The contribution of information and communication technologies to the growth of the Spanish economy (1)

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1. INTRODUCTION

In recent decades the branches of activity of goods and services related to information and communication technologies (ICT) have made significant technological advances, enabling final prices to be significantly reduced at the same time as the quality of the goods and services produced has been improved.

There is a general consensus as to the importance of the diffusion of technical progress for economic growth. In relation to information and communication technologies three main channels of transmission should be distinguished. First, it might be expected that the ICT industries in which the technological innovation takes place will, in the initial phase of the process, see an increase in their rates of change of output and of productivity. Second, the reductions in prices and improvements in quality of ICT goods and services should boost investment in new technologies across the other branches of activity, and intensify the capital-labour ratio, thereby increasing the rate of growth of productivity in the other productive branches. Finally, positive spillover effects and improvements in the organisation of the production of the economy as a whole, linked to the use of this type of goods and services, may foreseeably emerge, with a positive impact on total factor productivity (TFP).

Given how significant the development of the new technologies may be for economic growth, it is important to try to quantify the impact of the three channels of transmission mentioned above. However, this task involves some serious problems. First, for most economies, detailed data are not available for output by industry and for stocks of IT and communications capital. Second, measurement of the output of some of the components of these branches of activity involves certain difficulties. Finally, the deflators used to estimate output and the stock of capital do not taken into account the full extent of quality changes, which in recent decades have had a very marked effect on ICT goods and services. Nonetheless, numerous recent studies try to overcome these limitations and analyse the contribution of new technologies to the growth of certain western economies (2).

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(1) This article is a summary of the forthcoming Working Paper with the same title.

(2) See, for example, Gordon (2000), Jogerson and Stiroh (2000), *Report of the President* (2001), Schreyer (2000), Van Ark (2001), IMF(2001).

TABLE 1

Weight of the ICT industries in the Spanish economy

a) As a percentage of the value added of the total market economy

	ICT manu-facturing	ICT commu-nications	ICT computer activities	Total ICT
1995	0.88	2.43	0.68	3.99
1996	0.87	2.55	0.73	4.15
1997	0.94	2.68	0.68	4.30
1998	0.94	2.76	0.95	4.65
1999	0.87	3.07	1.28	5.23

b) As a percentage of dependent employment in the total market economy

	ICT manu-facturing	ICT commu-nications	ICT computer activities	Total ICT
1995	0.83	1.13	0.76	2.72
1996	0.85	1.17	0.80	2.81
1997	0.84	1.09	0.97	2.89
1998	0.83	1.00	1.15	2.98
1999	0.79	0.93	1.25	2.97

Sources: Central Balance Sheet Office, DIRCE and National Accounts.

In the United States (where the aforementioned methodological problems are less serious) the numerous available studies coincide in indicating that the contribution of ICT to GDP growth has been significant, both as regards the direct impact of the industries producing ICT, which have seen their output and productivity rise, and through greater use of the new technologies as productive inputs. However, the results in terms of the effect on total factor productivity are not so unambiguous. Meanwhile, the studies existing for the European economy show that the growth of industries producing ICT and the greater use of these goods as inputs have had a positive effect on the expansion of GDP, albeit a smaller one than in the US. Nonetheless, this growth of ICT in Europe does not seem to have been sufficient to prompt significant increases in productivity, or at least to offset the effect of other factors that have had a negative impact on the efficiency of the European economy.

As regards Spain, the studies available analyse the contribution of ICT to economic growth from the viewpoint of their use as inputs by the rest of the branches of activity. Daveri (2001) and Hernando and Núñez (2001) find that, as in the case of most European economies, the contribution of the stock of ICT capital to growth of output and labour productivity has been significant, especially when it is taken into account that the weight

of this kind of capital good in the total capital stock is still low. Hernando and Núñez (2001) also find a tendency for this contribution to grow during the nineties.

The main purpose of this paper is to try to estimate, for the Spanish economy, the direct impact of the industries producing ICT goods and services on the growth of output, employment and productivity, making a comparative analysis with the overall growth of the market economy and developments in other EU economies and in the United States.

The analysis is based on the definition of ICT industries used by the OECD, which includes three kinds of activity: the manufacture of computer and communications equipment (ICT manufacturing), telecommunications services (ICT communications) and the services of computer and related activities (ICT computer activities) (3). The main source of information used in this analysis has been the Central Balance Sheet Office of the Banco de España (CBBE), since the National Accounts information has significant limitations, both in terms of the number of variables available and the level of detail required. Moreover, it has a significant time lag (the latest available data corresponding to 1997). By contrast, the information provided by the Central Balance Sheet Office (although it also has certain methodological problems, as we shall see later) goes up to 1999, enables a large number of economic variables to be compiled and covers around 55% of the employment of the ICT sector, according to the DIRCE (national directory of corporations). Although the coverage is relatively uneven across the various industries, the CBBE data provide a sufficiently representative statistical base. Meanwhile, the information relating to other European economies has been obtained from Van Ark (2001).

It should be taken into account that not all firms are represented in the CBBE and that neither are all the various branches of activity equally well represented, so that this information cannot be used directly to calculate the economic weight of the ICT industries in the economy as a whole, nor their contribution to the growth of the latter. Population variables have therefore had to be constructed for each of the variables analysed. They have been estimated by applying certain coverage ratios to

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(3) Following the CNAE three-digit classification of economic activities, the branches included in ICT manufacturing are 300, 313, 321, 322, 323, 332 and 333, in ICT communications 642, and in ICT computer activities, the whole of division 72.

the sample values (4) and, like all estimates, must be interpreted with caution.

Finally, certain limitations of the CBBE information for the conduct of this analysis should be noted. First, most of the variables analysed refer to nominal values, so that their transformation into real terms requires the application of deflators, which are not always available with the degree of detail required. Also, as already mentioned, the deflators used do not sufficiently taken into account the changes in quality in ICT goods and services, so that the real value added and productivity may be underestimated. At the same time, the CBBE is somewhat biased towards large established firms, which means that developments in the ICT industries according to these data are largely determined by this kind of firm. Finally, the variables obtained from individual data usually display a higher degree of variability than those observed at the aggregate level and, in this respect, it may be more appropriate to conduct the analysis for a period of years rather than confining it to specific years. In spite of these limitations, the information presented in this paper is sufficiently representative to make a general assessment of the economic development of the ICT industries and their contribution to the growth of the economy as a whole. This same information constitutes the basis of the indicators of information and communication technologies presented on the Banco de España's website.

This article is organised as follows. Section two analyses the weight of the industries producing ICT goods and services in the economy as a whole and the economic behaviour of these industries is characterised relative to the patterns observed for the market economy as a whole. Section three examines the contribution of the ICT industries to the growth of value added, labour productivity and total factor productivity of the market economy as a whole. In both sections the results obtained for Spain are subjected to international comparison. Finally, section four sets out the main conclusions.

2. RELATIVE IMPORTANCE AND ECONOMIC CHARACTERISATION OF THE ICT INDUSTRIES

According to the Central Balance Sheet Office data presented in Table 1a, the weight of the val-

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(4) Specifically, following the CBBE methodology, the sample values have been divided by the employment coverage of the sample. The variables that have been calculated by means of this procedure are: employment, value added, GFCF, the capital stock, personnel costs, profits and R&D expenditure. The rates of change have been calculated on the basis of a constant population, i.e. using the same firms, for each two consecutive years.

TABLE 2

International comparison of the relative weight of the ICT sector in 1998

	ICT manu-facturing	ICT services	Total ICT
	a) As percentage of the value added of the whole economy (a)		
Germany	1.44	4.46	5.90
Denmark	1.16	3.63	4.78
Finland	4.57	3.82	8.39
France	1.98	4.12	6.09
Netherlands	1.35	4.52	5.86
Italy	1.07	3.65	4.72
UK	1.97	5.17	7.14
EU (b)	1.57	4.27	5.84
Euro area (b)	1.49	4.08	5.57
US	3.49	4.61	8.10
Spain	0.73	3.19	3.92
	b) As a percentage of total employment		
Germany	1.34	2.19	3.53
Denmark	1.05	2.70	3.74
Finland	2.24	3.57	5.82
France	1.03	2.68	3.71
Netherlands	1.14	3.12	4.26
Italy	2.24	3.57	5.82
UK	1.48	3.58	5.07
EU (b)	1.40	2.91	4.31
Euro area (b)	1.39	2.76	4.14
US	1.67	3.41	5.08
Spain	0.69	2.90	3.60

Sources: Van Ark (2001), AMECO, Central Balance Sheet Office, DIRCE and National Accounts.
(a) Constant prices. 1995=100.
(b) Average weighted by 1998 GDP.

ue added of the ICT sector relative to the market economy as a whole displayed a rising trend over the period 1995-1999, increasing by somewhat more than one percentage point to 5.2% of total value added in 1999. This trend reflects the path followed by the computer activities and communications branches of ICT (the most important of the three) since the relative weight of ICT manufacturing has remained comparatively unchanged. The importance of employment in the activities related to the new technologies has also displayed an upward trend, although a more moderate one. This is exclusively attributable to the growth in employment in the computer activities branch, which in 1999 reached 1.25% of all dependent employment (see Table 1b). The weight of the ICT industries as a whole is lower in terms of dependent employment than in terms of value added, which indicates a relatively high level of productivity.

TABLE 3

Economic growth in the ICT sector 1996-1999
Average annual rates of change (a)

	Value added	Dependent employment	Hours worked	Labour productivity (b)	Total factor productivity (c)	Capital *stock*
ICT manufacturing	6.97	1.43	0.93	6.05	6.14	0.62
ICT communications	9.19	-3.67	-3.89	13.15	12.38	-2.83
ICT computer activities	14.03	17.42	16.17	-2.41	-0.32	10.33
Total ICT	9.80	5.13	4.78	5.00	7.45	0.38
Total manufacturing	3.82	4.01	3.77	0.04	0.99	1.27
Total market services	2.99	3.99	2.37	0.61	0.30	3.17
Total market economy	3.70	4.13	2.73	0.95	0.87	2.91

Sources: Central Balance Sheet Office, DIRCE, and National Accounts.

(a) The average rates of change are calculated for the variables in real terms.

(b) Calculated as value added per hour worked.

(c) Calculated as rate of ch. PTF = rate of ch. (VA/hours worked) - [1-(wages and salaries/VA)] *rate of ch. (K stock/hours worked).

As seen in Table 2 (which makes an international comparison of these variables), the weight of ICT activities in Europe, both in terms of value added and employment (with the sole exception of Finland), is lower than in the United States (5). Of the European economies considered, Spain, in turn, displays a more marked lag in terms of value added than in terms of employment and in the branches that manufacture ICT products than in the services branches. In 1998, the weight of ICT manufacturing in GDP in Spain was half the EU level and almost five times lower than in the United States (0.7%, as against 1.6% and 3.5%, respectively). As for ICT services (postal, communication and computer activities), the differences are smaller, especially in terms of employment. However, as we shall see below, the increases in output have been relatively similar in Spain and in the EU over the five-year period analysed, and the increases in employment considerably higher in Spain, so that the gap seen may be due to the discrepancies in the starting levels or the notable dynamism of the rest of the productive sectors of the Spanish economy.

As regards the characterisation of the behaviour of the ICT industries, it is appropriate to analyse first the growth of the variables most closely related to the determinants of economic growth. In the period considered, the ICT sector recorded, on aggregate, significantly higher growth in value added than the market economy as a whole (6) (see Table 3) (9.8% and 3.7%, respectively). Dependent employment also grew by more, although unevenly across the various industries that make up ICT. Thus, while a high rate of job creation was sustained in computer activities, the increase in employment in the manufacturing branch of ICT was very modest and in communications non-existent.

This behaviour by output and employment in the ICT sector has naturally been reflected in labour productivity. In the sector as a whole labour productivity grew by more than in the market economy, but the growth was uneven across the various ICT industries. The significant increases in the communications branch and the fall in productivity in the computer activities branch stand out. In the latter case, the outcome may partly reflect a downward bias in the calculation of the rate of growth of value added, as a consequence of the deflator used (7).

As seen in Table 3, lying behind this better performance of labour productivity in the ICT sector as a whole were the significant increases in total factor productivity (8), given the technological progress incorporated in the productive processes in the new technology branches.

(5) In order to make the Spanish data comparable with those for the countries shown in this table, postal services have been included in ICT services (communications plus computer activities), the figures for dependent employment have been adjusted to total employment and the percentages have been calculated in relation to the economy as a whole, instead of the market economy. Accordingly, the figures given for Spain in this table do not coincide with those in Table 1.

(6) A detailed explanation of the deflators used, the construction of the series of employment in hours and of total factor productivity may be found in the Working Paper entitled "la contribución de las ramas de las tecnologías de la información y las comunicaciones al crecimiento de la economía española".

(7) Although the capital-labour ratio is also seen to contribute negatively to the productivity of this branch of activity, because the rate of change of the capital stock has been lower than the rate of job creation.

Again, a more detailed analysis would show reductions in TFP in computer activities, which could be explained, at least in part, by the measurement problems mentioned above (9). Meanwhile, the increase in the capital stock in the ICT sector as a whole has been modest in comparison with the rates of growth of employment, so that the capital-labour ratio only increased in the communications branch. However, the stock of capital in this branch grew at a negative rate in the period analysed. This may be explained by the major restructuring undertaken since the disappearance of the former monopoly, which has probably involved changes in the composition of its tangible fixed assets.

Nonetheless, the modesty of this contribution by the capital-labour ratio to the growth of labour productivity in the ICT sector as a whole is attributable to the small increase in the stock of capital unrelated to new technologies. In fact, Hernando and Núñez (2001) show that when the rate of change of the capital stock of the ICT sector as a whole is decomposed, the growth of ICT capital goods (mainly computers and equipment for the transmission of information) amounted to 26.1% per annum over the period 1995-1999, while other fixed assets were accumulated at a rate of 0.4%.

Table 4 shows the rates of change of value added, employment and labour productivity in the various European economies and in the United States (10). It can be seen that the performance of the ICT sector in Europe has been positive, with rates of growth of value added and productivity well above those for the market economy as a whole and a somewhat higher rate of job creation. In the European economies, unlike in America, services activities have been more dynamic than manufacturing. Meanwhile, the growth in value added recorded by the ICT sector in the Spanish economy has been similar to that in the EU as a whole, both in ICT manufacturing and in services, while the growth in employment has been significantly higher. Productivity growth rates have therefore been comparatively low in Spain.

The rest of the information needed to characterise the behaviour of the ICT industries is set out in Table 5. As can be seen, corporate

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(8) Total factor productivity has been approximated as the difference between the rate of change of labour productivity and the rate of change of the capital-labour ratio multiplied by the proportion of value added that is not used to compensate the labour factor.

(9) Insofar as value added is underestimated, so TFP, which is estimated residually, will be too.

(10) The information for this table was harmonised using the same criteria as for Table 2.

TABLE 4

International comparison of economic growth in the ICT sector
Average growth rates 1996-1999

	ICT manufacturing	ICT services	Total ICT	Whole economy
a) VALUE ADDED				
DE (a)	3.80	10.00	8.31	1.82
DK	3.17	5.77	5.11	2.34
FI	28.80	14.80	22.03	4.64
FR (a)	15.16	6.87	9.27	1.86
NL	2.72	16.65	13.05	3.66
IT	1.13	7.83	6.24	1.41
UK	5.54	12.60	10.50	2.82
EU (b)	6.51	9.84	9.05	2.26
Euro area (b)	6.84	9.30	8.82	2.12
US	18.93	6.97	11.66	4.68
ES	6.97	9.54	9.05	3.68
(b) EMPLOYMENT				
DE (a)	-3.43	-1.88	-2.49	0.14
DK	0.59	0.78	0.70	1.37
FI	9.18	5.92	7.16	2.32
FR (a)	-0.96	1.44	0.74	0.58
NL	0.33	11.73	8.28	2.70
IT	9.18	5.92	7.16	2.32
UK	1.09	7.22	5.36	1.59
EU (b)	0.99	3.29	2.62	1.43
Euro area (b)	0.97	2.42	2.02	1.40
US	1.81	5.33	4.14	1.98
ES	3.85	6.50	5.98	5.07
(c) LABOUR PRODUCTIVITY				
DE (a)	7.44	12.11	11.08	1.68
DK	2.49	5.04	4.44	0.95
FI	17.82	8.36	13.79	2.27
FR (a)	16.28	5.40	8.50	1.27
NL	2.38	4.42	4.40	0.93
IT	-7.31	1.85	-0.82	-0.88
UK	4.50	5.02	4.88	1.22
EU (b)	5.71	6.50	6.43	0.82
Euro area (b)	6.09	6.90	6.86	0.72
US	16.88	1.57	7.25	2.64
ES (c)	3.11	3.04	3.07	-1.39

Sources: Van Ark (2001), AMECO, Central Balance Sheet Office, DIRCE and National Accounts.
(a) 1996-1998 rates, as no rates available for 1999.
(b) Average weighted by 1998 GDP.
(c) Calculated as the difference between growth rates of VA and employment.

TABLE 5

ICT sector 1996-1999
Average annual rates of change of other economic variables (a)

	Tangible GFCF	Average wages	Profits	Market value	R & D expenditure
ICT manufacturing	6.69	4.65	19.87	51.39	17.59
ICT communications	2.96	8.89	24.02	93.75	4.03
ICT computer activities	32.62	-1.63	34.96	128.77	28.17
Total ICT	4.88	3.76	24.58	93.10	13.49
Total manufacturing	8.18	7.51	16.59	39.87	11.86
Total market services	11.02	-1.46	22.07	49.79	6.19
Total market economy	8.18	-1.17	17.60	43.17	9.04

Sources: Central Balance Sheet Office, DIRCE and National Accounts.

(a)   Average rates of change of the variables in real terms, except for market value, for which nominal values used.

profits, approximated by net ordinary profits, also grew faster in the ICT sector in the period analysed, which explains the notable increase in the market value of the firms analysed. That said, the declines in the profits and share prices of the firms in the ICT sector since the middle of last year suggest that more up-to-date Central Balance Sheet Office information would qualify this assessment. Gross fixed capital formation (GFCF), for its part, grew at lower rates than in the market economy as a whole, in step with the capital stock. However, there seems to have been more innovation in ICT activities than in other industries, with significantly higher rates of growth of R&D in this sector than in the market economy as a whole. Finally, in the manufacturing and communications branches of ICT, average wages have risen at higher rates than in the economy as a whole, but at lower rates than productivity.

In short, over the period 1995-99 the ICT sector as a whole performed better than the ag-gregate market economy, although there is a certain disparity between the various activities analysed. In fact, the computer activities branch displayed the largest increases in value added and employment, although the poor perform-ance of labour productivity, which apart from the measurement problems that might be in-volved, may be influenced by a lower rate of in-vestment than required by employment growth. For their part, the ICT manufacturing and com-munications branches expanded more slowly, although they recorded notably higher labour productivity growth than the market economy as a whole, basically on account of improvements in total factor productivity.

3. THE DIRECT CONTRIBUTION OF ICT INDUSTRIES TO THE GROWTH OF THE ECONOMY

One way of assessing the effect that the de-velopment of new technologies is having on the

TABLE 6

Contribution of the ICT sector to economic growth
Annual average 1996-1999

	Value added	Employment	Labour productivity	Total factor productivity
GROWTH:				
Whole economy	3.70	4.13	0.95	0.87
CONTRIBUTION OF:				
ICT manufacturing	0.06	0.01	0.05	0.06
ICT communications	0.24	-0.03	0.25	0.33
ICT computer activities	0.11	0.14	0.08	0.00
Total ICT (a)	**0.42**	**0.11**	**0.38**	**0.38**

Source: DIRCE, National Accounts and Central Balance Sheet Office.

(a)   Calculated as the sum of the contributions of the three branches of ICT.

economy is to analyse the contributions of the ICT industries to the growth of value added, employment and productivity in the aggregate market economy. Examination of these contributions also enables the information analysed so far to be summarised, since the weight of each branch and the growth rates of the economic variables considered relevant are taken into account when they are calculated (11).

In this respect, although the ICT industries only account for 5% of the value added of the market economy, their contribution to the growth of this variable has been relatively significant in the period analysed (see Table 6). In fact, of the 3.7 percentage points by which the total value added of the market economy increased on average each year, 0.4 percentage points are attributable to the industries producing ICT services, which amounts to a relative contribution of 11%. On the other hand, the contribution of the ICT industries to employment growth was much smaller. As a result, the new technologies have had a significant direct impact on the growth of the labour productivity of the market economy, explaining almost 40% of its increase. Meanwhile, there is also evidence to indicate that the use of information and communication technologies as a productive input by other branches of activity has significantly contributed to the growth of labour productivity [see Hernando and Núñez (2001)]. Taken together these results show that the ICT industries, both directly and through their use as inputs, have made a positive contribution to productivity growth.

The ICT industries have also clearly contributed to the growth of the total factor productivity of the economy. As seen in the final column of Table 6, the average annual contribution of the ICT sector was almost 0.40 percentage points, which accounts for somewhat more than 40% of the recorded increase in TFP over the period analysed. This significant important contribution means that, as in the case of labour productivity, the other branches of activity, with a much higher weight, have recorded a very low rate of TFP growth. These results might suggest therefore that the use of ICT has not given rise to positive spillover effects that have translated into increases in productive efficiency, or, if there have been any, they have not been able to offset the negative effect of other determinants of total productivity.

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(11)   Thus, branches of relatively small importance may make a significant contribution to the increase in total output, whenever their rates of growth are higher than those of the other productive branches. A detailed description of the criteria used to calculate the different contributions may be found in the Working Paper entitled "La contribución de las ramas de las tecnologías de la información y las comunicaciones al crecimiento de la economía española".

TABLE 7

International comparison of the contribution to growth of the ICT sector
Average annual contributions 1996-1999

	Contributions to growth			Growth
	ICT manu-facturing	ICT services	Total ICT	Whole economy
(a) VALUE ADDED				
DE (a)	0.05	0.38	0.43	1.82
DK	0.03	0.20	0.23	2.34
FI	1.01	0.48	1.49	4.64
FR (a)	0.24	0.26	0.49	1.86
NL	0.04	0.64	0.68	3.66
IT	0.01	0.27	0.29	1.41
UK	0.11	0.58	0.69	2.82
EU (b)	0.11	0.38	0.49	2.26
Euro area (b)	0.11	0.34	0.45	2.12
US	0.57	0.32	0.89	4.68
ES	0.05	0.28	0.33	3.68
(b) EMPLOYMENT				
DE (a)	-0.05	-0.04	-0.09	0.14
DK	0.01	0.02	0.02	1.37
FI	0.19	0.20	0.39	2.32
FR (a)	-0.01	0.04	0.03	0.58
NL	0.00	0.32	0.32	2.70
IT	0.19	0.20	0.39	2.32
UK	0.02	0.24	0.26	1.59
EU (b)	0.02	0.11	0.13	1.43
Euro area (b)	0.02	0.08	0.10	1.40
US	0.03	0.17	0.20	1.98
ES	0.03	0.18	0.21	5.07
(c) LABOUR PRODUCTIVITY				
DE (a)	0.05	0.38	0.44	1.68
DK	0.02	0.15	0.17	0.95
FI	0.86	0.38	1.25	2.27
FR (a)	0.23	0.23	0.46	1.27
NL	0.00	0.51	0.51	0.93
IT	-0.01	0.19	0.18	-0.88
UK	0.08	0.49	0.56	1.22
EU (b)	0.09	0.32	0.41	0.82
Euro area (b)	0.09	0.29	0.38	0.72
US	0.50	0.22	0.71	2.64
ES	0.01	0.13	0.14	-1.39

Sources: Van Ark (2001), AMECO, Central Balance Sheet Office, DIRCE and National Accounts.
(a)   1996-1998 rates, as no rates available for 1999.
(b)   Average weighted by 1998 GDP.

As can be seen in Table 7, which presents an international comparison of the contributions of ICT industries, the contribution of this kind of activity to the growth of output, employment and labour productivity (of the economy as a whole) has been significant in all the countries analysed. Perhaps the most significant difference is the contrast between the rates of increase of productivity in Europe and the United States. In the latter country, not only did the ICT sector make a significant contribution to its growth, but so too did the other branches of activity.

4. CONCLUSIONS

The foregoing analysis shows that in recent years in Spain ICT goods and services industries have followed a more favourable path than the market economy as a whole. This is reflected in all the variables relating to economic growth: value added, employment, labour productivity and factor productivity. Nonetheless, there are a number of differences in the pattern of growth followed by the three major groups of activity. While in the branch of computer activities it was based on the expansion of inputs and, in particular, employment, in the manufacturing and communications branches it was mainly based on an increase in total factor productivity, reflecting the technological advances in these branches.

In the medium term, when the bouts of slowdown recorded recently by the ICT producing industries are overcome, sustained growth of this type of activity can be expected, based on the following factors. First, the capital endowment of the ICT sector in the Spanish economy is still low relative to international levels, so that strong demand for ICT goods and services can be expected, in order to reduce this difference. Second, ICT capital goods depreciate at a very fast rate, which forces the user firms to replace them. Finally, the process of technological improvements in the production of ICT goods does not seem to have been exhausted, so that further increases in the productive efficiency of these branches, enabling fresh price reductions and stimulating investment in the goods they produce, should not be ruled out.

The higher growth of the ICT sector relative to other economic activities has meant that, although its share in the productive structure is still not very significant, its contribution to the average annual growth of the economy as a whole has been significant, which confirms the existence of positive direct effects of the ICT sector on economic growth and productivity in Spain. However, as yet, the use of ICT does not seem to have given rise to significant improvements in the degree of economic efficiency of the economy as a whole through the induced effects on the productivity of other branches of activity. From this perspective, the current level of development of ICT in Spain is not sufficient to support an increase in potential output.

Studies of the EU as a whole reach a similar conclusion, namely that the contribution of ICT to growth, through its production and use as a productive input, has been notable. However, unlike in the United States, the significant growth in productivity, that one would expect to see, has not been apparent. In numerous economic fora (OECD, IMF, ECB, European Commission, etc.) the fact that EU factor and goods markets are less flexible than in the US has been identified as the reason for the differences with respect to the US economy. This highlights the need for structural reforms to enable new opportunities to be better exploited, which requires flexible markets, efficient regulation and greater investment in human capital.

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