors explaining the distribution of ICT employment between European regions. Of course, human capital is not the only variable that could affect the location of ICT firms. The latter is also due to the regional demand side effect for ICT products. The main bulk purchasers for the products of the ICT manufacturing industry and for the computer services are government institutions, large firms, and insurance and banking companies, which are mainly concentrated in rich regions. At the same time, it is possible that human capital captures the effect of another variable that is correlated with itself. Therefore, we also control for an index of labor productivity at regional level, that is the log of value added per employee. The estimated equation is the following:

$$\ln(ICT)_{r,c} = \alpha_c + \underset{(4.32)}{1.15}\ln(Y/L)_{r,c} + \underset{(7.02)}{0.31}\ln(HC)_{r,c} + \varepsilon_{r,c} \qquad \bar{R}^2 = 0{,}61;\ N = 74$$

where *ICT* denotes the share of the *ICT* sector relative to Industry and Market Services in terms of employment, *Y/L* denotes the value added per employment in the Industry and Market Services sector, *HC* is the proxy for human capital supply, *r* stands for region and *c* for country.[7] Values in parentheses denote *t*-statistics with heteroschedastic robust standard errors. The human capital index enters significantly in both the estimated equations and its coefficient is weakly affected by the presence of the productivity index. The latter is estimated positive and significative, too.[8] Thus, European regions seem to corroborate our main hypothesis that the counterpart of a relative large ICT sector is a high educational level.

5-Regional Growth and the use of ICT

In this section we present an explorative analysis of the relationship between productivity growth rates and the use of ICT, among the European regions for 1993-99. We consider the value added per employee, mainly for the Market Services sectors, as index of productivity, and the log difference of the value added per employee as a measure of growth. We are interested at the services sector as in this sector the effect of ICT, if any, should be identified as due to the use of ICT. At the same, as a measure of the diffusion of ICT we use the share of employment in ICT services relative to total employment. In this way, we hope to disentangle any effect related to the use of ICT instead of the production of ICT. We have regressed the productivity growth rate on the share of ICT employment and on the growth rate of total employment, also allowing for initial level of productivity and countries

[6] In this case the proxy is given by the share of registered student multiplied by regional populations.

[7] Estimates for the country dummies, as differences respect to the value for Italy, are: -2.65 (-2.36) for Spain; -0.46 (-3.21) for Germany; -0.18 (-1.62) for France; 0.65 (3.88) for UK. In parenthesis we report t-statistics.

[8] We also introduced among the regressors the share of employment in Industry and Market Services sectors and the employment level. Coefficients of both variables are not estimated significantly different from zero.

dummies. The main result is the positive and significative correlation between the regional growth rate and our index of the extent of the ICT sector (Table 6). In particular, the estimated coefficient measuring such correlation increases when we restrict the analysis at the end of the 90's, supporting the idea that the diffusion of the ICT is recent and that it takes time to exploit the advantage of the ICT. With reference to the estimate for 1995-99, an increase of employment in Computer and Related Activities sector by 1 percent of the total employment in Market Services sector matches a productivity increase (for the Market Services sector) of 0.5 percent per year, on average. Apparently this is a very strong impact of ICT. However, it is important to note that 1 percent of the total employment in Market Services sector corresponds, for many countries, to roughly 50% of employment in Computer and Related Activities sector at 1998. Table 6 also shows estimates relative to specific sub-sectors. The coefficient of interest is always estimated positive and significative. We believe of main interest results for the Financial Services sector as this sector is for sure just an user of ICT goods.[9]

6. Conclusions

Economic growth can be spurred by the development of the ICT sector mainly through two channels related, respectively, to the technological progress in the production of ICT goods and the exploitation of advantages in using ICT goods. In fact, in the recent past the production of ICT goods has been characterised by very high rate of technological progress, which has determined a discrete shift of the overall growth rate of any ICT-producing economy; at the same time, it has been recognised that by using the information and communication technologies almost all sectors of an economy can increase their growth rates. Therefore, the TFP growth rate of regions or countries characterised by high shares of the ICT-producing sector should be higher than elsewhere, due to the high rates of technological progress in the production of ICT goods. At the same time, it is also true that the labour productivity growth rate of regions or countries characterised by high rates of investment should be higher than elsewhere, due to the usual capital deepening effect. It has been argued, however, that there is a third channel through which the information and communication technologies can spur the growth rate of an economy. In fact, by using these technologies the overall growth rate of an economy can be further increased because of an externalitiy effect which determines a discrete shift of the production frontier. Examples of the latter effect should be traced to the use of computers and internet, the convergence between communication and information technologies, and the opportunity of networking (Fig.2).

At the moment it exists a large consesus among researchers that just the production effect of ICT can be ascertained empirically. A matter of fact is the substantial decrease of market prices for ICT goods which has been related to the strong technological progress in manufacturing these goods. At the same time, the externality effect of ICT has not been ascertained, yet. The latter, however, is much more difficult to measure empirically and it takes some time to be exploited by the firms. As many authors emphasise, in the near future many industries of the so called "old economy" will beneficiate of large productivity increments, thanks to re-organizations concerning the relationships among employees within the firms, the relationships among firms in the same sector, and the relationships between firms and consumers.

In this paper we propose a first step towards a complete analysis of the relationships that Fig. 1 and Fig. 2 entail. We have found a positive correlation between ICT concentration and human capital as well as between regional growth and an index of the use of ICT in

[9] See also Bailey (2002) for a similar result.

Europe. Thus, our results are in line with the premise of the paper that the widening of the disparities among European regions can be traced to the diffusion of the ICT.

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Appendix

A1. Fonti:

- D30:Eurostat-New Cronos
- D32:Eurostat-New Cronos
- K72:Eurostat-New Cronos (Germany: Statistiches Bundesamt-IIID2-Beschaftigtenstatistik; UK: Annual Employment Survey: Employee Analysis-ONS Crown)
- Employment in manufacturing and market services, GVA in manufacturing and market services: Cambridge Econometrics.

A2. Regioni e Paesi:

BELGIUM
Région Bruxellescapitale/Brussels hoofdstad gewest, Vlaams Gewest, Région Wallonne.
DENMARK
GERMANY
BadenWürttemberg, Bayern, Berlin, Brandenburg, Bremen, Hamburg, Hessen, MecklenburgVorpommern, Niedersachsen, NordrheinWestfalen, RheinlandPfalz, Saarland, Sachsen, SachsenAnhalt, SchleswigHolstein, Thüringen.
SPAIN
Noroeste, Noreste, Comunidad de Madrid, Centro (E), Este, Sur, Canarias (ES)
FRANCE
Île de France, ChampagneArdenne, Picardie, HauteNormandie, Centre, BasseNormandie, Bourgogne, Nord PasdeCalais, Lorraine, Alsace, FrancheComté, Pays de la Loire, Bretagne, PoitouCharentes, Aquitaine, MidiPyrénées, Limousin, RhôneAlpes, Auvergne, LanguedocRoussillon, ProvenceAlpesCôte d'Azur, Corse.
IRELAND
ITALY
Piemonte-Valle d'Aosta, Liguria, Lombardia, Trentino Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Toscana, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna.
NETHERLANDS
SWEDEN
Stockholm, Östra Mellansverige, Småland med öarna (NUTS95), Sydsverige, Västsverige (NUTS95), Norra Mellansverige, Mellersta Norrland, Övre Norrland.
UK
Cleveland, Durham (NUTS95), Cumbria (NUTS95), Northumberland,Tyne and Wear (NUTS95), Humberside (NUTS95), North Yorkshire (NUTS95), South Yorkshire (NUTS95), West Yorkshire (NUTS95), Derbyshire, Nottinghamshire (NUTS95), Leicestershire, Northamptonshire (NUTS95), Lincolnshire (NUTS95), East Anglia (NUTS95), Bedfordshire, Hertfordshire (NUTS95), Berkshire, Buckinghamshire, Oxfordshire (NUTS95), Surrey, EastWest Sussex (NUTS95), Essex (NUTS95), Greater London (NUTS95), Hampshire, Isle of Wight (NUTS95), Kent (NUTS95), Avon, Gloucestershire, Wiltshire (NUTS95), Cornwall, Devon (NUTS95), Dorset, Somerset (NUTS95), Hereford and Worcester, Warwickshire (NUTS95), Shropshire, Staffordshire (NUTS95), West Midlands (County) (NUTS95), Cheshire (NUTS95), Greater Manchester (NUTS95), Lancashire (NUTS95), Merseyside (NUTS95), Clwyd, Dyfed, Gwynedd, Powys (NUTS95), Gwent, MidSouthWest Glamorgan (NUTS95), BordersCentralFifeLothianTayside (NUTS95), Dumfries and Galloway, Strathclyde

(NUTS95), Highlands, Islands (NUTS95), Grampian (NUTS95), Northern Ireland (UK)(NUTS95).
AUSTRIA
Ostösterreich, Südösterreich, Westösterreich.
PORTUGAL
Norte, Centro (P), Lisboa e Vale do Tejo, Alentejo, Algarve, Açores (PT), Madeira (PT).
FINLAND
Uusimaa (NUTS95), EteläSuomi (NUTS95), ItäSuomi, VäliSuomi, PohjoisSuomi, Åland.
NORWAY

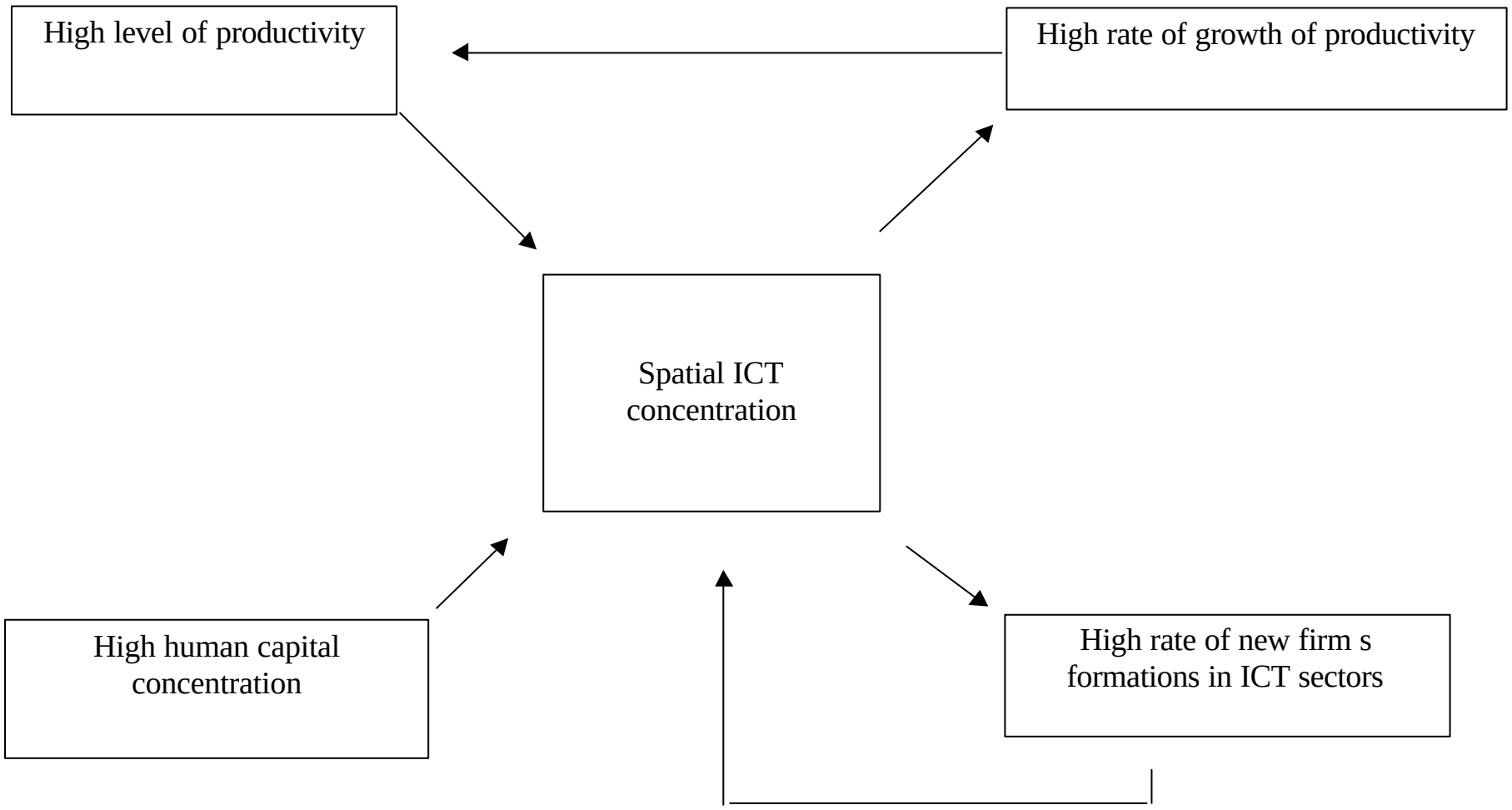

Figure 1. The vicious circle of ICT concentration

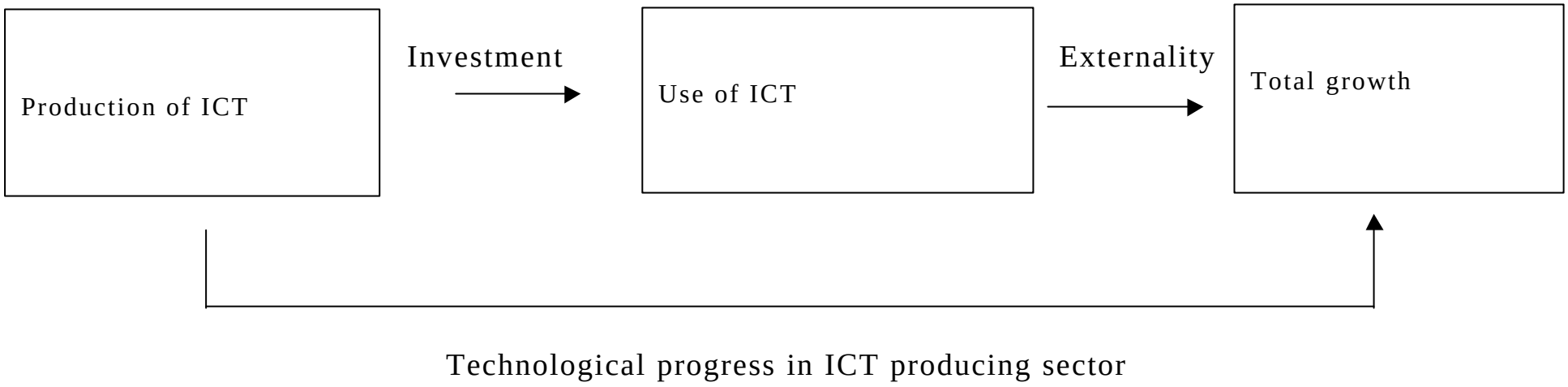

Figure 2. ICT and Growth

	Market Services		Manufacturing and energy		Distribution & Lodging Catering	Transport and communication	Financial services	Other financial services
	93–99	95–99	97–99	95–99	95–99	95–99	95–99	95–99
$(K72/L)_{97-8}$	0.47 * (2.35)	0.49 (3.64)	0.63 (3.53)	0.21 (1.46)	0.56 (3.74)	0.54 (3.56)	0.42 (3.35)	0.39 (3.21)
$\ln(Y/L)_{t_0}$	– 0.02 (– 4.25)	– 0.01 (– 1.47)	– 0.01 (– 1.60)	– 0.06 (– 5.78)	– 0.01 (– 1.98)	– 0.01 (– 1.24)	– 0.00 (– 0.46)	– 0.00 (– 1.11)
ΔL	– 0.54 (– 3.87)	– 0.72 (– 6.07)	– 0.94 (– 5.84)	– 0.88 (– 6.60)	– 0.68 (– 6.07)	– 0.68 (– 5.11)	– 0.64 (– 4.28)	– 0.48 (– 3.58)
N	67	89	89	89	89	89	89	89
$\overline{R}^2$	0.70	0.83	0.80	0.37	0.79	0.81	0.88	0.86

Table 4. Growth and the use of ICT (Dependent variable: rate of growth of labour productivity)