

ICT and Economic Growth in Spain 1985-2002

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Abstract

Using new sectoral data on investment and capital services we carry out a growth accounting exercise on Spain 1985-2002. We compute the contribution to output and labour productivity growth of employment, non-ICT and ICT capital, labour qualification and Total Factor Productivity. Results are given for 29 different branches; individually and grouped into four clusters according to their ICT use intensity. Three ICT assets (hardware, communications and software) are considered. We find that although the ICT intensive group appears to be the most dynamic cluster, most of the impact on productivity is still to come. There is some evidence of a reversal of the productivity slow down of the nineties starting in the year 2000.

Key words: growth accounting, productivity, ICT.

JEL: O47, O52

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1. Introduction

Since the late nineties, the role played by ICT in the reversal of the total factor productivity slow down has been the object of attention for many authors¹. Direct and indirect effects on labour productivity, embodied technological progress and total factor productivity have been claimed as the main mechanisms of transmission of ICT productivity impulses.

In this article we carry out a growth accounting exercise on the role of ICT on Spanish output and productivity growth over the period 1985-2002. We use new available data on ICT and non-ICT capital services as well as an own elaborated indicator of labour qualification. Since data on the ICT production sector are not available, we have to limit ourselves to analyse the impact of the new technologies on the ICT using sectors. As Spain is not a big ICT production country, the main impact on productivity must arise from their use in other (basically all) branches of the economy. These sectors are classified according to their ICT capital using intensities giving rise to four different broad sectors or clusters.

The structure of the paper is as follows. Section 1 describes the data. Section 2 carries out taxonomy of all the branches according to their intensity of ICT use. Section 3 computes the branch contribution to output, employment and productivity. Section 4 analyses capital accumulation and Section 5 computes an index of labour qualification. Section 6 presents the main results of the growth accounting exercise at the aggregate and sectoral level. Section 7 concludes.

¹ Bailey (2003), Bailey & Gordon (1988), Colechia & Schreyer (2001), Gordon (1999), Jorgenson & Stiroh (2000), Oliner & Sichel (2000), O'Mahony & Van Ark (2003), Pilat (2003), Stiroh (2002), Van Ark & Timmer (2004).

2. Data

Output data come from the Spanish National Accounts. Since residential capital is not considered part of the definition of productive capital, we exclude two items from the output measurement: rents from dwellings and incomes from private households with employed persons. We measure labour in hours worked. The employment figures come also from the National Accounts. The number of hours worked per employee has been taken from OECD and was available at the Groningen Growth Development Center, *60 Industry Database*. They assume that the number of yearly working hours by employee is the same in all branches but different throughout time. The labour quality index considers seven different types of qualification according to the level of studies achieved. The information on the number of employees comes from the “Active Population Survey”, INE (*Instituto Nacional de Estadística*), and the corresponding wages from the “Wage Structure Survey” also compiled by INE for the year 1995.

The new available data on investment and capital services for Spain² have been elaborated using the new methodology as proposed by OECD (2001 a, b). They provide detail for 18 different types of assets and 33 branches of the economy. Statistical reasons forced us to integrating some of them³. Consequently we were left with 29 branches. Three different types of ICT assets are considered: Hardware, Communications and Software. All rates of growth are computed using Törnqvist indexes.

² Mas, Pérez & Uriel (dir.) (2004)

³ Namely, *Energy products with Other mining into Mining & quarrying; Textiles & clothing with Leather, leather goods & footwear; Miscellaneous manufacturing with Wood & products of wood & cork; and Public health with Public social services.*

3. ICT taxonomy of economic branches

Since data on the ICT production sector are not yet available we concentrate on the role of ICT in enhancing economic growth through the ICT using branches of the economy. With the 29 branches of the economy we form four different groups. First, we consider the *Non Market Sector* made up by the three branches that are public in nature, namely: *Public education*, *Public health and social services*, and *Rest of public administrations*. The fact that the measurement of their output is not independent of the input use justifies their common treatment as a special group separated from the market sector.

The second group, *Other Non-intensive ICT users* is formed by five branches that are not exactly part of manufacturing, nor of the service sectors. These are: *Agriculture & Forestry*, *Fishing*, *Construction*, *Mining & quarrying*, *Mineral oil refining, coke & nuclear fuel*. We classify the remaining 21 branches into two groups: *Intensive ICT users* and *Non-Intensive ICT users*. We use one basic criterion:⁴ the relation between the value of ICT capital and total capital services in each branch during the period 1995-2002. If the ratio of a particular branch is above the average ratio for all sectors, we include it in the former group. Contrarily, if the ratio is lower than the mean value we include it in the *Non-Intensive* group. Additionally, we use a second indicator: the ratio of ICT capital services over employment (hours worked). We compute the indicators for the initial, ending and interval average values of the period 1995-2002.

The proposed taxonomy of the 29 branches of the Spanish economy is shown in Table 1. Some comments are relevant. First, the *Private health and social services* branch is considered *Intensive ICT* although in terms of the second criterion (but not of the first one) the ratio of ICT services value over employment has a value (0.26) much lower than the mean for the whole economy (0.65). Secondly, the *Electricity, gas & water supply* branch should not be included in the *Intensive ICT* group following the first criterion. Nevertheless, the second criterion gives a value 6.5 times higher than the average of the economy. For this reason we have included it in the intensive group. Thirdly, *Wholesale & retail trade; Repairs*, and *Machinery & mechanical equipment* are two branches of difficult classification. After applying the first criterion we consider them as *Non- Intensive ICT* branches.⁵

The last column in Table 1 shows the proposed classification of branches according to ICT use. Table 2 shows the relative size of the four groups characterised above in terms of output and employment. The *Non Market* and *Other Non Intensive ICT users* groups account for 28% of the value added and 37% of employment. The *Intensive ICT* group accounts for 31% of value added and 23% of employment, and both shares show increasing values for the period. It implies also higher than average labour productivity values for the group as a whole and for all branches but with the

⁴ We follow Stiroh (2002) and O'Mahony & Van Ark (2003), but using Spanish data instead of those of the US.

⁵ As in the US, *Wholesale Trade* could be an ICT intensive branch if we could separate it from the other branches.

exception of following three: *Business services*, *Private health and social services* and *Other community, social & personal services*.

Not all the branches in the *Intensive ICT* group have gained weight during the period according with the two proposed indicators. *Electricity, gas & water supply*; *Electric, electronic & optic equipment*; and *Financial intermediation* lose some weight in output as well as in employment. The following branches showed the biggest gains: *Other community, social & personal services*; *Private health and social services*, *Business services* and *Transport & communications*.

Of the remaining groups it is interesting to note the great reduction in the agricultural employment share, much bigger than in output. Contrarily, there is an important gain in output and employment share of *Construction* and *Hotels & catering* while other traditional branches gradually lose ground.

Table 1. Branch taxonomy according to ICT use.
ICT capital services/Non Residential capital services.
Percentages

	1995	2002	Average 1995-2002	Taxonomy
Agriculture and forestry	0,22	0,22	0,22	<i>Other Non-Intensive ICT users</i>
Fishing	1,05	2,15	1,60	<i>Other Non-Intensive ICT users</i>
Mining and quarrying	6,76	7,86	7,31	<i>Other Non-Intensive ICT users</i>
Mineral oil refining, coke & nuclear fuel	7,95	11,71	9,83	<i>Other Non-Intensive ICT users</i>
Electricity, gas and water supply	9,30	10,20	9,75	<i>Intensive ICT users</i>
Food, drink and tobacco	11,83	12,36	12,10	<i>Non-Intensive ICT users</i>
Textiles, clothing, leather and footwear	11,46	11,64	11,55	<i>Non-Intensive ICT users</i>
Pulp, paper, printing & publishing	19,18	16,93	18,06	<i>Intensive ICT users</i>
Chemicals	12,10	12,44	12,27	<i>Non-Intensive ICT users</i>
Rubber & plastics	11,31	11,88	11,59	<i>Non-Intensive ICT users</i>
Other non-metallic mineral products	10,44	10,01	10,23	<i>Non-Intensive ICT users</i>
Fabricated metal products	8,21	9,39	8,80	<i>Non-Intensive ICT users</i>
Machinery & mechanical equipment	16,62	15,21	15,91	<i>Non-Intensive ICT users</i>
Electric, electronic & optic equipment	30,47	28,07	29,27	<i>Intensive ICT users</i>
Transport equipment manufacturing	9,62	10,45	10,04	<i>Non-Intensive ICT users</i>
Wood & products of wood & cork; Miscellaneous manufacturing	11,90	11,63	11,77	<i>Non-Intensive ICT users</i>
Construction	4,21	4,25	4,23	<i>Other Non-Intensive ICT users</i>
Wholesale & retail trade; Repairs	16,28	18,39	17,33	<i>Non-Intensive ICT users</i>
Hotels & catering	9,52	10,58	10,05	<i>Non-Intensive ICT users</i>
Transport and communications	30,54	41,14	35,84	<i>Intensive ICT users</i>
Financial intermediation	58,66	59,68	59,17	<i>Intensive ICT users</i>
Real estate activities	2,97	3,83	3,40	<i>Non-Intensive ICT users</i>
Business services	44,49	32,37	38,43	<i>Intensive ICT users</i>
Public education	8,31	10,65	9,48	<i>Non-Market</i>
Public health & social services	16,80	19,48	18,14	<i>Non-Market</i>
Rest of public administration	6,32	7,73	7,03	<i>Non-Market</i>
Private education	7,44	14,24	10,84	<i>Non-Intensive ICT users</i>
Private health & social services	19,05	25,19	22,12	<i>Intensive ICT users</i>
Other community, social & personal services	46,05	41,89	43,97	<i>Intensive ICT users</i>
TOTAL	16,09	19,57	17,83	

Source: FBBVA-Ivie and own calculations

Table 2 . Share of each branch on total. Gross Value Added and employment (in hours worked).

Percentages

	Output						Employment (in hours worked)					
	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Intensive ICT users	31,54	30,35	31,05	32,24	31,73	32,50	22,97	21,36	22,61	24,22	24,05	24,69
Electricity, gas and water supply	2,80	3,36	3,21	2,66	2,71	2,30	0,59	0,68	0,63	0,53	0,56	0,47
Pulp, paper, printing & publishing	1,65	1,72	1,68	1,62	1,67	1,64	1,30	1,30	1,36	1,36	1,38	1,41
Electric, electronic & optic equipment	1,62	1,90	1,63	1,36	1,41	1,33	1,25	1,32	1,21	1,14	1,17	1,15
Transport and communications	8,87	7,88	7,99	8,98	8,62	9,08	6,39	6,27	6,04	6,17	6,12	6,08
Financial intermediation	6,10	6,44	6,41	6,07	5,77	5,92	2,76	2,99	2,73	2,51	2,52	2,33
Business services	5,42	4,43	5,09	6,08	6,03	6,59	5,40	4,18	5,34	6,57	6,36	7,06
Private health & social services	1,75	1,35	1,73	2,13	2,16	2,25	1,78	1,47	1,78	2,09	2,11	2,23
Other community, social & personal services	3,32	3,29	3,30	3,34	3,35	3,39	3,49	3,16	3,53	3,86	3,84	3,96
Non-Intensive ICT users	40,36	40,79	40,03	39,59	40,28	39,69	40,28	40,11	40,57	40,73	40,99	41,04
Food, drink and tobacco	3,57	4,15	3,54	2,96	3,02	2,66	3,03	3,33	3,22	2,92	2,95	2,71
Textiles, clothing, leather and footwear	2,08	2,49	1,85	1,45	1,50	1,37	3,01	3,43	2,90	2,49	2,54	2,45
Chemicals	1,99	2,15	1,92	1,76	1,79	1,69	1,06	1,15	1,07	0,99	0,98	0,96
Rubber & plastics	0,91	0,92	0,90	0,89	0,92	0,92	0,73	0,71	0,75	0,77	0,78	0,81
Other non-metallic mineral products	1,68	1,85	1,68	1,51	1,54	1,50	1,33	1,37	1,34	1,30	1,30	1,31
Fabricated metal products	2,87	3,02	2,59	2,44	2,51	2,42	2,68	2,62	2,46	2,52	2,55	2,62
Machinery & mechanical equipment	1,44	1,50	1,29	1,24	1,25	1,29	1,29	1,26	1,21	1,24	1,23	1,30
Transport equipment manufacturing	1,78	1,88	2,13	2,04	2,21	2,04	1,88	1,90	1,80	1,77	1,80	1,80
Wood & products of wood & cork; Miscellaneous manufacturing	1,51	1,67	1,45	1,29	1,37	1,34	2,11	2,16	2,11	2,07	2,12	2,15
Wholesale & retail trade; Repairs	12,06	12,00	12,03	12,10	12,23	12,02	15,28	14,95	15,82	16,14	16,18	16,20
Hotels & catering	6,98	6,03	7,34	8,29	8,35	8,67	5,64	5,26	5,84	6,22	6,29	6,33
Real estate activities	2,03	1,87	1,98	2,14	2,08	2,24	0,54	0,46	0,44	0,51	0,50	0,60
Private education	1,45	1,28	1,32	1,49	1,50	1,53	1,69	1,52	1,61	1,78	1,77	1,79
Other Non-Intensive ICT users	14,94	15,84	15,12	14,22	13,95	14,13	21,49	23,45	20,25	18,29	18,28	18,11
Agriculture and forestry	4,59	5,62	4,86	3,83	3,98	3,40	10,97	13,29	9,43	7,11	7,33	6,41
Fishing	0,39	0,48	0,38	0,29	0,30	0,23	0,55	0,63	0,49	0,42	0,44	0,37
Mining and quarrying	0,77	0,90	0,66	0,54	0,54	0,46	0,49	0,63	0,46	0,32	0,33	0,26
Mineral oil refining, coke & nuclear fuel	0,77	0,76	0,52	0,54	0,56	0,56	0,08	0,08	0,07	0,06	0,07	0,06
Construction	8,42	8,08	8,69	9,03	8,58	9,48	9,40	8,81	9,79	10,38	10,12	11,01
Non-Market	13,16	13,02	13,80	13,95	14,04	13,67	15,27	15,08	16,57	16,76	16,68	16,16
Public education	3,33	3,21	3,49	3,62	3,63	3,55	3,54	3,39	3,77	3,92	3,89	3,80
Public health & social services	3,41	3,41	3,64	3,64	3,67	3,56	3,74	3,74	4,07	4,06	4,04	3,92
Rest of public administration	6,42	6,40	6,68	6,69	6,74	6,57	7,99	7,95	8,73	8,78	8,75	8,43

Source: INE and own calculations

4. Contribution to aggregate output, employment and labour productivity by branch

We now turn into the analysis of the evolution of output, employment (hours worked) and productivity of the 29 sectors of the economy. At an aggregate level, Table 3 shows the evolution of these variables over the whole period 1985-2002 and also for five different sub-periods. Graph 1 plots the series.

Table 3. Real Gross Value Added, employment and labor productivity by hours worked. Annual Rates of Growth.

Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
Gross Value Added (constant prices)	3,03	4,75	0,94	3,25	3,52	2,58
Employment (in hours)	1,82	3,09	-0,59	2,71	3,05	1,86
Employment (number of workers)	1,96	3,43	-0,49	2,72	3,05	1,88
Hours Worked (by worker/year)	-0,13	-0,34	-0,11	-0,01	-0,01	-0,01
Labor Productivity by hours worked	1,21	1,67	1,53	0,54	0,48	0,71

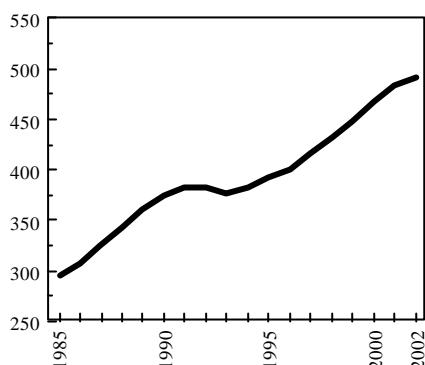
Source: INE and own calculations

We see that for the whole period the three variables show a positive trend. Output and employment present a cyclical profile while productivity increases in a continuous way at a decreasing rate. The average annual growth rate of real output for 1985-2002 was 3.03%, and that of employment 1.8%, so that productivity grew at 1.2%. It is interesting to note that labour productivity growth has different drivers. In the first sub-period (1985-1990) is due to the rapid increase of output (4.75%) over the positive rate of employment creation (3.09%). In the second period (1990-1995) is the result of a very modest output growth (0.94%) and a reduction of employment (-0.59%), and in the final period (1995-2002) is the combination of a common pick up of the rate of growth of real output (3.25%) and of the rate of growth of employment (2.71%).

Graph 1. GVA, employment (in hours worked) and labour productivity

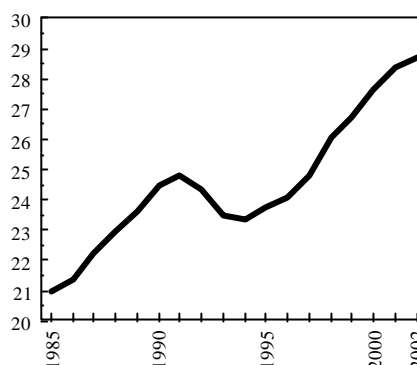
a) GVA

Thousands of millions of euros



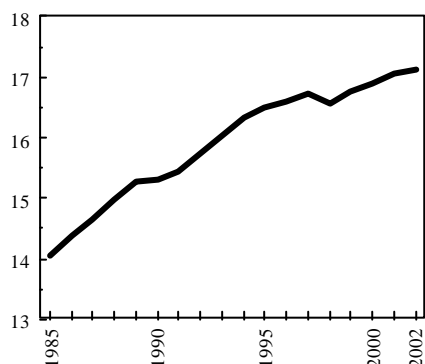
b) Employment (in hours worked)

Thousands of millions of hours



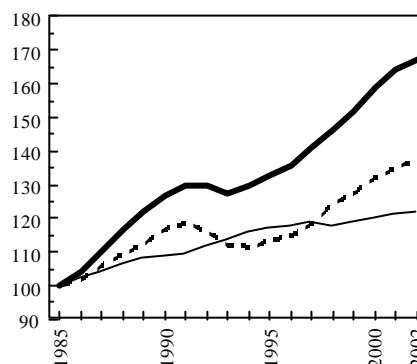
c) Labour productivity




Euros per hour



d) GVA, employment and labour productivity

1985 = 100



 GVA at constant 1995 prices
 Employment (in hours worked)
 Labour productivity per hour worked

Therefore, the slow down of productivity experienced in Spain in the second part of the nineties does not seem to be different from those seen in many other OECD countries. The economy recovers from the previous recession period in output and employment. However it does not reach the output growth rates of the late eighties and performs much better in employment creation. Consequently, productivity growth falls to an annual rate of 0.54%.

However, we find reasons to think that this last sub-period could contain, in turn, two further sub-periods, (1995-2000) and (2000-2002), as presented in Table 3. Output and employment growth slowed down by 1 and 1.2 percentage points respectively between periods. As a result, productivity growth recovered from 0.48% to 0.71%. It could be an indication that the economy is now moving along a new long term path described by a 2.6% annual rate of growth of real output, 1.85% in employment, and 0.75% in productivity.

For each of these variables, it is clear that the contribution of a particular branch depends on its relative size in the aggregate economy as well as on its absolute rate of expansion. According to Table 4 the growth of real output in Spain has been driven by the *Construction* sector as well as by some service branches like *Transport & communications*; *Business services*; *Wholesale & retail trade*; *Repairs*; and *Hotels and catering*. Also the *Non-Market* group –comprising the main public services- contributed significantly to aggregate growth, in particular during the 1990-95 period. Of the industrial branches only *Fabricated metal products*; *Machinery & mechanical equipment*; and *Electricity, gas & water supply* made significant contributions to growth.

If we look at Table 4 we find the output contributions of the 4 broad groups. It is worth noting that the Intensive ICT group made an important contribution to total output growth, in particular during the period 1995-2002, namely 41%, much higher than its relative size of 32% of GDP. This divergence is even larger in the last sub-period 2000-2002, when output contribution of the Intensive ICT group was 47%, 15 points bigger than its relative size. Within this group two branches were particularly active, namely, *Transports & communications* and *Financial intermediation*.

Special mention deserve the *Construction* sector and, for the opposite reason, the *Hotels & catering* sector. The former makes an output contribution that is roughly twice its relative size (18.5% *vis a vis* 9.5%). The later one makes a contribution that is less than one third of its size (2.4% *vis a vis* 8.7%).

Table 5 presents information regarding the contribution of the different sectors to employment creation. Interestingly enough, the Intensive ICT branches as a group, show an active role over the whole period, intensified after 2000. Two branches, *Business services* and *Other community, social & personal services*, are the main employment drivers. The *Other Non-Intensive* group combines branches with employment destruction like *Agriculture & forestry* with other sectors with positive employment creation like *Construction*. Therefore, the net impact is a relatively modest one. The *Non-Market* broad sector shows a positive contribution to employment over the entire period and particularly high in the first sub-period 1985-1990. Finally, the *Non-Intensive ICT* group shows a reduction during the 1990-1995 period and a positive contribution thereafter.

With respect to labour productivity Table 6 shows the main results. First, there is a deceleration of aggregate productivity growth during the 1995-2000 period and a weak pick up thereafter driven by the *Intensive ICT* group. Secondly, almost all branches contribute positively to productivity growth over the entire period. Two of the exceptions -*Other community, social & personal services* and *Business services*- belonging to the *Intensive ICT* group were extremely active in employment creation. Other branches that contribute negatively to productivity growth are *Wholesale & retail trade*; *Repairs* and *Construction*, also two of the most active branches in generating new employment. Thirdly, the *Intensive ICT* group - although very active in employment creation- is also responsible of 90,7% of the aggregate growth of productivity during the 1995-2002 period (specially *Transport & communications* and *Financial intermediation*). Finally, we find a great impact on productivity arising from the *Agriculture & forestry* and the *Construction* sectors. The former one contributes positively due to the large decrease in agricultural employment, whereas the later contributes negatively due to the large job creation in the construction sector.

Table 4. Branch Contributions to Aggregate GVA growth (constant prices)*Percentages*

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	3,03	4,75	0,94	3,25	3,52	2,58
Intensive ICT users	1,10	1,57	0,25	1,33	1,36	1,21
Electricity, gas and water supply	0,09	0,15	0,02	0,11	0,13	0,06
Pulp, paper, printing & publishing	0,04	0,06	-0,02	0,06	0,08	0,02
Electric, electronic & optic equipment	0,08	0,18	0,04	0,05	0,06	0,02
Transport and communications	0,38	0,30	0,30	0,44	0,43	0,41
Financial intermediation	0,08	0,35	-0,33	0,19	0,08	0,42
Business services	0,28	0,29	0,19	0,32	0,38	0,18
Private health & social services	0,06	0,08	0,04	0,07	0,09	0,02
Other community, social & personal services	0,09	0,16	0,02	0,10	0,11	0,07
Non-Intensive ICT users	1,07	1,57	0,44	1,11	1,33	0,62
Food, drink and tobacco	0,04	0,11	-0,01	0,03	0,03	0,05
Textiles, clothing, leather and footwear	0,02	0,03	-0,03	0,03	0,04	0,01
Chemicals	0,05	0,06	0,04	0,05	0,05	0,05
Rubber & plastics	0,04	0,04	0,02	0,04	0,06	0,01
Other non-metallic mineral products	0,06	0,12	0,02	0,06	0,07	0,04
Fabricated metal products	0,07	0,07	0,01	0,09	0,11	0,06
Machinery & mechanical equipment	0,07	0,00	0,10	0,07	0,09	0,05
Transport equipment manufacturing	0,07	0,16	0,03	0,05	0,11	-0,05
Wood & products of wood & cork; Miscellaneous manufacturing	0,04	0,10	-0,03	0,05	0,08	-0,02
Wholesale & retail trade; Repairs	0,29	0,40	0,12	0,35	0,40	0,22
Hotels & catering	0,19	0,28	0,15	0,15	0,18	0,06
Real estate activities	0,08	0,13	0,00	0,08	0,07	0,11
Private education	0,05	0,08	0,03	0,04	0,05	0,04
Other Non-Intensive ICT users	0,44	0,96	-0,10	0,47	0,48	0,44
Agriculture and forestry	0,09	0,24	-0,02	0,07	0,12	-0,04
Fishing	-0,01	0,00	-0,02	0,00	0,00	0,00
Mining and quarrying	-0,01	0,00	0,01	-0,02	-0,02	0,00
Mineral oil refining, coke & nuclear fuel	0,01	0,04	0,00	0,01	0,01	0,01
Construction	0,35	0,69	-0,07	0,41	0,37	0,48
Non-Market	0,42	0,66	0,35	0,33	0,35	0,30
Public education	0,10	0,11	0,10	0,09	0,09	0,09
Public health & social services	0,12	0,19	0,12	0,08	0,08	0,08
Rest of public administration	0,21	0,36	0,13	0,16	0,17	0,14

Source: INE and own calculations

Table 5. Branch Contributions to Aggregate Employment Growth (in hours worked)
Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	1,82	3,09	-0,59	2,71	3,05	1,86
Intensive ICT users	0,66	0,78	0,26	0,84	0,92	0,63
Electricity, gas and water supply	-0,01	0,00	-0,01	-0,01	-0,01	-0,02
Pulp, paper, printing & publishing	0,04	0,08	-0,02	0,05	0,06	0,00
Electric, electronic & optic equipment	0,01	0,02	-0,03	0,03	0,04	0,00
Transport and communications	0,09	0,04	0,03	0,15	0,15	0,16
Financial intermediation	0,00	0,00	-0,03	0,01	0,01	0,03
Business services	0,33	0,39	0,18	0,38	0,39	0,34
Private health & social services	0,08	0,09	0,07	0,09	0,12	0,03
Other community, social & personal services	0,12	0,16	0,06	0,14	0,16	0,09
Non-Intensive ICT users	0,80	1,38	-0,19	1,12	1,37	0,51
Food, drink and tobacco	0,02	0,09	-0,04	0,01	0,00	0,02
Textiles, clothing leather and footwear	-0,02	0,03	-0,15	0,04	0,06	0,00
Chemicals	0,01	0,03	-0,03	0,02	0,02	0,03
Rubber & plastics	0,02	0,04	-0,01	0,03	0,04	0,00
Other non-metallic mineral products	0,02	0,05	-0,03	0,04	0,04	0,03
Fabricated metal products	0,04	0,02	-0,02	0,09	0,12	0,01
Machinery & mechanical equipment	0,03	0,04	-0,02	0,05	0,06	0,04
Transport equipment manufacturing	0,02	0,03	-0,02	0,05	0,07	0,01
Wood & products of wood & cork; Miscellaneous manufacturing	0,04	0,08	-0,04	0,06	0,10	-0,01
Wholesale & retail trade; Repairs	0,39	0,68	0,03	0,44	0,51	0,27
Hotels & catering	0,18	0,26	0,10	0,18	0,24	0,05
Real estate activities	0,02	0,02	-0,01	0,04	0,05	0,03
Private education	0,04	0,02	0,05	0,05	0,06	0,04
Other Non-Intensive ICT users	-0,04	0,16	-0,84	0,45	0,49	0,35
Agriculture and forestry	-0,40	-0,59	-0,62	-0,07	-0,06	-0,10
Fishing	-0,01	-0,03	-0,01	-0,01	0,00	-0,01
Mining and quarrying	-0,02	-0,01	-0,04	-0,01	-0,01	0,00
Mineral oil refining, coke & nuclear fuel	0,00	0,00	0,00	0,00	0,00	0,00
Construction	0,40	0,79	-0,18	0,53	0,56	0,46
Non-Market	0,40	0,78	0,18	0,30	0,27	0,38
Public education	0,10	0,16	0,07	0,08	0,07	0,10
Public health & social services	0,09	0,20	0,02	0,08	0,07	0,10
Rest of public administration	0,20	0,42	0,09	0,15	0,13	0,19

Source: INE and own calculations

Table 6. Branch Contributions to Labor Productivity Aggregate Growth (constant prices)
Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	1,21	1,67	1,53	0,54	0,48	0,71
Intensive ICT users	0,44	0,79	-0,01	0,49	0,44	0,58
Electricity, gas and water supply	0,09	0,15	0,02	0,12	0,14	0,08
Pulp, paper, printing & publishing	0,00	-0,02	0,00	0,02	0,02	0,02
Electric, electronic & optic equipment	0,07	0,16	0,06	0,02	0,02	0,02
Transport and communications	0,29	0,27	0,27	0,28	0,28	0,25
Financial intermediation	0,08	0,35	-0,31	0,17	0,08	0,39
Business services	-0,05	-0,10	0,01	-0,06	-0,01	-0,15
Private health & social services	-0,02	-0,02	-0,03	-0,02	-0,03	-0,01
Other community, social & personal services	-0,03	-0,00	-0,04	-0,04	-0,05	-0,02
Non-Intensive ICT users	0,26	0,19	0,64	-0,01	-0,04	0,11
Food, drink and tobacco	0,03	0,03	0,04	0,02	0,02	0,02
Textiles, clothing, leather and footwear	0,03	-0,00	0,12	-0,01	-0,02	0,01
Chemicals	0,04	0,03	0,07	0,03	0,03	0,03
Rubber & plastics	0,01	0,00	0,02	0,01	0,02	0,01
Other non-metallic mineral products	0,04	0,07	0,04	0,02	0,03	0,02
Fabricated metal products	0,03	0,05	0,03	0,00	-0,01	0,05
Machinery & mechanical equipment	0,04	-0,04	0,13	0,02	0,02	0,01
Transport equipment manufacturing	0,05	0,13	0,05	0,01	0,04	-0,06
Wood & products of wood & cork; Miscellaneous manufacturing	0,00	0,02	0,01	-0,01	-0,01	-0,01
Wholesale & retail trade; Repairs	-0,09	-0,29	0,09	-0,09	-0,11	-0,05
Hotels & catering	0,01	0,02	0,05	-0,03	-0,05	0,01
Real estate activities	0,06	0,12	0,02	0,04	0,02	0,08
Private education	0,01	0,06	-0,02	-0,01	-0,01	-0,01
Other Non-Intensive ICT users	0,48	0,81	0,74	0,03	-0,00	0,10
Agriculture and forestry	0,49	0,83	0,60	0,14	0,18	0,06
Fishing	0,01	0,03	-0,01	0,01	0,00	0,01
Mining and quarrying	0,01	0,01	0,04	-0,01	-0,01	0,00
Mineral oil refining, coke & nuclear fuel	0,02	0,04	0,00	0,01	0,01	0,01
Construction	-0,05	-0,10	0,10	-0,12	-0,18	0,01
Non-Market	0,03	-0,12	0,16	0,03	0,08	-0,08
Public education	-0,00	-0,05	0,03	0,01	0,02	-0,01
Public health & social services	0,03	-0,01	0,10	0,01	0,02	-0,02
Rest of public administration	0,00	-0,06	0,04	0,02	0,05	-0,05

Source: INE and own calculations

It is interesting to note that if we exclude from the aggregate output the branches belonging to the *Non Market* group as well as two further sectors, *Agriculture & forestry* and *Fishing*, our results enlarge the slow down and subsequent pick up of productivity⁶. The average productivity growth for the entire period would be lower: 0.68% versus 1.21%. The deceleration during the 1995-2000 period would be more intense (down to 0.21% versus 0.48%) and also the pick up would be slightly larger (up to 0.72% instead of 0.71%).

5. Capital accumulation

The rate of accumulation of non-residential capital in Spain was quite strong over the 1985-2002 period averaging an annual rate of 5%. Table 7 shows a slow down of such rate to 4% during the recession period of the first nineties and a value of 4.9% for the last 2000-2002 sub-period. It is interesting to note the high contribution (44.2%) to capital accumulation of the *ICT Intensive* group, driven fundamentally by *Transports & communications* with an annual rate of growth of 18.8% for the entire period and 24.4% over the 2000-2002 sub-period. Also *Business services* and *Financial intermediation* show strong capital accumulation rates.

Note that the annual average ICT capital accumulation rate for the entire period was 11.1% (Table 8), twice as large as that of non-residential capital. The ICT group was responsible for 66.7% of such ICT capital accumulation and only two branches, *Transports & communications* and *Financial intermediation*, represented 39% of the total.

⁶ Many international productivity analyses use private non agricultural output.

Table 7. Branch Contributions to Aggregate Volume Index of Capital Services Growth (excluding Residential)

Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	4,95	5,34	4,01	5,19	5,19	4,91
Intensive ICT users	2,19	2,05	1,57	2,40	2,42	2,29
Electricity, gas and water supply	0,02	0,08	-0,07	0,05	0,03	0,07
Pulp, paper, printing & publishing	0,13	0,16	0,09	0,14	0,13	0,14
Electric, electronic & optic equipment	0,12	0,15	0,08	0,13	0,13	0,12
Transport and communications	0,93	0,76	0,60	1,09	1,04	1,20
Financial intermediation	0,30	0,29	0,37	0,23	0,26	0,16
Business services	0,44	0,34	0,27	0,47	0,50	0,39
Private health & social services	0,05	0,02	0,04	0,06	0,06	0,06
Other community, social & personal services	0,21	0,26	0,19	0,22	0,25	0,15
Non-Intensive ICT users	1,72	1,90	1,44	1,83	1,87	1,58
Food, drink and tobacco	0,19	0,22	0,15	0,19	0,21	0,16
Textiles, clothing, leather and footwear	0,04	0,07	0,02	0,04	0,05	0,02
Chemicals	0,08	0,06	0,05	0,10	0,11	0,07
Rubber & plastics	0,05	0,06	0,04	0,05	0,05	0,04
Other non-metallic mineral products	0,10	0,17	0,07	0,08	0,08	0,08
Fabricated metal products	0,12	0,19	0,05	0,14	0,12	0,18
Machinery & mechanical equipment	0,05	0,06	0,03	0,05	0,05	0,04
Transport equipment manufacturing	0,15	0,01	0,21	0,15	0,16	0,15
Wood & products of wood & cork; Miscellaneous manufacturing	0,06	0,08	0,04	0,07	0,07	0,07
Wholesale & retail trade; Repairs	0,44	0,49	0,35	0,50	0,52	0,40
Hotels & catering	0,13	0,17	0,13	0,09	0,11	0,03
Real estate activities	0,30	0,33	0,28	0,34	0,32	0,32
Private education	0,02	0,01	0,01	0,03	0,02	0,03
Other Non-Intensive ICT users	0,19	0,22	0,01	0,27	0,25	0,30
Agriculture and forestry	0,02	0,10	-0,08	0,05	0,05	0,05
Fishing	-0,02	0,00	-0,03	-0,02	-0,02	-0,01
Mining and quarrying	0,01	0,02	-0,01	0,02	0,02	0,02
Mineral oil refining, coke & nuclear fuel	0,01	-0,04	0,01	0,03	0,03	0,04
Construction	0,17	0,14	0,12	0,19	0,18	0,20
Non-Market	0,85	1,17	0,99	0,69	0,66	0,73
Public education	0,07	0,09	0,08	0,06	0,07	0,03
Public health & social services	0,07	0,11	0,08	0,06	0,05	0,08
Rest of public administration	0,71	0,98	0,83	0,57	0,53	0,62

Source: FBBVA-Ivie and own calculations

Table 8. Branch Contributions to ICT Volume Index of Capital Services Growth
Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	11,11	14,19	6,04	12,02	12,24	10,83
Intensive ICT users	7,41	9,18	4,10	7,51	7,72	6,87
Electricity, gas and water supply	0,19	0,38	0,09	0,16	0,16	0,06
Pulp, paper, printing & publishing	0,24	0,37	0,11	0,28	0,27	0,27
Electric, electronic & optic equipment	0,41	0,57	0,19	0,51	0,48	0,40
Transport and communications	3,12	2,77	1,30	3,44	3,37	3,73
Financial intermediation	1,68	2,26	1,75	1,13	1,27	0,89
Business services	0,99	1,67	0,23	1,16	1,30	0,75
Private health & social services	0,12	0,05	0,09	0,15	0,17	0,14
Other community, social & personal services	0,65	1,11	0,33	0,68	0,70	0,62
Non-Intensive ICT users	2,46	3,55	0,94	2,92	2,98	2,42
Food, drink and tobacco	0,31	0,46	0,17	0,34	0,38	0,24
Textiles, clothing, leather and footwear	0,09	0,15	0,05	0,10	0,11	0,06
Chemicals	0,16	0,24	0,08	0,17	0,20	0,10
Rubber & plastics	0,07	0,09	0,04	0,07	0,08	0,06
Other non-metallic mineral products	0,14	0,25	0,07	0,15	0,14	0,14
Fabricated metal products	0,22	0,31	0,08	0,26	0,23	0,27
Machinery & mechanical equipment	0,09	0,14	0,05	0,10	0,11	0,06
Transport equipment manufacturing	0,18	0,15	0,12	0,22	0,21	0,20
Wood & products of wood & cork; Miscellaneous manufacturing	0,09	0,13	0,04	0,10	0,10	0,09
Wholesale & retail trade; Repairs	0,82	1,23	0,18	1,06	1,04	0,88
Hotels & catering	0,12	0,20	0,05	0,14	0,16	0,09
Real estate activities	0,13	0,20	0,00	0,18	0,17	0,17
Private education	0,03	0,01	0,02	0,04	0,04	0,05
Other Non-Intensive ICT users	0,20	0,26	0,07	0,22	0,22	0,21
Agriculture and forestry	0,00	0,00	0,00	0,00	0,00	0,00
Fishing	0,01	0,01	0,00	0,01	0,01	0,01
Mining and quarrying	0,03	0,02	0,01	0,03	0,04	0,02
Mineral oil refining, coke & nuclear fuel	0,05	0,03	0,03	0,06	0,04	0,09
Construction	0,11	0,19	0,04	0,12	0,13	0,09
Non-Market	1,03	1,20	0,92	1,37	1,31	1,34
Public education	0,10	0,11	0,08	0,12	0,14	0,09
Public health & social services	0,21	0,23	0,19	0,27	0,28	0,25
Rest of public administration	0,73	0,85	0,66	0,98	0,89	1,00

Source: FBBVA-Ivie and own calculations

Also note that, accordingly, the rate of Non-ICT capital accumulation for the entire period was 3.9% (Table 9), driven by the *Non-Intensive ICT* group (*Wholesale & retail trade; Repairs and Real Estate*).

6. Labour qualification

Productivity gains are usually attributed to three different sources: i) more and more efficient capital; ii) improvements of labour qualifications; and iii) more efficient combinations of more and more efficient (qualified) capital and labour. This implies that it is necessary to analyze labour qualification in order to be able to explain the sources of Spanish growth. Human capital (specific and generic) is an important determinant of productivity and we propose in this section a synthetic index of labour qualification. We will use it later on the growth accounting exercise.

Spain has experienced a great transformation in labour qualification over the period under study. Table 10 shows that only 17 years ago, 63.6% of the Spanish population had a level of education no higher than primary school, and 12% were illiterate or had no studies at all. In 2002 these numbers had been reduced to 18.4% and 3.6% respectively. On the opposite side of the educational ladder only 4.9% of the workers had a college educational level in 1985. This percentage had risen to 11.5% in 2002. However, the most radical change took place at the secondary school level where the rate rose from 26.4% in 1985 to 57.2% in 2002. As a result of this outstanding change the proportion of Spanish workers with at least a secondary school level of education more than doubled rising from 36.4% in 1985 to 78% in 2002.

Table 11 presents evidence on employment creation by level of education. On the lowest level (illiterate, primary school or less) jobs were lost at an annual rate of 3.5-4.5%. Retirees and employment destruction in the agricultural sector were responsible for this loss. On the opposite side, near to or at college level, employment grew at a substantial rate, a clear indication of an improvement in the average level of qualification of the Spanish working force. In the middle, jobs for professional training levels have grown also very rapidly during the period of analysis.

We construct a synthetic index of labour qualification based on the growth rates of employment in each of the seven levels of education, weighted by their relative wages⁷. The index improves if a high-educated worker replaces a less educated one, or if the general level of employment rises. Table 12 shows the profiles of the contributions to the index made by the different educational levels. We see a continuous improvement of the index over the whole period, intensified after 1995. This is the result of two complementary elements: a higher rate of employment creation and a simultaneous improvement in education, specially at the college level.

⁷ We assume that wages are indicators of marginal productivities. We use 1995 data coming from the Wage Structure Survey (*Encuesta de Estructura Salarial*), published by the National Institute of Statistics (INE).

Table 9. Branch Contributions to Non-ICT Volume Index of Capital Services Growth
Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	3,88	4,07	3,63	3,71	3,69	3,49
Intensive ICT users	1,27	1,04	1,10	1,28	1,28	1,20
Electricity, gas and water supply	-0,01	0,03	-0,10	0,03	0,00	0,08
Pulp, paper, printing & publishing	0,11	0,13	0,08	0,11	0,11	0,11
Electric, electronic & optic equipment	0,07	0,09	0,06	0,05	0,06	0,05
Transport and communications	0,51	0,48	0,48	0,56	0,53	0,60
Financial intermediation	0,06	0,01	0,11	0,04	0,05	-0,02
Business services	0,36	0,15	0,27	0,33	0,33	0,30
Private health & social services	0,03	0,01	0,03	0,04	0,04	0,04
Other community, social & personal services	0,14	0,14	0,16	0,12	0,15	0,04
Non-Intensive ICT users	1,61	1,66	1,53	1,60	1,64	1,38
Food, drink and tobacco	0,17	0,18	0,15	0,16	0,17	0,14
Textiles, clothing, leather and footwear	0,03	0,06	0,02	0,03	0,03	0,02
Chemicals	0,06	0,03	0,04	0,09	0,09	0,06
Rubber & plastics	0,05	0,05	0,03	0,04	0,05	0,03
Other non-metallic mineral products	0,09	0,16	0,07	0,06	0,06	0,07
Fabricated metal products	0,11	0,18	0,04	0,12	0,10	0,16
Machinery & mechanical equipment	0,04	0,05	0,02	0,04	0,04	0,03
Transport equipment manufacturing	0,14	-0,01	0,23	0,14	0,15	0,13
Wood & products of wood & cork; Miscellaneous manufacturing	0,06	0,07	0,04	0,06	0,06	0,06
Wholesale & retail trade; Repairs	0,38	0,38	0,38	0,39	0,41	0,29
Hotels & catering	0,13	0,17	0,15	0,08	0,10	0,02
Real estate activities	0,33	0,34	0,34	0,37	0,35	0,35
Private education	0,02	0,00	0,01	0,02	0,02	0,03
Other Non-Intensive ICT users	0,19	0,21	0,00	0,28	0,26	0,33
Agriculture and forestry	0,02	0,11	-0,10	0,06	0,06	0,06
Fishing	-0,02	0,00	-0,04	-0,02	-0,02	-0,02
Mining and quarrying	0,01	0,02	-0,01	0,02	0,02	0,02
Mineral oil refining, coke & nuclear fuel	0,01	-0,05	0,00	0,03	0,02	0,03
Construction	0,18	0,13	0,14	0,20	0,19	0,23
Non-Market	0,81	1,17	1,00	0,55	0,52	0,58
Public education	0,06	0,08	0,08	0,05	0,05	0,02
Public health & social services	0,05	0,09	0,06	0,02	0,01	0,04
Rest of public administration	0,70	1,00	0,86	0,49	0,46	0,53

Source: FBBVA-Ivie and own calculations.

Table 10. Employment Structure by Educational Levels.*Percentages*

	1985	1990	1995	2000	2002
TOTAL	100,00	100,00	100,00	100,00	100,00
Illiterate	12,02	10,83	7,08	4,97	3,63
Primary Education	51,57	38,77	31,02	20,80	18,35
Secondary Educ. (1st level)	15,79	20,80	24,28	26,81	28,14
Secondary Educ. (2nd level)	7,77	9,12	9,97	12,08	12,48
Professional Training	2,82	8,03	12,17	16,10	16,57
Tertiary Educ. (1st level)	5,16	6,37	7,41	8,51	9,32
Tertiary Educ. (2nd level)	4,87	6,07	8,07	10,73	11,51

Source: INE and own calculations**Table 11. Employment by Educational Levels. Annual Rates of Growth***Percentages*

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
Illiterate	-4,45	1,44	-9,30	-5,19	-2,21	-12,66
Primary Education	-3,49	-2,18	-5,26	-3,16	-3,13	-3,26
Secondary Educ. (1st level)	5,98	9,03	2,30	6,44	6,85	5,41
Secondary Educ. (2nd level)	5,37	6,72	0,97	7,55	8,73	4,60
Professional Training	13,01	24,49	7,50	8,74	10,47	4,42
Tertiary Educ. (1st level)	6,06	7,73	2,21	7,61	7,66	7,50
Tertiary Educ. (2nd level)	7,64	7,93	4,89	9,41	10,56	6,51

Source: INE and own calculations**Table 12. Labor Quality Index Annual Growth Rates. Contributions of each educational level***Percentages*

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	1,35	0,96	0,33	2,41	2,75	1,70
Illiterate	-0,35	0,02	-0,55	-0,33	-0,24	-0,49
Primary Education	-1,51	-1,97	-1,18	-1,16	-1,29	-0,75
Secondary Educ. (1st level)	0,66	0,77	0,50	0,68	0,66	0,70
Secondary Educ. (2nd level)	0,36	0,29	0,10	0,61	0,72	0,36
Professional Training	1,07	1,22	0,81	0,81	0,99	0,39
Tertiary Educ. (1st level)	0,38	0,30	0,13	0,61	0,57	0,67
Tertiary Educ. (2nd level)	0,74	0,33	0,51	1,20	1,34	0,83

Source: INE and own calculations

Table 13. Branch Contributions to the Aggregate Labor Quality Index
Percentages

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
TOTAL	1,35	0,96	0,33	2,41	2,75	1,70
Intensive ICT users	0,66	0,67	0,09	0,96	1,16	0,50
Electricity, gas and water supply	0,01	0,01	0,02	0,02	0,04	-0,01
Pulp, paper, printing & publishing	0,03	0,03	0,02	0,03	0,03	0,04
Electric, electronic & optic equipment	-0,01	0,07	-0,10	0,02	0,04	-0,04
Transport and communications	0,12	0,19	-0,03	0,18	0,23	0,06
Financial intermediation	0,12	0,11	0,07	0,16	0,24	-0,04
Business services	0,24	0,21	0,03	0,37	0,37	0,36
Private health & social services	0,11	0,00	0,17	0,09	0,12	0,02
Other community, social & personal services	0,03	0,05	-0,10	0,10	0,09	0,11
Non-Intensive ICT users	0,34	0,35	-0,12	0,71	0,82	0,53
Food, drink and tobacco	0,00	-0,04	-0,06	0,08	0,11	0,03
Textiles, clothing, leather and footwear	-0,04	0,01	0,00	-0,05	-0,06	-0,02
Chemicals	0,02	0,01	-0,03	0,06	0,04	0,11
Rubber & plastics	-0,01	-0,02	0,00	-0,01	-0,01	0,01
Other non-metallic mineral products	0,00	0,01	-0,02	0,02	0,01	0,04
Fabricated metal products	-0,01	0,07	-0,11	0,04	0,05	0,03
Machinery & mechanical equipment	0,04	0,04	0,05	0,02	0,02	0,03
Transport equipment manufacturing	0,02	0,06	-0,04	0,04	0,04	0,05
Wood & products of wood & cork;	0,02	-0,06	0,06	0,04	0,06	0,00
Miscellaneous manufacturing						
Wholesale & retail trade; Repairs	0,10	0,16	-0,16	0,22	0,36	-0,05
Hotels & catering	0,11	0,03	0,11	0,12	0,10	0,15
Real estate activities	0,03	0,01	0,06	0,01	0,03	-0,02
Private education	0,07	0,06	0,01	0,11	0,09	0,17
Other Non-Intensive ICT users	0,03	-0,16	0,12	0,20	0,18	0,25
Agriculture and forestry	-0,14	-0,19	0,06	-0,06	-0,08	-0,01
Fishing	0,00	0,04	-0,02	-0,01	-0,01	0,00
Mining and quarrying	0,01	-0,01	0,02	0,01	0,03	-0,01
Mineral oil refining, coke & nuclear fuel	0,00	-0,01	0,00	0,00	0,00	0,01
Construction	0,17	0,00	0,06	0,25	0,25	0,25
Non-Market	0,32	0,10	0,25	0,54	0,58	0,42
Public education	0,11	0,08	0,05	0,19	0,17	0,23
Public health & social services	0,09	-0,01	0,14	0,10	0,10	0,10
Rest of public administration	0,12	0,04	0,06	0,24	0,31	0,09

Source: INE and own calculations

It is interesting to note that the main contributors to the improvement of the labour qualification index were the branches included in the *Intensive ICT* group, like *Business services*; *Transports & communications*; *Financial intermediation*; and (in the last years) *Other community, social & personal services* (Table 13). We consider this result of great relevance for the analysis of the ICT contribution to Spanish growth to which we now turn in the next section.

7. Growth accounting

We now have the necessary elements to analyse the impact of ICT use on Spanish growth over the period 1985-2002. Previous years, although available, are not relevant for our purposes since ICT had not yet acquired a significant level in investment expenditures. We consider the same sub-periods as in previous sections⁸.

The impact of ICT on output and productivity growth can follow several transmission mechanisms. As any other capital good, investment in ICT raises labour productivity through capital deepening⁹. As a particular form of capital, ICT assets have a special nature that cut across all sectors of the economy enhancing overall labour productivity. Finally, ICT investment can increase Total Factor Productivity TFP both in its own production sector as well as in all ICT using sectors (spillover effects (positive externalities)¹⁰).

In sum, three different testing hypotheses can be proposed. 1) Labour productivity gains are due to capital deepening (ICT and non ICT). 2) TFP gains should be observed in the ICT production sector only. 3) ICT using branches could show labour productivity gains arising from spillover effects and/or embodied technical progress. In our study, the data set does not identify the ICT producing sector of the economy so that hypothesis 2 cannot be tested yet. However we know from other indicators that the relative weight of the Spanish ICT production sector is not very large. Consequently, we turn our attention to hypotheses 1 and 3.

Growth accounting exercises require a specific definition of the aggregate production function of the economy. We propose the following function:

$$y_t = g(KP_t, HL_t, KH_t, B) \quad [1]$$

where y_t = real output, KP_t = productive capital (a volume index of capital services), HL_t = employment (hours worked), KH_t = labour force qualification or human capital (index of labour

⁸ The two reasons why aggregate output growth figures do not coincide with those of the Official Statistical Office (INE) are: first, we have excluded real estate rents and private households with employed persons from the output definition and residential housing from the capital measures. Secondly, we use Törnqvist indexes.

⁹ Bailey & Gordon (1988), Stiroh (1998), Jorgenson & Stiroh (1999).

¹⁰ Bresnahan (1986) & Bartelsman et al (1994).

qualification) and B = the level of efficiency in the use of productive factors. Taking logarithms and increments on equation [1], we get the following expression ¹¹:

$$\Delta \ln y_t = \sum_j w_{KP,j,t} \Delta \ln KP_{j,t} + w_{HL,t} \Delta \ln HL_t + w_{KH,t} \Delta \ln KH_t + \Delta \ln TFPR$$

$$w_{KP,j,t} = \frac{1}{2} \left[\frac{CS_{j,t}}{\sum_j CS_{j,t} + RA_t} + \frac{CS_{j,t-1}}{\sum_j CS_{j,t-1} + RA_{t-1}} \right] \quad [2]$$

$$w_{HL,t} = \frac{1}{2} \left[\frac{RA_t}{\sum_j CS_{j,t} + RA_t} + \frac{RA_{t-1}}{\sum_j CS_{j,t-1} + RA_{t-1}} \right]$$

where Δ is the incremental operator, the log differentials are growth rates, $v_{KP,j,t}$, $v_{HL,t}$, $v_{KH,t}$ are cost shares of the different factors of production; CS are the capital services provided by asset j , and RA are total compensation of employees as given by the National Accounts after reassigning the mixed incomes either to capital or labour. $TFPR$ is the rest of the rate of growth of technical progress not explained by improvements of KH or by changes in the composition of the capital stock. Growth rate calculations as well as the construction of the KH index are detailed in the annex.

¹¹ In equation [2] $TFPR$ measures the apparent Total Factor Productivity. It is the real shift in the production function (primal) or in the cost function (dual) if the production function has constant returns to scale and there is perfect competition. If these requirements are not fulfilled the rate of technical progress measured by the primal or dual will not be the same, nor will be the apparent TFP. In our case, the discrepancy will be present, since by assuming an exogenous rate of return, the output value can differ from total cost. However, as shown by Schreyer (2004), from a practical point of view, $TFPR$ as given by equation [2] is a good approximation to the rate of technical progress. It has also the advantage of keeping Growth Accounting in a non parametric context. In the opposite case, it would be necessary to run econometric estimates on the returns to scale and/or the mark-ups fixed by firms.

Equation [2] can be expressed in terms of labour productivity as shown by equation [3].

$$\Delta \ln y_t - \mathbf{D} \ln HL_t = \sum v_{KP,j,t} (\Delta \ln KP_{j,t} - \Delta \ln HL_t) + v_{HL,t} \Delta \ln KH_t + \Delta \ln TFPR_t \quad [3]$$

Table 14 shows the aggregate growth accounting results. In the upper part it contains the output decomposition as given by equation [2]. In the middle part it offers the decomposition of labour productivity as given by equation [3]. Finally, the bottom part –containing the contributions of labour qualification and the estimates of *TFPR*- is shared by both equations.

Over the entire period under study real output grew at an annual rate of 3.03%. The four components of equation [2] contributed positively. Capital contributed with 1.2 points (39.6% of total) shared by ICT (0.39) and non-ICT capital (0.82). Labour contribution was 1.37 points (45.2%) and labour qualification 1.02 points (33.6%). The Rest of Total Factor Productivity contribution, once qualification improvements have been taken into consideration, was negative and equal to –0.56 percentage points. This result can be interpreted as the incapacity of the Spanish economy to benefit completely from the rapid increase in labour qualification. In other words, a fraction of this factor improvement has not yet been transformed into a higher rate of output growth.

The role of ICT has been quite important in fostering output growth in Spain. In fact, ICT capital was less than 15% of total productive capital in 1990 but accounted for almost one third (32.5%) of the total capital contribution to growth, well above its quantitative significance. Within ICT hardware was the most important factor followed by software and communications.

Labour productivity grew at a lower pace (1.21%) than output due to the positive evolution of employment. 62.5% of such growth was explained by capital deepening and 84.1% by improvements in qualification. The excess over 100% is due to the negative contribution of *TFPR*. Again, apparently, part of the improvements in workers' training and educational levels and in the quality of the capital goods has not been exploited by the productive system and shows up as an inefficiency factor.

Table 14. Growth Accounting. All Branches. 1985-2002*Percentages*

	1985-2002	1985-1990	1990-1995	1995-2002	1995-2000	2000-2002
1. GVA growth (=2+8+16+17)	3,03	4,75	0,94	3,25	3,52	2,58
2. Capital Contribution (=3+7)	1,20	1,37	1,00	1,23	1,23	1,08
3. ICT (=4+5+6)	0,39	0,45	0,24	0,51	0,51	0,46
4. Software	0,12	0,13	0,06	0,12	0,11	0,12
5. Communications	0,11	0,12	0,07	0,14	0,15	0,15
6. Hardware	0,16	0,20	0,11	0,25	0,25	0,19
7. Non-ICT	0,82	0,92	0,77	0,73	0,72	0,62
8. Labor (hours worked) Contribution	1,37	2,29	-0,44	2,06	2,32	1,45
9. Labor Productivity Growth (=10+16+17)	1,21	1,67	1,53	0,54	0,48	0,71
10. Contribution of capital per hour worked (=11+15)	0,76	0,58	1,15	0,59	0,50	0,67
11. ICT (=12+13+14)	0,32	0,36	0,26	0,39	0,38	0,38
12. Software	0,10	0,11	0,06	0,09	0,08	0,10
13. Communications	0,08	0,07	0,08	0,09	0,09	0,11
14. Hardware	0,14	0,17	0,12	0,21	0,22	0,17
15. Non-ICT	0,43	0,22	0,89	0,19	0,12	0,29
16. Labor Force Qualification	1,02	0,71	0,25	1,84	2,10	1,32
17. <i>PFR</i>	-0,56	0,37	0,13	-1,88	-2,12	-1,28
18. Qualification+ <i>PFR</i> (=16+17)	0,45	1,09	0,38	-0,05	-0,03	0,04

Source: Own Calculations

The role of ICT in enhancing labour productivity is much larger (43%) than the level that would correspond to its relative weight in total productive capital. In different terms, more than 25% of the total labour productivity growth was due only to ICT capital. Again, hardware was the most dominant element followed by software and communications.

Tables 15-18 contain the growth accounting results after disaggregating output into the four categories defined in section 2. They split the sample into four different sub-periods.

1985-2002

Table 15 allows us to qualify the corresponding results of table 14¹². First, we now see that it was the *Intensive ICT* group the most active broad sector of the economy over the entire period in raising output and productivity.¹³ Secondly, the *Intensive ICT* group showed also the highest contribution to output made by ICT capital (0.60%), at least three times as large as those of the other groups. Three branches were the most active ones in raising their ICT capital-labour ratio: *Electric, electronic & optic equipment* (0.82); *Transports & communications* (1.02); and *Financial intermediation* (1.27). Thirdly, the three ICT assets (hardware, communications and software) contribute in a similarly manner to productivity growth of the *Intensive ICT* group. Fourth, it is also the *Intensive ICT* group where we find the highest contribution of the labour quality index, in particular in *Private health & social services*, *Financial intermediation* and *Business services*. Finally, the contribution of the rest of the TFP is negative in all groups except the *Other Non-ICT users*. Again, this result is due to the job destruction in the *Agriculture & forestry* sector.

As expected, we find that inside the *Intensive ICT* group, *Electric, electronic & optic equipment* shows the highest improvement in *TFPR*. This is the branch that is closest related to the ICT production sector -for which we do not have yet available information- where most of the productivity impacts have been found for other countries.

¹² The complete results of this growth accounting exercise at the branch level are available from authors upon request. The most relevant conclusions are reported in the text.

¹³ This second argument is true only if we exclude the Other ICT Non-intensive group dominated by the high productivity growth implied by the employment destruction in agriculture.

Table 15. Growth Accounting. 1985-2002*Percentages*

	All Branches	Intensive ICT users	Non- Intensive ICT users	Other Non- Intensive ICT users	Non-Market
1. GVA growth (=2+8+16+17)	3,03	3,49	2,64	2,95	3,21
2. Capital Contribution (=3+7)	1,20	1,63	1,13	0,36	1,18
3. ICT (=4+5+6)	0,39	0,82	0,22	0,05	0,22
4. Software	0,12	0,30	0,04	0,01	0,04
5. Communications	0,11	0,25	0,06	0,01	0,02
6. Hardware	0,16	0,26	0,12	0,03	0,16
7. Non-ICT	0,82	0,82	0,91	0,31	0,96
8. Labor (hours worked) Contribution	1,37	2,07	1,51	0,01	2,05
9. Labor Productivity Growth (=10+16+17)	1,21	0,66	0,65	2,93	0,61
10. Contribution of capital per hour worked (=11+15)	0,76	0,87	0,65	0,36	0,64
11. ICT (=12+13+14)	0,32	0,60	0,18	0,05	0,19
12. Software	0,10	0,23	0,03	0,01	0,03
13. Communications	0,08	0,15	0,04	0,01	0,01
14. Hardware	0,14	0,22	0,10	0,03	0,14
15. Non-ICT	0,43	0,27	0,46	0,31	0,45
16. Labor Force Qualification	1,02	1,70	0,71	0,63	1,46
17. <i>PTFR</i>	-0,56	-1,91	-0,71	1,94	-1,49
18. Qualification+ <i>PTFR</i> (=16+17)	0,45	-0,21	0,00	2,57	-0,02

Source: Own Calculations

Table 16. Growth Accounting. 1985-1990*Percentages*

	All Branches	Intensive ICT users	Non- Intensive ICT users	Other Non- Intensive ICT users	Non-Market
1. GVA growth (=2+8+16+17)	4,75	5,16	3,84	6,06	5,07
2. Capital Contribution (=3+7)	1,37	1,72	1,29	0,38	1,77
3. ICT (=4+5+6)	0,45	0,96	0,30	0,06	0,23
4. Software	0,13	0,30	0,08	0,02	0,04
5. Communications	0,12	0,33	0,05	0,00	0,02
6. Hardware	0,20	0,33	0,18	0,03	0,17
7. Non-ICT	0,92	0,76	0,99	0,32	1,54
8. Labor (hours worked) Contribution	2,29	2,64	2,55	0,52	4,06
9. Labor Productivity Growth (=10+16+17)	1,67	1,53	0,41	5,34	-0,11
10. Contribution of capital per hour worked (=11+15)	0,58	0,73	0,41	0,18	0,66
11. ICT (=12+13+14)	0,36	0,70	0,23	0,05	0,18
12. Software	0,11	0,24	0,06	0,02	0,03
13. Communications	0,07	0,19	0,02	0,00	0,01
14. Hardware	0,17	0,27	0,15	0,03	0,14
15. Non-ICT	0,22	0,02	0,18	0,13	0,48
16. Labor Force Qualification	0,71	2,25	0,62	-0,44	0,50
17. <i>PTFR</i>	0,37	-1,44	-0,62	5,60	-1,27
18. Qualification+ <i>PTFR</i> (=16+17)	1,09	0,80	0,00	5,16	-0,77

Source: Own Calculations

Table 17. Growth Accounting. 1990-1995*Percentages*

	All Branches	Intensive ICT users	Non- Intensive ICT users	Other Non- Intensive ICT users	Non-Market
1. GVA growth (=2+8+16+17)	0,94	0,80	1,11	-0,67	2,52
2. Capital Contribution (=3+7)	1,00	1,25	0,98	0,03	1,35
3. ICT (=4+5+6)	0,24	0,51	0,10	0,02	0,20
4. Software	0,06	0,17	0,00	0,00	0,03
5. Communications	0,07	0,15	0,04	0,00	0,01
6. Hardware	0,11	0,20	0,06	0,02	0,15
7. Non-ICT	0,77	0,74	0,88	0,01	1,15
8. Labor (hours worked) Contribution	-0,44	0,82	-0,36	-3,16	0,86
9. Labor Productivity Growth (=10+16+17)	1,53	-0,33	1,58	3,47	1,40
10. Contribution of capital per hour worked (=11+15)	1,15	0,95	1,10	1,01	1,09
11. ICT (=12+13+14)	0,26	0,42	0,11	0,04	0,18
12. Software	0,06	0,14	0,00	0,00	0,03
13. Communications	0,08	0,10	0,05	0,02	0,01
14. Hardware	0,12	0,17	0,06	0,02	0,14
15. Non-ICT	0,89	0,53	0,99	0,97	0,91
16. Labor Force Qualification	0,25	0,25	-0,22	0,53	1,08
17. <i>PTFR</i>	0,13	-1,53	0,71	1,93	-0,77
18. Qualification+ <i>PTFR</i> (=16+17)	0,38	-1,28	0,48	2,47	0,32

Source: Own Calculations

Table 18. Growth Accounting. 1995-2002*Percentages*

	All Branches	Intensive ICT users	Non- Intensive ICT users	Other Non- Intensive ICT users	Non-Market
1. GVA growth (=2+8+16+17)	3,25	4,13	2,80	3,33	2,39
2. Capital Contribution (=3+7)	1,23	1,75	1,20	0,51	0,89
3. ICT (=4+5+6)	0,51	0,98	0,34	0,07	0,31
4. Software	0,12	0,28	0,05	0,01	0,04
5. Communications	0,14	0,32	0,09	0,02	0,02
6. Hardware	0,25	0,38	0,20	0,04	0,25
7. Non-ICT	0,73	0,77	0,86	0,44	0,58
8. Labor (hours worked) Contribution	2,06	2,53	2,11	1,95	1,40
9. Labor Productivity Growth (=10+16+17)	0,54	0,67	0,06	0,89	0,58
10. Contribution of capital per hour worked (=11+15)	0,59	0,82	0,56	0,02	0,48
11. ICT (=12+13+14)	0,39	0,67	0,27	0,06	0,28
12. Software	0,09	0,18	0,04	0,01	0,03
13. Communications	0,09	0,17	0,06	0,01	0,01
14. Hardware	0,21	0,31	0,17	0,04	0,23
15. Non-ICT	0,19	0,15	0,29	-0,04	0,20
16. Labor Force Qualification	1,84	2,65	1,41	1,03	2,30
17. <i>PTFR</i>	-1,88	-2,80	-1,92	-0,16	-2,20
18. Qualification+ <i>PTFR</i> (=16+17)	-0,05	-0,15	-0,51	0,87	0,10

Source: Own Calculations

1985-1990

This period of rapid recovery of the Spanish economy is also evident in the evolution of the *ICT Intensive* group with a GVA annual growth rate of 5.16% (table 16). Within the cluster, some branches were very dynamic like *Electric, electronic & optic equipment*; *Business services*; and *Financial intermediation*: 9.4%, 6.45% and 5.46% respectively. Again, the advance in productivity was highest in the *Intensive ICT* group with the same qualifying comments on the behaviour of the agricultural sector that were made above. ICT capital accumulation was highest in the *Intensive ICT* group, with a contribution twice as large as that of the average for the whole economy. It was quite intensive in *Financial intermediation*, *Business services* and *Transport & communications*. Again the contribution of the different types of ICT assets (hardware, communications and software) was very even in the *ICT Intensive* group but was predominantly concentrated in hardware in the other three clusters.

Job creation was very active in the *Intensive ICT* group and together with the improvement in training and educational levels gave rise to a very rapid improvement of the labour qualification index (three times higher than the mean of the whole economy). This was the case of *Electric, electronic & optic equipment*, *Business services* and *Financial intermediation*. Again the rest of the *TFPR* shows a negative contribution.

1990-1995

This period of general economic crisis brought about an episode of severe job destruction that was not uniform across sectors (see table 17). Thus, the *Intensive ICT* group had positive rates of employment lead by: *Private health & social services*, *Business services*, *Other community, social & personal services*, and *Transports & Communications*. As a result of this increase in employment and a slow advance of output, labour productivity in the *Intensive ICT* group fell slightly over the period, particularly in *Financial intermediation* and *Private health & social services*.¹⁴ Contrarily, *Electric, electronic & optic equipment* and *Transports & communications* presented high rates of productivity change, 4.5% and 3.2% respectively.

Capital accumulation slowed down during the crisis but was gradually replacing labour in its contribution to output growth. Within the *intensive ICT* group ICT capital deepening contributed positively to productivity growth, particularly in *Financial intermediation*. Contrarily, *TFPR* contribution to output was negative in *Intensive ICT* branches with the exception of *Electric, electronic & optic equipment* and *Transport and communications*.

1995-2002

Table 18 shows the sudden productivity slow down of the second part of the nineties. Rapid employment growth across all sectors of the economy was the first reason for this reduction. Output and employment in the *Intensive ICT* branches grew at the highest rate, 4.13% and 2.53%

¹⁴ This branch experienced during the crisis a severe reduction in output and employment, the consequence both of a big reduction in financial margins and the need to write off nonperforming assets.

respectively. Also labour productivity and the labour qualification index for this group showed higher rates of increase than the average over the period: 0.67% and 2.65%. In particular, the productivity gains of the following branches were quite substantial: *Electricity, gas & water supply* (6.1%), *Financial intermediation* (2.5%) and *Transport & communications* (2.4%).

ICT capital accumulation (mainly in hardware) and improvements in labour qualification (particularly in *Business services*) were very strong in the *Intensive-ICT* group. Contrarily, the contribution of *TFPR* was very negative in all categories and particularly in the *Intensive-ICT* group. Within this cluster the only exception was *Electricity, gas & water supply*.

Tables 19 and 20 show the results of the same exercise carried out for the two sub-periods 1995-2000 and 2000-2002. The observed slow down in aggregate output

Table 19. Growth Accounting. 1995-2000*Percentages*

	All Branches	Intensive ICT users	Non- Intensive ICT users	Other Non- Intensive ICT users	Non-Market
1. GVA growth (=2+8+16+17)	3,52	4,30	3,30	3,47	2,46
2. Capital Contribution (=3+7)	1,23	1,76	1,21	0,47	0,84
3. ICT (=4+5+6)	0,51	0,99	0,34	0,07	0,29
4. Software	0,11	0,25	0,05	0,01	0,04
5. Communications	0,15	0,34	0,09	0,02	0,02
6. Hardware	0,25	0,40	0,20	0,05	0,24
7. Non-ICT	0,72	0,76	0,88	0,40	0,54
8. Labor (hours worked) Contribution	2,32	2,81	2,58	2,12	1,24
9. Labor Productivity Growth (=10+16+17)	0,48	0,48	-0,04	0,80	0,86
10. Contribution of capital per hour worked (=11+15)	0,50	0,74	0,45	-0,07	0,47
11. ICT (=12+13+14)	0,38	0,65	0,26	0,06	0,26
12. Software	0,08	0,16	0,03	0,01	0,03
13. Communications	0,09	0,17	0,06	0,01	0,01
14. Hardware	0,22	0,33	0,17	0,04	0,22
15. Non-ICT	0,12	0,09	0,19	-0,13	0,21
16. Labor Force Qualification	2,10	3,26	1,60	0,94	2,51
17. <i>PTFR</i>	-2,12	-3,53	-2,10	-0,06	-2,12
18. Qualification+ <i>PTFR</i> (=16+17)	-0,03	-0,27	-0,50	0,88	0,39

Source: Own Calculations

Table 20. Growth Accounting. 2000-2002*Percentages*

	All Branches	Intensive ICT users	Non- Intensive ICT users	Other Non- Intensive ICT users	Non-Market
1. GVA growth (=2+8+16+17)	2,58	3,72	1,57	3,12	2,22
2. Capital Contribution (=3+7)	1,08	1,54	0,95	0,53	0,90
3. ICT (=4+5+6)	0,46	0,89	0,28	0,07	0,32
4. Software	0,12	0,31	0,04	0,01	0,04
5. Communications	0,15	0,32	0,09	0,02	0,03
6. Hardware	0,19	0,26	0,15	0,04	0,25
7. Non-ICT	0,62	0,65	0,67	0,46	0,58
8. Labor (hours worked) Contribution	1,45	1,90	0,98	1,57	1,86
9. Labor Productivity Growth (=10+16+17)	0,71	1,16	0,33	1,21	-0,13
10. Contribution of capital per hour worked (=11+15)	0,67	0,88	0,69	0,20	0,41
11. ICT (=12+13+14)	0,38	0,66	0,25	0,06	0,28
12. Software	0,10	0,23	0,03	0,01	0,03
13. Communications	0,11	0,20	0,08	0,02	0,02
14. Hardware	0,17	0,22	0,14	0,03	0,22
15. Non-ICT	0,29	0,22	0,44	0,14	0,13
16. Labor Force Qualification	1,32	1,34	1,07	1,31	1,87
17. <i>PTFR</i>	-1,28	-1,07	-1,43	-0,29	-2,41
18. Qualification+ <i>PTFR</i> (=16+17)	0,04	0,28	-0,36	1,01	-0,54

Source: Own Calculations

growth (from 3.52% to 2.58%) was less intense in the *ICT Intensive* group due to the good performance of *Transports & communications* and *Financial intermediation*. Also the rate of growth of employment was lower during the second sub-period inducing both a faster productivity growth (from 0.48% to 0.71%) and a slower rate of improvement of the index of labour qualification. This was particularly true in some of the branches of the *ICT Intensive* group. Finally, the *TFPR* contribution to output was negative during the two sub-periods but less intense during the second part.

Productivity slow down

From what we have already seen labour productivity has grown at a decelerating rate over the last three sub-periods, 1.67%, 1.53% and 0.54%. This evolution had very different causes. During the first period (1985-1990) productivity grew because output growth was very high and larger than the also strong employment growth rate. During the period of crisis (1990-1995) productivity advanced thanks to the destruction of employment, and in the last recovery period (1995-2002) productivity slowed down because output growth was only slightly higher than the strong rate of employment creation.

To synthesise the main results on productivity, there was a deceleration of productivity growth in the second half of the nineties and a possible start of a pick up period after 2000. At the aggregate level productivity slowed down from an annual rate of 1.53% during the first half of the nineties to one of 0.48% for the 1995-2000 period. Several factors contributed to this slow down. First, the *TFPR* factor was reduced by 2.26 percentage points, a very significant amount. All groups contributed very negatively to this reduction. Secondly, there was a significant reduction in the intensity of capital deepening, 0.65 percentage points lower than in the previous period. This effect was mainly driven by a strong deceleration in non ICT capital intensity. The ICT capital-labour ratio continued to grow at a modest 0.12% average annual rate and with a positive rate in all four groups.

Labour qualification also improved very rapidly during this period, due to the positive evolution of employment of more qualified workers. This expansion was particularly strong in the ICT capital intensive cluster. This group was also the only broad sector experiencing a positive productivity gain driven by: *Financial intermediation*, *Electricity, gas & water supply* and *Other community, social & personal services*.

As for the incipient productivity pick up of the last sub-period 2000-2002, if consolidated, it could mean a structural change in the Spanish growth pattern. In this stage, productivity growth can no longer be based on reducing employment. It has to rely on technological progress embodied in capital goods, improvements in labour qualification and continuous advances in *TFPR*. We find a pick up of labour productivity from 0.48% to 0.71% (almost a 50% increase) brought about by several factors. First, a positive evolution of *TFPR* that reduces its annual fall from -2.12% to -1.28% (one percentage point of improvement), mainly driven by the *Intensive-ICT* group. Secondly, non-ICT capital accumulation recovered from the previous period and was able to contribute 0.17 additional points. The ICT crisis is reflected in a null contribution to a productivity pick up. Thirdly, the slower employment growth reduces the high rate of improvement of the labour qualification index of the late nineties and allows an increase of labour productivity.

The *Intensive ICT* group experienced the highest pick up of productivity confirming the strength of the recovery in five of the eight branches: *Financial intermediation*, and in a lesser degree, *Electric electronic & optic equipment*; *Private health and social services*, *Pulp, paper, printing & editing*; and *Other community, social & personal services*. Still the behaviour of *TFPR* for this group is negative (-1.07%), although it has improved 2.46 percentage points from the previous period.

8. Concluding remarks

Thanks to the new series on fixed capital stock and investment by assets we have been able to analyse the growth patterns of Spain over the 1985-2002 period distinguishing the contributions of ICT and non ICT capital, as well as their components. The macro results proceed from the aggregation of the 29 branches and the four categories in which these have been grouped.

The main conclusion that we reach in this study is that, in Spain, the (presumably beneficial) full effects of ICT capital on total factor productivity growth are not observable as yet. There is additional evidence of a more positive influence in raising output and labour productivity. Our economy has made a significant effort in capital accumulation reaching an annual rate of 5% and, in the case of ICT, 11%. Also employment has increased rapidly over this period, solving –substantially– the main social problem of unemployment of the mid eighties. Nevertheless the accumulation rate was high enough to allow for an annual increase of the capital labour ratio of about 2.5-3%.

Furthermore, a much better qualification level of education and training has accompanied the creation of new employment. Hence, as a result of this improvement of labour qualification and of the process of capital deepening mentioned in the previous paragraph, the residual of labour productivity growth –the contribution of Total Factor Productivity– has become smaller and smaller and even negative. Only over the last period 2000-2002 we have found some evidence of a very shy pick up of productivity. This change of trend will have to be confirmed over the next years once some structural elements –like agricultural employment destruction or the evolution of the non-market economy– lose significance.

The absence of statistical data has not allowed us to analyse the direct impact of ICT on its own ICT production sector. From other studies we know that this mechanism has been found very relevant in countries that have a large ICT production sector, which is not the case of Spain. Therefore we have limited the study to the impact of ICT on aggregate growth and productivity through the numerous branches that use but not produce ICT capital. In this sense, Spain is more an ICT user than an ICT producer country, although it should not be included neither into the most advanced group of the former ones. A late start is probably one of the main reasons for not finding yet clear evidence of a productivity pick up induced by ICT technologies. Also some structural features –like the country's productive structure or its low starting level of labour qualification– can explain this delay in experiencing the positive effects on productivity of a strong ICT technology push.

The main engines of output growth over the entire period have been (ICT & non ICT) capital accumulation, employment and the continuous improvement of labour qualification. However, the intensity of their use has been different in the three stages in which we have divided our period of

study. i) The second half of the eighties got the best records in terms of output, employment, capital accumulation, *TFPR* improvements and labour qualification. The contribution of ICT capital to output and productivity growth much exceeded its relative size. ii) The first part of the nineties was hit by a general economic crisis that slowed output growth more than four percentage points, destroyed employment, and slowed down productivity gains and *TFPR* improvements. ICT capital accumulation resented severely during this recession period. iii) The long and strong recovery phase that started in the mid nineties was driven by the creation of employment and the improvement in labour qualification at the expense of a slow pace of labour productivity gains. Two factors appear responsible for this slow down: the deceleration of the accumulation of non-ICT capital and the poor behaviour of *TFPR*. Contrarily, ICT capital contributed positively to the sustainment of the level of labour productivity.

We have explored the possibility of a recent change of productivity trend starting in the year 2000. There is some evidence of a likely pick up of labour productivity that was made possible once employment started to grow at a slower rate, labour qualification improvements were introduced more gradually, and *TFPR* behaviour bettered off. Such evidence is strongest when we exclude from the output definition some special branches of the economy like the *Non-market* cluster (containing all public services), *Agriculture & forestry* and the *Fishing* sectors.

Of the four groups that conform the whole economy, the *intensive ICT* cluster has been the most dynamic in terms of output, employment, capital deepening –specially in ICT capital– and improvement of labour qualification. This outstanding performance has been accompanied by a modest productivity growth rate explained by a systematically negative evolution of *TFPR*. We claim that this is evidence of a technological leap forward not yet digested by individuals and firms and, consequently, not present as a return on the output figures. Some extra time and additional efforts on innovation, education & training and R & D will be needed in Spain to extract all the potential from the new ICT technologies. Anyhow, this would not be different from what previously occurred in those economies, like the US, where ICT capital eventually showed a strong impact on reversing the productivity slow down of the nineties.

References

- BAILEY, M.N. (2003): “The Sources of Economic Growth in OECD Countries: A Review Article”, *International Productivity Monitor*, 7, otoño 2003.
- BAILEY, M.N., Y R.J. GORDON (1988): “The Productivity Slowdown, Measurement Issues and the Explosion of Computer Power”, *Brookings Papers on Economic Activity*, vol. 19 (2): 347-420.
- BARTELSMAN, E.J., CABALLERO, R.J. Y R.K. LYONS (1994): “Customer –and supplier- driven externalities”, *American Economic Review*, 84 (4) septiembre, págs. 1075-1084.
- BRESNAHAN, T.F. (1986): “Measuring the spillovers from technical advance: mainframe computers in financial services”, *American Economic Review*, 76 (4), septiembre, págs. 741-755.
- COLECCHIA A. Y P. SCHREYER (2001): “ICT Investment and Economic Growth in the 1990’s: is the United States a Unique Case? A Comparative Study of nine OECD Countries”, *Review of Economic Dynamics*, abril, 5(2): 408-42.
- GORDON, R.J. (1999): “Has the ‘New Economy’ rendered the productivity slowdown obsolete?”, Mimeo, Northwestern University, Junio.
- JORGENSEN, D.W. Y K. STIROH (2000): “Raising the Speed Limit: US Economic Growth in the Information Age”, *Brookings Papers on Economic Activity*, (1): 125-211.
- MAS, M., PÉREZ, F. Y E. URIEL (dirs.) (2004): *Estimación stock de capital 1964-2002. Nueva metodología*. Fundación BBVA, Bilbao.
- OECD (2001a): *Measuring Productivity. Measurement of Aggregate and Industry-level productivity Growth*, Manual OCDE, Paris.
- _____ (2001b): *Measuring Capital*, Manual OCDE, Paris.
- OLINER S.D., Y D.E. SICHEL (2000): “The Resurgence of Growth in the Late 1990’s: Is Information Technology the Story?”, *Journal of Economic Perspectives*, 14, otoño, 3-22.
- O’MAHONY, M. Y B. VAN ARK (eds.) (2003): *EU productivity and competitiveness: an industry perspective*, Comisión Europea.
- PILAT, D. (2003): “ICT and Economic Growth – Evidence from OECD Countries, Industries and Firms” DSTI, ICCP (2003) 2, OECD, París.

- SCHREYER, P. (2004): ‘Measuring multi-factor productivity when rates of return are exogenous’, ponencia presentada en el SSHRC International Conference on Index Number theory and the measurement of prices and productivity, Vancouver, 30 junio – 3 julio.
- STIROH, K. (2002): “Information Technology and U.S. Productivity Revival: What Do the Industry Data Say?”, *American Economic Review*, 92 (5), diciembre: 1559-1576.
- VAN ARK, B., Y M. TIMMER (2004): “Computers and the Big Divide: Productivity Growth in the European Union and the United States” In Mas and Schreyer (eds): *Growth, Capital Stock and New Technologies*, BBVA Foundation, Bilbao, forthcoming.

Annex: Computing rates of growth.

In this appendix we show the formulae for the calculation of the different rates of growth. Sub-indexes “*i*” stands for branch of activity, “*j*” the asset type, and “*k*” the labour qualifications level.

1. Rate of growth of aggregate real output (*y*)

$$\frac{1}{T}[\ln y_t - \ln y_{t-T}] = \frac{1}{T} \left\{ \sum_i 0,5 \left[\frac{Y_{i,t}}{\sum_i Y_{i,t}} + \frac{Y_{i,t-T}}{\sum_i Y_{i,t-T}} \right] (\ln y_{i,t} - \ln y_{i,t-T}) \right\} \quad [\text{A.1}]$$

where $Y_{i,t} \equiv$ Nominal Added Value of branch *i* at time *t*. We have excluded from Nominal Added Value two items; rents from dwellings and income from private households with employed persons. The reason is that productive capital does not include residential capital.

2. Growth rate of total hours worked (*HL*)

$$\frac{1}{T}[\ln HL_t - \ln HL_{t-T}] = \frac{1}{T} \left\{ \sum_i 0,5 \left[\frac{HL_{i,t}}{\sum_i HL_{i,t}} + \frac{HL_{i,t-T}}{\sum_i HL_{i,t-T}} \right] (\ln HL_{i,t} - \ln HL_{i,t-T}) \right\} \quad [\text{A.2}]$$

where $HL_{i,t} \equiv$ employment times yearly hours per worker in branch *i* and year *t*. In this variable we have excluded also employment in private households (with employed persons).

3. Growth rate of aggregate labour productivity [*y/HL*]

$$\frac{1}{T} \left[\ln \left(\frac{y}{HL} \right)_t - \ln \left(\frac{y}{HL} \right)_{t-T} \right] = \frac{1}{T} [(\ln y_t - \ln y_{t-T}) - (\ln HL_t - \ln HL_{t-T})] \quad [\text{A.3}]$$

4. Growth rate of aggregate productive capital (*KP*)

$$\frac{1}{T}[\ln KP_t - \ln KP_{t-T}] = \frac{1}{T} \left\{ \sum_i \sum_j 0,5 \left[\frac{CS_{i,j,t}}{\sum_i \sum_j CS_{i,j,t}} + \frac{CS_{i,j,t-T}}{\sum_i \sum_j CS_{i,j,t-T}} \right] [\ln KP_{i,j,t} - \ln KP_{i,j,t-T}] \right\} \quad [\text{A.4}]$$

where $CS_{i,j,t} \equiv$ Value of capital services of asset j in branch i in year t ,

$$CS_{i,j,t} = p_{j,t-1} [i_t + d_{j,t} - q_{j,t}] KP_{i,j,t-1} = [i_t + d_{j,t} - q_{j,t}] KP_{i,j,t-1}^c \quad [A.5]$$

and $KP_{i,j}$ is the productive capital stock in asset j and branch i at constant prices and $KP_{i,j}^c$ at current prices; q_{jt} is a three year centered moving average of the rate of increase of the market price of asset j ; d_{jt} is the depreciation rate of asset j and i_t is the nominal interest rate in period t , taken as an annual rate of 4% plus a three year centered rate of increase of the Consumer Price Index.

5. Growth rate of the labour qualification index (KH)

$$\frac{1}{T} [\ln KH_t - \ln KH_{t-T}] = \frac{1}{T} \left\{ \sum_i \sum_k 0,5 \left[\frac{GA_{i,k,t}}{\sum_i \sum_k GA_{i,k,t}} + \frac{GA_{i,k,t-T}}{\sum_i \sum_k GA_{i,k,t-T}} \right] \left[(\ln HL_{i,k,t} - \ln HL_{i,k,t-T}) - (\ln HL_{i,t} - \ln HL_{i,t-T}) \right] \right\} \quad [A.6]$$

k are the seven levels of labour qualification. The average yearly compensation per worker comes from the Survey of Wage Structure (*Encuesta de Estructura Salarial*: INE, 1995). We assume that it is constant for the entire period. We assume also that the number of hours worked per employee is the same for all types of qualifications k .

$GA_{i,k,t} \equiv$ average earnings per worker and qualification (k) in 1995, divided by the number of hours worked (in 1995), times the number of workers in qualification k in the year t , times the number of hours worked in year t .

6. Decomposition of aggregate labour productivity sources of growth.

$$\begin{aligned}
 & \frac{1}{T} \left[\ln \left(\frac{y}{HL} \right)_t - \ln \left(\frac{y}{HL} \right)_{t-T} \right] = \\
 & \frac{1}{T} \left\{ \sum_i \sum_j 0,5 \left[\frac{CS_{i,j,t}}{\sum_i \sum_j CS_{i,j,t} + RA_t} + \frac{CS_{i,j,t-T}}{\sum_i \sum_j CS_{i,j,t-T} + RA_{t-T}} \right] \left[(\ln KP_{i,j,t} - \ln KP_{i,j,t-T}) - (\ln HL_{i,t} - \ln HL_{i,t-T}) \right] \right. \\
 & \quad + \left[\sum_i \sum_j 0,5 \left(\frac{RA_t}{\sum_i \sum_j CS_{i,j,t} + RA_t} + \frac{RA_{t-T}}{\sum_i \sum_j CS_{i,j,t-T} + RA_{t-T}} \right) (\ln KH_t - \ln KH_{t-T}) \right. \\
 & \quad \left. \left. + [\ln PTFR_t - \ln PTFR_{t-T}] \right\} \right. \\
 & \hspace{20em}]
 \end{aligned} \tag{A.7}$$

where RA_t = workers compensation. The number from the National Accounts has been modified after reassigning mixed incomes into capital and labour.

Table A.1. Growth Accounting. 1985-2002. Gross Value Added
Percentages

	GVA	Capital						Hours worked	Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT					
			Total	Software	Communi-cations		Hardware				
TOTAL	3,03	1,20	0,39	0,12	0,11	0,16	0,82	1,37	1,02	-0,56	0,45
Intensive ICT users	3,49	1,63	0,82	0,30	0,25	0,26	0,82	2,07	1,70	-1,91	-0,21
Electricity, gas and water supply	3,18	0,23	0,29	0,16	0,06	0,06	-0,06	-0,30	0,66	2,59	3,25
Pulp, paper, printing & publishing	2,35	2,02	0,52	0,07	0,14	0,31	1,50	1,96	1,57	-3,21	-1,64
Electric, electronic & optic equipment	4,93	1,73	0,86	0,07	0,09	0,70	0,87	0,48	-0,10	2,82	2,71
Transport and communications	4,24	2,23	1,17	0,46	0,59	0,12	1,06	0,91	1,35	-0,24	1,11
Financial intermediation	1,33	1,52	1,26	0,74	0,02	0,51	0,26	-0,05	2,87	-3,01	-0,14
Business services	5,18	1,56	0,60	0,20	0,07	0,32	0,96	5,38	3,30	-5,05	-1,75
Private health & social services	3,60	0,78	0,31	0,07	0,01	0,23	0,48	4,29	4,51	-5,99	-1,48
Other community, social & personal services	2,79	1,45	0,64	0,11	0,32	0,21	0,80	2,86	0,50	-2,01	-1,51
Non-Intensive ICT users	2,64	1,13	0,22	0,04	0,06	0,12	0,91	1,51	0,71	-0,71	0,00
Food, drink and tobacco	1,21	1,40	0,32	0,05	0,10	0,17	1,07	0,36	0,36	-0,91	-0,55
Textiles, clothing, leather and footwear	0,77	0,50	0,16	0,02	0,05	0,08	0,34	-0,47	-0,58	1,32	0,74
Chemicals	2,46	0,94	0,27	0,05	0,09	0,14	0,67	0,51	0,87	0,13	1,01
Rubber & plastics	3,88	1,27	0,25	0,02	0,10	0,12	1,03	2,19	-0,85	1,27	0,42
Other non-metallic mineral products	3,81	1,38	0,27	0,03	0,13	0,12	1,11	1,05	0,19	1,19	1,38
Fabricated metal products	2,38	0,85	0,21	0,03	0,07	0,11	0,64	0,95	0,10	0,48	0,58
Machinery & mechanical equipment	4,72	0,79	0,21	0,03	0,06	0,13	0,58	1,79	2,62	-0,48	2,14
Transport equipment manufacturing	3,99	1,44	0,25	0,04	0,10	0,11	1,19	0,89	0,80	0,86	1,66
Wood & products of wood & cork; Miscellaneous manufacturing	2,64	0,97	0,19	0,02	0,07	0,10	0,78	1,42	0,76	-0,50	0,25
Wholesale & retail trade; Repairs	2,44	1,07	0,29	0,09	0,03	0,16	0,78	2,16	0,59	-1,38	-0,79
Hotels & catering	2,68	0,67	0,09	0,02	0,04	0,04	0,57	2,81	1,62	-2,42	-0,80
Real estate activities	3,77	3,35	0,20	0,02	0,07	0,12	3,14	0,98	2,29	-2,85	-0,56
Private education	3,68	0,31	0,08	0,02	0,01	0,05	0,23	2,49	2,55	-1,66	0,89
Other Non-Intensive ICT users	2,95	0,36	0,05	0,01	0,01	0,03	0,31	0,01	0,63	1,94	2,57
Agriculture and forestry	1,89	0,14	0,00	0,00	0,00	0,00	0,14	-2,31	-0,03	4,10	4,07
Fishing	-1,29	-0,64	0,05	0,00	0,04	0,01	-0,69	-1,54	0,03	0,85	0,89
Mining and quarrying	-0,86	0,43	0,14	0,01	0,06	0,07	0,29	-2,32	1,49	-0,46	1,03
Mineral oil refining, coke & nuclear fuel	1,94	0,84	0,52	0,20	0,22	0,11	0,32	-0,31	0,51	0,89	1,40
Construction	4,14	0,58	0,05	0,01	0,00	0,04	0,53	3,69	1,26	-1,39	-0,13
Non-Market	3,21	1,18	0,22	0,04	0,02	0,16	0,96	2,05	1,46	-1,49	-0,02
Public education	2,90	0,40	0,08	0,01	0,01	0,06	0,31	2,54	1,74	-1,77	-0,03
Public health & social services	3,51	0,42	0,18	0,04	0,01	0,14	0,24	2,27	1,88	-1,06	0,82
Rest of public administration	3,21	1,91	0,30	0,06	0,03	0,22	1,61	1,74	1,14	-1,58	-0,44

Source: FBBVA-Ivie and own calculations

Table A.2. Growth Accounting. 1985-2002. Labor Productivity

Percentages

	LP	Capital						Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT				
			Total	Software	Communications		Hardware			
TOTAL	1,21	0,76	0,32	0,10	0,08	0,14	0,43	1,02	-0,56	0,45
Intensive ICT users	0,66	0,87	0,60	0,23	0,15	0,22	0,27	1,70	-1,91	-0,21
Electricity, gas and water supply	4,15	0,91	0,34	0,17	0,09	0,07	0,57	0,66	2,59	3,25
Pulp, paper, printing & publishing	-0,35	1,29	0,41	0,06	0,11	0,25	0,88	1,57	-3,21	-1,64
Electric, electronic & optic equipment	4,29	1,58	0,82	0,07	0,08	0,68	0,75	-0,10	2,82	2,71
Transport and communications	2,89	1,78	1,02	0,43	0,48	0,11	0,76	1,35	-0,24	1,11
Financial intermediation	1,40	1,54	1,27	0,74	0,02	0,51	0,26	2,87	-3,01	-0,14
Business services	-0,90	0,85	0,29	0,05	0,03	0,21	0,56	3,30	-5,05	-1,75
Private health & social services	-1,14	0,34	0,24	0,05	0,01	0,19	0,09	4,51	-5,99	-1,48
Other community, social & personal services	-0,74	0,78	0,36	0,06	0,13	0,17	0,41	0,50	-2,01	-1,51
Non-Intensive ICT users	0,65	0,65	0,18	0,03	0,04	0,10	0,46	0,71	-0,71	0,00
Food, drink and tobacco	0,68	1,23	0,31	0,05	0,09	0,17	0,92	0,36	-0,91	-0,55
Textiles, clothing, leather and footwear	1,36	0,62	0,17	0,02	0,06	0,09	0,45	-0,58	1,32	0,74
Chemicals	1,71	0,70	0,25	0,04	0,08	0,13	0,45	0,87	0,13	1,01
Rubber & plastics	0,98	0,55	0,18	0,02	0,07	0,10	0,37	-0,85	1,27	0,42
Other non-metallic mineral products	2,11	0,74	0,22	0,02	0,09	0,10	0,52	0,19	1,19	1,38
Fabricated metal products	0,92	0,34	0,17	0,03	0,05	0,10	0,16	0,10	0,48	0,58
Machinery & mechanical equipment	2,64	0,49	0,17	0,03	0,04	0,11	0,32	2,62	-0,48	2,14
Transport equipment manufacturing	2,77	1,11	0,23	0,04	0,08	0,10	0,89	0,80	0,86	1,66
Wood & products of wood & cork; Miscellaneous manufacturing	0,90	0,65	0,16	0,02	0,06	0,08	0,49	0,76	-0,50	0,25
Wholesale & retail trade; Repairs	-0,09	0,70	0,23	0,06	0,03	0,14	0,47	0,59	-1,38	-0,79
Hotels & catering	-0,47	0,33	0,06	0,01	0,02	0,03	0,27	1,62	-2,42	-0,80
Real estate activities	0,12	0,67	0,12	0,00	0,03	0,09	0,55	2,29	-2,85	-0,56
Private education	1,06	0,17	0,07	0,02	0,00	0,05	0,10	2,55	-1,66	0,89
Other Non-Intensive ICT users	2,93	0,36	0,05	0,01	0,01	0,03	0,31	0,63	1,94	2,57
Agriculture and forestry	5,53	1,46	0,00	0,00	0,00	0,00	1,46	-0,03	4,10	4,07
Fishing	1,32	0,43	0,07	0,00	0,05	0,01	0,36	0,03	0,85	0,89
Mining and quarrying	3,39	2,36	0,27	0,02	0,16	0,09	2,10	1,49	-0,46	1,03
Mineral oil refining, coke & nuclear fuel	2,85	1,45	0,57	0,21	0,25	0,11	0,88	0,51	0,89	1,40
Construction	-0,08	0,05	0,04	0,01	0,00	0,03	0,01	1,26	-1,39	-0,13
Non-Market	0,61	0,64	0,19	0,03	0,01	0,14	0,45	1,46	-1,49	-0,02
Public education	0,09	0,12	0,07	0,01	0,00	0,05	0,05	1,74	-1,77	-0,03
Public health & social services	1,02	0,20	0,16	0,03	0,00	0,12	0,04	1,88	-1,06	0,82
Rest of public administration	0,66	1,10	0,26	0,05	0,02	0,19	0,84	1,14	-1,58	-0,44

Source: FBBVA-Ivie and own calculations

Table A.3. Growth Accounting. 1985-1990. Gross Value Added
Percentages

	GVA	Capital						Hours worked	Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT					
			Total	Software	Communications		Hardware				
TOTAL	4,75	1,37	0,45	0,13	0,12	0,20	0,92	2,29	0,71	0,37	1,09
Intensive ICT users	5,16	1,72	0,96	0,30	0,33	0,33	0,76	2,64	2,25	-1,44	0,80
Electricity, gas and water supply	4,43	0,61	0,38	0,07	0,11	0,20	0,23	0,09	0,48	3,26	3,74
Pulp, paper, printing & publishing	3,65	2,68	0,75	0,05	0,15	0,55	1,92	4,42	1,79	-5,23	-3,44
Electric, electronic & optic equipment	9,40	2,20	1,06	0,03	0,09	0,94	1,14	0,87	3,18	3,15	6,33
Transport and communications	3,86	2,07	0,93	0,15	0,76	0,03	1,14	0,39	2,26	-0,86	1,40
Financial intermediation	5,46	1,35	1,32	0,65	0,02	0,65	0,03	0,11	3,01	0,99	4,00
Business services	6,45	1,77	1,10	0,59	0,04	0,47	0,67	8,35	4,60	-8,27	-3,67
Private health & social services	5,59	0,35	0,15	0,03	0,00	0,11	0,20	5,59	-0,41	0,06	-0,35
Other community, social & personal services	4,88	2,09	1,13	0,27	0,59	0,27	0,96	4,16	0,94	-2,30	-1,36
Non-Intensive ICT users	3,84	1,29	0,30	0,08	0,05	0,18	0,99	2,55	0,62	-0,62	0,00
Food, drink and tobacco	2,74	1,57	0,41	0,05	0,08	0,29	1,16	1,79	-0,80	0,17	-0,63
Textiles, clothing, leather and footwear	1,02	0,76	0,21	0,01	0,06	0,14	0,55	0,58	0,38	-0,71	-0,33
Chemicals	2,66	0,65	0,35	0,04	0,05	0,26	0,29	1,70	0,50	-0,18	0,31
Rubber & plastics	4,57	1,50	0,29	0,02	0,10	0,18	1,21	4,15	-1,52	0,43	-1,08
Other non-metallic mineral products	6,27	2,36	0,43	0,03	0,14	0,25	1,93	2,14	0,34	1,43	1,77
Fabricated metal products	2,48	1,31	0,27	0,01	0,10	0,16	1,04	0,54	1,45	-0,82	0,63
Machinery & mechanical equipment	-0,23	1,16	0,33	0,02	0,06	0,25	0,83	2,48	3,67	-7,53	-3,87
Transport equipment manufacturing	8,36	0,06	0,18	0,02	0,02	0,14	-0,12	1,09	2,15	5,06	7,21
Wood & products of wood & cork; Miscellaneous manufacturing	5,97	1,26	0,26	0,01	0,07	0,18	1,00	2,87	-2,44	4,28	1,84
Wholesale & retail trade; Repairs	3,29	1,29	0,41	0,19	0,01	0,21	0,88	3,92	0,85	-2,77	-1,91
Hotels & catering	4,61	1,06	0,15	0,07	0,03	0,05	0,91	4,37	0,48	-1,30	-0,82
Real estate activities	7,14	3,70	0,30	0,13	0,01	0,16	3,40	0,74	1,17	1,53	2,70
Private education	6,08	0,10	0,03	0,00	0,00	0,02	0,08	1,40	2,73	1,85	4,58
Other Non-Intensive ICT users	6,06	0,38	0,06	0,02	0,00	0,03	0,32	0,52	-0,44	5,60	5,16
Agriculture and forestry	4,27	0,48	0,00	0,00	0,00	0,00	0,48	-2,75	-0,79	7,33	6,54
Fishing	-0,55	-0,01	0,03	0,01	0,01	0,01	-0,05	-2,83	3,09	-0,79	2,29
Mining and quarrying	-0,11	0,49	0,08	0,00	0,04	0,03	0,41	-1,30	-0,42	1,13	0,70
Mineral oil refining, coke & nuclear fuel	4,72	-1,96	0,21	0,08	-0,04	0,17	-2,17	-0,27	-1,45	8,40	6,95
Construction	8,54	0,51	0,09	0,04	0,00	0,05	0,42	7,72	-0,17	0,48	0,31
Non-Market	5,07	1,77	0,23	0,04	0,02	0,17	1,54	4,06	0,50	-1,27	-0,77
Public education	3,57	0,59	0,10	0,02	0,01	0,07	0,49	4,26	1,30	-2,58	-1,27
Public health & social services	5,53	0,67	0,18	0,04	0,01	0,14	0,48	4,82	-0,24	0,29	0,05
Rest of public administration	5,58	2,83	0,31	0,05	0,04	0,22	2,52	3,60	0,35	-1,20	-0,85

Source: FBBVA-Ivie and own calculations

Table A.4. Growth Accounting. 1985-1990. Labor Productivity

Percentages

	LP	Capital						Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT				
			Total	Software	Communi-cations		Hardware			
TOTAL	1,67	0,58	0,36	0,11	0,07	0,17	0,22	0,71	0,37	1,09
Intensive ICT users	1,53	0,73	0,70	0,24	0,19	0,27	0,02	2,25	-1,44	0,80
Electricity, gas and water supply	4,12	0,38	0,36	0,07	0,10	0,19	0,02	0,48	3,26	3,74
Pulp, paper, printing & publishing	-2,41	1,03	0,49	0,04	0,08	0,37	0,55	1,79	-5,23	-3,44
Electric, electronic & optic equipment	8,26	1,93	0,99	0,02	0,08	0,89	0,94	3,18	3,15	6,33
Transport and communications	3,30	1,89	0,88	0,14	0,71	0,03	1,01	2,26	-0,86	1,40
Financial intermediation	5,33	1,33	1,31	0,65	0,02	0,64	0,02	3,01	0,99	4,00
Business services	-2,81	0,86	0,54	0,30	0,00	0,24	0,32	4,60	-8,27	-3,67
Private health & social services	-0,57	-0,22	0,11	0,02	0,00	0,09	-0,33	-0,41	0,06	-0,35
Other community, social & personal services	-0,30	1,06	0,66	0,19	0,27	0,20	0,41	0,94	-2,30	-1,36
Non-Intensive ICT users	0,41	0,41	0,23	0,06	0,02	0,15	0,18	0,62	-0,62	0,00
Food, drink and tobacco	0,13	0,76	0,34	0,04	0,05	0,25	0,42	-0,80	0,17	-0,63
Textiles, clothing, leather and footwear	0,28	0,60	0,19	0,01	0,05	0,13	0,41	0,38	-0,71	-0,33
Chemicals	0,10	-0,21	0,28	0,03	0,02	0,22	-0,49	0,50	-0,18	0,31
Rubber & plastics	-0,97	0,12	0,18	0,01	0,04	0,13	-0,06	-1,52	0,43	-1,08
Other non-metallic mineral products	2,67	0,90	0,31	0,02	0,08	0,21	0,59	0,34	1,43	1,77
Fabricated metal products	1,58	0,95	0,25	0,01	0,08	0,15	0,70	1,45	-0,82	0,63
Machinery & mechanical equipment	-3,15	0,72	0,28	0,01	0,05	0,21	0,44	3,67	-7,53	-3,87
Transport equipment manufacturing	6,92	-0,29	0,16	0,02	0,01	0,13	-0,45	2,15	5,06	7,21
Wood & products of wood & cork; Miscellaneous manufacturing	2,42	0,59	0,20	0,01	0,05	0,15	0,38	-2,44	4,28	1,84
Wholesale & retail trade; Repairs	-1,28	0,63	0,30	0,14	0,00	0,16	0,33	0,85	-2,77	-1,91
Hotels & catering	-0,32	0,51	0,10	0,05	0,01	0,04	0,41	0,48	-1,30	-0,82
Real estate activities	3,71	1,01	0,21	0,10	-0,02	0,13	0,80	1,17	1,53	2,70
Private education	4,61	0,02	0,02	0,00	-0,01	0,02	0,00	2,73	1,85	4,58
Other Non-Intensive ICT users	5,34	0,18	0,05	0,02	0,00	0,03	0,13	-0,44	5,60	5,16
Agriculture and forestry	8,67	2,13	0,00	0,00	0,00	0,00	2,13	-0,79	7,33	6,54
Fishing	4,37	2,08	0,05	0,01	0,02	0,01	2,04	3,09	-0,79	2,29
Mining and quarrying	2,19	1,49	0,13	0,00	0,09	0,04	1,35	-0,42	1,13	0,70
Mineral oil refining, coke & nuclear fuel	5,61	-1,34	0,24	0,08	-0,02	0,18	-1,58	-1,45	8,40	6,95
Construction	-0,40	-0,70	0,06	0,03	0,00	0,03	-0,76	-0,17	0,48	0,31
Non-Market	-0,11	0,66	0,18	0,03	0,01	0,14	0,48	0,50	-1,27	-0,77
Public education	-1,23	0,05	0,06	0,01	-0,01	0,06	-0,02	1,30	-2,58	-1,27
Public health & social services	0,21	0,16	0,14	0,03	0,00	0,12	0,02	-0,24	0,29	0,05
Rest of public administration	0,30	1,15	0,24	0,04	0,02	0,18	0,91	0,35	-1,20	-0,85

Source: FBBVA-Ivie and own calculations

Table A.5. Growth Accounting. 1990-1995. Gross Value Added
Percentages

	GVA	Capital						Hours worked	Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT					
			Total	Software	Communi-cations		Hardware				
TOTAL	0,94	1,00	0,24	0,06	0,07	0,11	0,77	-0,44	0,25	0,13	0,38
Intensive ICT users	0,80	1,25	0,51	0,17	0,15	0,20	0,74	0,82	0,25	-1,53	-1,28
Electricity, gas and water supply	0,52	-0,57	0,12	0,04	0,04	0,05	-0,69	-0,30	0,65	0,73	1,38
Pulp, paper, printing & publishing	-1,11	1,37	0,28	0,02	0,11	0,15	1,10	-1,27	1,08	-2,30	-1,22
Electric, electronic & optic equipment	2,27	1,15	0,44	0,01	0,07	0,36	0,71	-1,69	-4,80	7,60	2,81
Transport and communications	3,75	1,61	0,54	0,19	0,31	0,04	1,07	0,35	-0,30	2,09	1,80
Financial intermediation	-5,23	1,86	1,38	0,64	0,04	0,70	0,47	-0,89	1,78	-7,97	-6,20
Business services	3,77	1,13	0,16	-0,01	0,04	0,12	0,97	2,97	0,54	-0,87	-0,33
Private health & social services	2,25	0,78	0,28	0,07	0,01	0,20	0,51	3,56	9,77	-11,86	-2,09
Other community, social & personal services	0,54	1,31	0,37	0,01	0,27	0,09	0,94	1,37	-1,92	-0,21	-2,13
Non-Intensive ICT users	1,11	0,98	0,10	0,00	0,04	0,06	0,88	-0,36	-0,22	0,71	0,48
Food, drink and tobacco	-0,23	1,15	0,19	0,02	0,08	0,10	0,95	-0,95	-1,28	0,85	-0,43
Textiles, clothing, leather and footwear	-1,46	0,29	0,11	0,01	0,04	0,06	0,18	-4,01	0,10	2,17	2,27
Chemicals	1,92	0,63	0,16	0,01	0,06	0,08	0,47	-2,01	-1,68	4,99	3,31
Rubber & plastics	1,79	0,95	0,15	0,01	0,08	0,07	0,80	-0,74	-0,11	1,70	1,59
Other non-metallic mineral products	0,91	1,05	0,16	0,00	0,10	0,06	0,89	-1,17	-1,04	2,08	1,03
Fabricated metal products	0,36	0,35	0,09	0,00	0,04	0,05	0,25	-0,52	-2,55	3,08	0,53
Machinery & mechanical equipment	7,92	0,54	0,14	0,00	0,04	0,10	0,39	-1,74	3,40	5,71	9,12
Transport equipment manufacturing	1,45	2,21	0,20	0,01	0,13	0,06	2,01	-0,94	-1,42	1,60	0,18
Wood & products of wood & cork; Miscellaneous manufacturing	-2,34	0,64	0,10	0,01	0,05	0,04	0,54	-1,58	2,62	-4,02	-1,40
Wholesale & retail trade; Repairs	0,96	0,88	0,07	-0,01	0,03	0,06	0,81	0,16	-0,84	0,76	-0,08
Hotels & catering	2,04	0,72	0,04	0,00	0,02	0,02	0,68	1,54	1,79	-2,01	-0,21
Real estate activities	0,24	3,21	0,01	-0,02	-0,01	0,04	3,20	-0,63	4,01	-6,35	-2,33
Private education	2,42	0,26	0,05	0,01	0,00	0,03	0,21	3,08	0,56	-1,47	-0,91
Other Non-Intensive ICT users	-0,67	0,03	0,02	0,00	0,00	0,02	0,01	-3,16	0,53	1,93	2,47
Agriculture and forestry	-0,45	-0,48	0,00	0,00	0,00	0,00	-0,48	-4,07	0,44	3,67	4,11
Fishing	-4,17	-1,06	0,01	-0,01	0,02	0,00	-1,07	-0,87	-2,01	-0,24	-2,24
Mining and quarrying	1,25	-0,23	0,04	0,01	0,01	0,02	-0,27	-4,50	2,47	3,52	5,99
Mineral oil refining, coke & nuclear fuel	0,23	0,54	0,30	0,03	0,13	0,14	0,24	-0,86	1,60	-1,04	0,55
Construction	-0,84	0,41	0,02	0,00	0,00	0,02	0,39	-1,62	0,63	-0,27	0,36
Non-Market	2,52	1,35	0,20	0,03	0,01	0,15	1,15	0,86	1,08	-0,77	0,32
Public education	2,86	0,45	0,07	0,01	0,00	0,06	0,38	1,70	0,77	-0,06	0,70
Public health & social services	3,30	0,46	0,17	0,03	0,01	0,13	0,29	0,50	3,05	-0,72	2,34
Rest of public administration	1,91	2,14	0,27	0,05	0,02	0,20	1,87	0,67	0,50	-1,40	-0,89

Source: FBBVA-Ivie and own calculations

Table A.6. Growth Accounting. 1990-1995. Labor Productivity
Percentages

	LP	Capital						Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT				
			Total	Software	Communi-cations		Hardware			
TOTAL	1,53	1,15	0,26	0,06	0,08	0,12	0,89	0,25	0,13	0,38
Intensive ICT users	-0,33	0,95	0,42	0,14	0,10	0,17	0,53	0,25	-1,53	-1,28
Electricity, gas and water supply	1,47	0,09	0,18	0,04	0,07	0,06	-0,09	0,65	0,73	1,38
Pulp, paper, printing & publishing	0,59	1,81	0,36	0,02	0,13	0,21	1,45	1,08	-2,30	-1,22
Electric, electronic & optic equipment	4,49	1,68	0,60	0,01	0,10	0,49	1,08	-4,80	7,60	2,81
Transport and communications	3,22	1,42	0,48	0,19	0,25	0,04	0,94	-0,30	2,09	1,80
Financial intermediation	-4,14	2,06	1,49	0,69	0,04	0,76	0,57	1,78	-7,97	-6,20
Business services	0,41	0,74	-0,05	-0,12	0,02	0,04	0,79	0,54	-0,87	-0,33
Private health & social services	-1,61	0,48	0,23	0,05	0,00	0,17	0,24	9,77	-11,86	-2,09
Other community, social & personal services	-1,20	0,94	0,19	-0,02	0,15	0,06	0,75	-1,92	-0,21	-2,13
Non-Intensive ICT users	1,58	1,10	0,11	0,00	0,05	0,06	0,99	-0,22	0,71	0,48
Food, drink and tobacco	1,13	1,56	0,24	0,02	0,10	0,12	1,31	-1,28	0,85	-0,43
Textiles, clothing, leather and footwear	3,61	1,34	0,22	0,01	0,10	0,11	1,12	0,10	2,17	2,27
Chemicals	4,79	1,48	0,26	0,02	0,10	0,13	1,22	-1,68	4,99	3,31
Rubber & plastics	2,75	1,17	0,18	0,01	0,09	0,08	0,99	-0,11	1,70	1,59
Other non-metallic mineral products	2,83	1,79	0,23	0,01	0,14	0,09	1,56	-1,04	2,08	1,03
Fabricated metal products	1,18	0,66	0,12	0,01	0,06	0,06	0,54	-2,55	3,08	0,53
Machinery & mechanical equipment	9,95	0,84	0,19	0,01	0,06	0,13	0,64	3,40	5,71	9,12
Transport equipment manufacturing	2,66	2,48	0,22	0,01	0,14	0,07	2,26	-1,42	1,60	0,18
Wood & products of wood & cork; Miscellaneous manufacturing	-0,41	0,99	0,14	0,01	0,07	0,06	0,85	2,62	-4,02	-1,40
Wholesale & retail trade; Repairs	0,77	0,85	0,07	-0,02	0,03	0,05	0,78	-0,84	0,76	-0,08
Hotels & catering	0,31	0,53	0,02	0,00	0,01	0,01	0,51	1,79	-2,01	-0,21
Real estate activities	3,36	5,70	0,10	0,01	0,02	0,07	5,60	4,01	-6,35	-2,33
Private education	-0,81	0,10	0,04	0,01	0,00	0,03	0,07	0,56	-1,47	-0,91
Other Non-Intensive ICT users	3,47	1,01	0,04	0,00	0,02	0,02	0,97	0,53	1,93	2,47
Agriculture and forestry	6,12	2,01	0,00	0,00	0,00	0,00	2,01	0,44	3,67	4,11
Fishing	-2,62	-0,38	0,02	-0,01	0,03	0,00	-0,39	-2,01	-0,24	-2,24
Mining and quarrying	9,14	3,15	0,26	0,01	0,21	0,04	2,89	2,47	3,52	5,99
Mineral oil refining, coke & nuclear fuel	2,41	1,86	0,39	0,04	0,19	0,16	1,47	1,60	-1,04	0,55
Construction	0,96	0,60	0,03	0,00	0,00	0,03	0,57	0,63	-0,27	0,36
Non-Market	1,40	1,09	0,18	0,03	0,01	0,14	0,91	1,08	-0,77	0,32
Public education	0,96	0,26	0,06	0,01	0,00	0,05	0,20	0,77	-0,06	0,70
Public health & social services	2,75	0,42	0,16	0,03	0,00	0,13	0,25	3,05	-0,72	2,34
Rest of public administration	0,87	1,77	0,24	0,04	0,02	0,18	1,52	0,50	-1,40	-0,89

Source: FBBVA-Ivie and own calculations

Table A.7. Growth Accounting. 1995-2002. Gross Value Added
Percentages

	GVA	Capital					Non-ICT	Hours worked	Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Total					
			Total	Software	Communications						
TOTAL	3,25	1,23	0,51	0,12	0,14	0,25	0,73	2,06	1,84	-1,88	-0,05
Intensive ICT users	4,13	1,75	0,98	0,28	0,32	0,38	0,77	2,53	2,65	-2,80	-0,15
Electricity, gas and water supply	4,19	0,57	0,32	0,20	0,05	0,08	0,25	-0,65	1,05	3,21	4,27
Pulp, paper, printing & publishing	3,88	1,96	0,71	0,10	0,17	0,44	1,25	2,55	1,77	-2,40	-0,63
Electric, electronic & optic equipment	3,63	2,06	1,38	0,11	0,11	1,16	0,68	1,75	1,10	-1,28	-0,19
Transport and communications	4,86	2,60	1,48	0,51	0,79	0,18	1,11	1,61	1,93	-1,27	0,66
Financial intermediation	3,06	1,22	1,04	0,44	0,02	0,58	0,18	0,41	3,74	-2,31	1,43
Business services	5,29	1,57	0,71	0,17	0,11	0,43	0,86	4,98	4,38	-5,64	-1,26
Private health & social services	3,13	0,88	0,40	0,05	0,02	0,33	0,47	3,99	3,28	-5,01	-1,74
Other community, social & personal services	2,91	1,36	0,74	0,10	0,32	0,32	0,62	2,88	1,89	-3,22	-1,33
Non-Intensive ICT users	2,80	1,20	0,34	0,05	0,09	0,20	0,86	2,11	1,41	-1,92	-0,51
Food, drink and tobacco	1,14	1,49	0,46	0,06	0,12	0,28	1,03	0,27	2,25	-2,86	-0,61
Textiles, clothing, leather and footwear	2,19	0,57	0,24	0,03	0,07	0,14	0,34	1,34	-1,69	1,96	0,27
Chemicals	2,71	1,36	0,41	0,06	0,13	0,22	0,95	1,48	3,49	-3,62	-0,13
Rubber & plastics	4,89	1,27	0,35	0,02	0,13	0,19	0,92	2,94	-0,57	1,25	0,68
Other non-metallic mineral products	4,12	1,13	0,37	0,03	0,15	0,18	0,76	1,85	1,00	0,13	1,13
Fabricated metal products	3,76	1,08	0,35	0,05	0,10	0,20	0,73	2,35	1,17	-0,85	0,32
Machinery & mechanical equipment	5,98	0,82	0,30	0,05	0,07	0,19	0,51	3,82	1,59	-0,25	1,34
Transport equipment manufacturing	2,67	1,53	0,39	0,06	0,13	0,20	1,14	2,08	1,70	-2,63	-0,93
Wood & products of wood & cork; Miscellaneous manufacturing	3,83	1,06	0,29	0,03	0,10	0,16	0,77	2,54	1,62	-1,38	0,23
Wholesale & retail trade; Repairs	2,88	1,18	0,44	0,11	0,06	0,27	0,74	2,32	1,28	-1,89	-0,62
Hotels & catering	1,75	0,44	0,12	0,01	0,06	0,05	0,32	2,59	1,86	-3,14	-1,28
Real estate activities	3,87	3,70	0,35	-0,02	0,16	0,21	3,35	2,20	0,66	-2,68	-2,02
Private education	2,87	0,40	0,11	0,02	0,01	0,08	0,29	2,88	3,86	-4,27	-0,41
Other Non-Intensive ICT users	3,33	0,51	0,07	0,01	0,02	0,04	0,44	1,95	1,03	-0,16	0,87
Agriculture and forestry	1,87	0,37	0,00	0,00	0,00	0,00	0,37	-0,63	-0,42	2,55	2,13
Fishing	0,24	-0,76	0,09	0,00	0,07	0,02	-0,85	-0,98	-0,87	2,85	1,98
Mining and quarrying	-2,91	0,87	0,23	0,01	0,11	0,12	0,63	-1,68	1,99	-4,08	-2,09
Mineral oil refining, coke & nuclear fuel	1,16	2,48	0,82	0,22	0,45	0,15	1,66	-0,01	1,73	-3,03	-1,30
Construction	4,55	0,56	0,06	0,01	0,00	0,06	0,49	4,67	2,37	-3,04	-0,67
Non-Market	2,39	0,89	0,31	0,04	0,02	0,25	0,58	1,40	2,30	-2,20	0,10
Public education	2,46	0,32	0,12	0,01	0,01	0,09	0,21	1,87	2,80	-2,54	0,26
Public health & social services	2,23	0,33	0,26	0,03	0,01	0,22	0,08	1,71	2,19	-2,01	0,18
Rest of public administration	2,45	1,41	0,42	0,06	0,03	0,34	0,98	1,09	2,09	-2,13	-0,04

Source: FBBVA-Ivie and own calculations

Table A.8. Growth Accounting. 1995-2002. Labor Productivity

Percentages

	LP	Capital						Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT				
			Total	Software	Communications		Hardware			
TOTAL	0,54	0,59	0,39	0,09	0,09	0,21	0,19	1,84	-1,88	-0,05
Intensive ICT users	0,67	0,82	0,67	0,18	0,17	0,31	0,15	2,65	-2,80	-0,15
Electricity, gas and water supply	6,10	1,83	0,45	0,22	0,13	0,10	1,38	1,05	3,21	4,27
Pulp, paper, printing & publishing	0,45	1,08	0,55	0,08	0,11	0,36	0,53	1,77	-2,40	-0,63
Electric, electronic & optic equipment	1,31	1,49	1,21	0,10	0,08	1,04	0,28	1,10	-1,28	-0,19
Transport and communications	2,35	1,70	1,16	0,44	0,55	0,17	0,54	1,93	-1,27	0,66
Financial intermediation	2,54	1,11	0,97	0,40	0,01	0,56	0,14	3,74	-2,31	1,43
Business services	-0,46	0,80	0,42	0,02	0,07	0,33	0,38	4,38	-5,64	-1,26
Private health & social services	-1,21	0,53	0,33	0,03	0,01	0,28	0,20	3,28	-5,01	-1,74
Other community, social & personal services	-0,72	0,61	0,41	0,05	0,09	0,27	0,20	1,89	-3,22	-1,33
Non-Intensive ICT users	0,06	0,56	0,27	0,04	0,06	0,17	0,29	1,41	-1,92	-0,51
Food, drink and tobacco	0,76	1,37	0,45	0,06	0,12	0,27	0,93	2,25	-2,86	-0,61
Textiles, clothing, leather and footwear	0,52	0,25	0,20	0,03	0,05	0,12	0,04	-1,69	1,96	0,27
Chemicals	0,66	0,79	0,34	0,05	0,10	0,19	0,45	3,49	-3,62	-0,13
Rubber & plastics	1,10	0,42	0,25	0,02	0,07	0,16	0,17	-0,57	1,25	0,68
Other non-metallic mineral products	1,21	0,08	0,26	0,03	0,09	0,15	-0,18	1,00	0,13	1,13
Fabricated metal products	0,26	-0,06	0,25	0,04	0,04	0,17	-0,31	1,17	-0,85	0,32
Machinery & mechanical equipment	1,55	0,21	0,21	0,04	0,04	0,13	0,01	1,59	-0,25	1,34
Transport equipment manufacturing	-0,11	0,82	0,32	0,05	0,09	0,17	0,50	1,70	-2,63	-0,93
Wood & products of wood & cork; Miscellaneous manufacturing	0,76	0,52	0,23	0,02	0,07	0,13	0,30	1,62	-1,38	0,23
Wholesale & retail trade; Repairs	0,14	0,76	0,36	0,08	0,04	0,24	0,39	1,28	-1,89	-0,62
Hotels & catering	-1,14	0,13	0,09	0,00	0,04	0,05	0,05	1,86	-3,14	-1,28
Real estate activities	-4,77	-2,75	0,13	-0,07	0,07	0,13	-2,88	0,66	-2,68	-2,02
Private education	-0,14	0,27	0,10	0,02	0,01	0,07	0,17	3,86	-4,27	-0,41
Other Non-Intensive ICT users	0,89	0,02	0,06	0,01	0,01	0,04	-0,04	1,03	-0,16	0,87
Agriculture and forestry	2,87	0,74	0,01	0,00	0,01	0,00	0,74	-0,42	2,55	2,13
Fishing	1,95	-0,03	0,10	0,00	0,08	0,02	-0,13	-0,87	2,85	1,98
Mining and quarrying	0,14	2,24	0,33	0,01	0,19	0,13	1,90	1,99	-4,08	-2,09
Mineral oil refining, coke & nuclear fuel	1,19	2,50	0,82	0,22	0,45	0,15	1,68	1,73	-3,03	-1,30
Construction	-0,60	0,07	0,04	0,00	0,00	0,04	0,03	2,37	-3,04	-0,67
Non-Market	0,58	0,48	0,28	0,03	0,01	0,23	0,20	2,30	-2,20	0,10
Public education	0,40	0,14	0,10	0,01	0,01	0,09	0,04	2,80	-2,54	0,26
Public health & social services	0,36	0,18	0,23	0,02	0,01	0,20	-0,05	2,19	-2,01	0,18
Rest of public administration	0,77	0,81	0,38	0,05	0,02	0,31	0,42	2,09	-2,13	-0,04

Source: FBBVA-Ivie and own calculations

Table A.9. Growth Accounting. 1995-2000. Gross Value Added
Percentages

	GVA	Capital					Non-ICT	Hours worked	Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT								
			Total	Software	Communi-cations	Hardware					
TOTAL	3,52	1,23	0,51	0,11	0,15	0,25	0,72	2,32	2,10	-2,12	-0,03
Intensive ICT users	4,30	1,76	0,99	0,25	0,34	0,40	0,76	2,81	3,26	-3,53	-0,27
Electricity, gas and water supply	4,80	0,31	0,30	0,21	0,06	0,03	0,01	-0,48	1,66	3,30	4,96
Pulp, paper, printing & publishing	4,92	1,90	0,66	0,07	0,17	0,42	1,23	3,51	1,64	-2,12	-0,48
Electric, electronic & optic equipment	4,52	1,97	1,27	0,08	0,13	1,06	0,70	2,56	2,66	-2,67	-0,01
Transport and communications	4,98	2,50	1,44	0,40	0,84	0,20	1,06	1,59	2,54	-1,65	0,89
Financial intermediation	1,42	1,34	1,14	0,45	0,02	0,67	0,21	0,16	5,59	-5,67	-0,08
Business services	6,30	1,72	0,80	0,18	0,12	0,50	0,92	5,35	4,66	-5,43	-0,77
Private health & social services	4,05	0,91	0,44	0,07	0,02	0,35	0,48	5,18	4,34	-6,38	-2,04
Other community, social & personal services	3,28	1,49	0,74	0,10	0,30	0,34	0,75	3,30	1,83	-3,34	-1,51
Non-Intensive ICT users	3,30	1,21	0,34	0,05	0,09	0,20	0,88	2,58	1,60	-2,10	-0,50
Food, drink and tobacco	0,88	1,58	0,50	0,08	0,13	0,30	1,08	0,12	2,89	-3,71	-0,82
Textiles, clothing, leather and footwear	2,85	0,66	0,27	0,03	0,08	0,17	0,39	1,94	-2,05	2,30	0,25
Chemicals	2,57	1,52	0,47	0,08	0,14	0,25	1,04	1,27	2,43	-2,64	-0,22
Rubber & plastics	6,23	1,35	0,38	0,03	0,13	0,22	0,98	4,15	-1,36	2,09	0,73
Other non-metallic mineral products	4,67	1,10	0,36	0,03	0,15	0,18	0,75	2,10	0,69	0,77	1,47
Fabricated metal products	4,20	0,91	0,30	0,04	0,09	0,17	0,61	3,18	1,28	-1,17	0,12
Machinery & mechanical equipment	6,95	0,88	0,33	0,04	0,07	0,22	0,55	4,40	1,62	0,06	1,68
Transport equipment manufacturing	4,82	1,54	0,37	0,05	0,14	0,18	1,17	2,80	1,57	-1,09	0,48
Wood & products of wood & cork; Miscellaneous manufacturing	5,95	1,03	0,28	0,02	0,10	0,15	0,75	3,76	2,31	-1,15	1,17
Wholesale & retail trade; Repairs	3,30	1,20	0,42	0,08	0,06	0,28	0,78	2,71	1,97	-2,58	-0,61
Hotels & catering	2,17	0,53	0,13	0,01	0,06	0,06	0,40	3,36	1,63	-3,36	-1,72
Real estate activities	3,51	3,58	0,34	0,01	0,14	0,18	3,24	2,60	1,19	-3,86	-2,67
Private education	3,08	0,35	0,10	0,01	0,01	0,07	0,25	3,11	3,18	-3,55	-0,37
Other Non-Intensive ICT users	3,47	0,47	0,07	0,01	0,02	0,05	0,40	2,12	0,94	-0,06	0,88
Agriculture and forestry	3,13	0,34	0,00	0,00	0,00	0,00	0,34	-0,49	-0,61	3,89	3,28
Fishing	0,15	-0,78	0,10	0,01	0,07	0,02	-0,88	-0,57	-1,16	2,65	1,49
Mining and quarrying	-3,94	0,82	0,28	0,01	0,10	0,17	0,53	-2,06	3,42	-6,12	-2,70
Mineral oil refining, coke & nuclear fuel	1,01	1,99	0,51	0,15	0,38	-0,01	1,48	0,09	-0,30	-0,77	-1,07
Construction	4,37	0,53	0,07	0,01	0,00	0,06	0,46	5,01	2,42	-3,59	-1,18
Non-Market	2,46	0,84	0,29	0,04	0,02	0,24	0,54	1,24	2,51	-2,12	0,39
Public education	2,45	0,37	0,13	0,02	0,01	0,10	0,23	1,69	2,53	-2,13	0,40
Public health & social services	2,25	0,29	0,26	0,03	0,01	0,22	0,03	1,50	2,18	-1,72	0,46
Rest of public administration	2,59	1,30	0,38	0,05	0,02	0,31	0,92	0,95	2,65	-2,31	0,34

Source: FBBVA-Ivie and own calculations

Table A.10. Growth Accounting. 1995-2000. Labor Productivity
Percentages

	LP	Capital						Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT				
			Total	Software	Communi- cations		Hardware			
TOTAL	0,48	0,50	0,38	0,08	0,09	0,22	0,12	2,10	-2,12	-0,03
Intensive ICT users	0,48	0,74	0,65	0,16	0,17	0,33	0,09	3,26	-3,53	-0,27
Electricity, gas and water supply	6,18	1,22	0,39	0,22	0,12	0,05	0,82	1,66	3,30	4,96
Pulp, paper, printing & publishing	0,25	0,73	0,45	0,05	0,09	0,31	0,28	1,64	-2,12	-0,48
Electric, electronic & optic equipment	1,17	1,18	1,04	0,07	0,08	0,90	0,14	2,66	-2,67	-0,01
Transport and communications	2,52	1,63	1,13	0,34	0,59	0,19	0,50	2,54	-1,65	0,89
Financial intermediation	1,22	1,30	1,11	0,44	0,02	0,66	0,19	5,59	-5,67	-0,08
Business services	0,15	0,92	0,50	0,04	0,08	0,39	0,42	4,66	-5,43	-0,77
Private health & social services	-1,56	0,48	0,34	0,04	0,01	0,29	0,14	4,34	-6,38	-2,04
Other community, social & personal services	-0,87	0,64	0,36	0,05	0,02	0,29	0,28	1,83	-3,34	-1,51
Non-Intensive ICT users	-0,04	0,45	0,26	0,03	0,06	0,17	0,19	1,60	-2,10	-0,50
Food, drink and tobacco	0,71	1,53	0,50	0,08	0,13	0,29	1,03	2,89	-3,71	-0,82
Textiles, clothing, leather and footwear	0,44	0,19	0,22	0,02	0,04	0,15	-0,03	-2,05	2,30	0,25
Chemicals	0,80	1,02	0,41	0,07	0,11	0,23	0,61	2,43	-2,64	-0,22
Rubber & plastics	0,92	0,19	0,24	0,02	0,06	0,17	-0,05	-1,36	2,09	0,73
Other non-metallic mineral products	1,37	-0,10	0,23	0,02	0,07	0,14	-0,33	0,69	0,77	1,47
Fabricated metal products	-0,50	-0,61	0,17	0,03	0,01	0,13	-0,78	1,28	-1,17	0,12
Machinery & mechanical equipment	1,86	0,18	0,22	0,03	0,03	0,15	-0,04	1,62	0,06	1,68
Transport equipment manufacturing	1,10	0,62	0,28	0,04	0,09	0,15	0,34	1,57	-1,09	0,48
Wood & products of wood & cork; Miscellaneous manufacturing	1,43	0,27	0,19	0,02	0,05	0,12	0,08	2,31	-1,15	1,17
Wholesale & retail trade; Repairs	0,12	0,74	0,34	0,05	0,05	0,24	0,39	1,97	-2,58	-0,61
Hotels & catering	-1,58	0,14	0,09	0,00	0,04	0,05	0,05	1,63	-3,36	-1,72
Real estate activities	-6,69	-4,02	0,09	-0,05	0,04	0,10	-4,11	1,19	-3,86	-2,67
Private education	-0,16	0,21	0,08	0,01	0,01	0,06	0,12	3,18	-3,55	-0,37
Other Non-Intensive ICT users	0,80	-0,07	0,06	0,01	0,01	0,04	-0,13	0,94	-0,06	0,88
Agriculture and forestry	3,90	0,62	0,00	0,00	0,00	0,00	0,62	-0,61	3,89	3,28
Fishing	1,13	-0,36	0,11	0,01	0,08	0,02	-0,47	-1,16	2,65	1,49
Mining and quarrying	-0,24	2,46	0,41	0,02	0,21	0,19	2,05	3,42	-6,12	-2,70
Mineral oil refining, coke & nuclear fuel	0,80	1,87	0,50	0,15	0,37	-0,01	1,37	-0,30	-0,77	-1,07
Construction	-1,16	0,01	0,05	0,00	0,00	0,05	-0,04	2,42	-3,59	-1,18
Non-Market	0,86	0,47	0,26	0,03	0,01	0,22	0,21	2,51	-2,12	0,39
Public education	0,59	0,20	0,12	0,01	0,01	0,10	0,08	2,53	-2,13	0,40
Public health & social services	0,62	0,15	0,23	0,03	0,01	0,20	-0,08	2,18	-1,72	0,46
Rest of public administration	1,11	0,77	0,34	0,04	0,02	0,28	0,43	2,65	-2,31	0,34

Source: FBBVA-Ivie and own calculations

Table A.11. Growth Accounting, 2000-2002. Gross Value Added
Percentages

	GVA	Capital						Hours worked	Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT					
			Total	Software	Communications		Hardware				
TOTAL	2,58	1,08	0,46	0,12	0,15	0,19	0,62	1,45	1,32	-1,28	0,04
Intensive ICT users	3,72	1,54	0,89	0,31	0,32	0,26	0,65	1,90	1,34	-1,07	0,28
Electricity, gas and water supply	2,66	0,88	0,14	-0,01	0,03	0,12	0,74	-1,12	-0,36	3,26	2,90
Pulp, paper, printing & publishing	1,28	1,80	0,66	0,10	0,17	0,38	1,14	0,26	2,31	-3,09	-0,78
Electric, electronic & optic equipment	1,39	1,66	1,10	0,10	0,09	0,91	0,55	-0,19	-2,81	2,73	-0,08
Transport and communications	4,57	2,68	1,61	0,71	0,77	0,14	1,07	1,69	0,62	-0,44	0,19
Financial intermediation	7,17	0,79	0,86	0,46	0,01	0,39	-0,07	1,04	-0,90	6,23	5,33
Business services	2,78	1,12	0,42	0,07	0,10	0,25	0,70	4,11	3,73	-6,18	-2,45
Private health & social services	0,84	0,75	0,36	0,04	0,02	0,30	0,39	1,07	0,62	-1,59	-0,97
Other community, social & personal services	1,99	0,83	0,66	0,06	0,38	0,22	0,18	1,87	2,21	-2,92	-0,72
Non-Intensive ICT users	1,57	0,95	0,28	0,04	0,09	0,15	0,67	0,98	1,07	-1,43	-0,36
Food, drink and tobacco	1,80	1,19	0,35	0,01	0,13	0,21	0,83	0,64	0,72	-0,75	-0,03
Textiles, clothing, leather and footwear	0,53	0,32	0,15	0,02	0,07	0,06	0,17	-0,15	-0,76	1,12	0,36
Chemicals	3,06	0,91	0,25	-0,02	0,13	0,14	0,65	2,01	6,31	-6,17	0,14
Rubber & plastics	1,54	0,89	0,26	0,00	0,13	0,13	0,63	0,00	1,62	-0,97	0,64
Other non-metallic mineral products	2,73	1,08	0,37	0,04	0,19	0,14	0,72	1,28	2,18	-1,81	0,37
Fabricated metal products	2,64	1,26	0,37	0,05	0,11	0,20	0,89	0,36	1,03	0,00	1,03
Machinery & mechanical equipment	3,54	0,59	0,19	0,02	0,07	0,10	0,40	2,41	1,86	-1,33	0,53
Transport equipment manufacturing	-2,68	1,31	0,35	0,02	0,13	0,19	0,96	0,34	2,17	-6,51	-4,33
Wood & products of wood & cork; Miscellaneous manufacturing	-1,48	0,92	0,25	0,03	0,10	0,12	0,67	-0,45	-0,07	-1,87	-1,95
Wholesale & retail trade; Repairs	1,84	0,86	0,36	0,12	0,05	0,20	0,50	1,43	-0,30	-0,14	-0,44
Hotels & catering	0,70	0,13	0,07	-0,01	0,05	0,04	0,06	0,68	2,45	-2,56	-0,11
Real estate activities	4,79	3,58	0,38	-0,08	0,21	0,25	3,20	1,58	-0,82	0,46	-0,36
Private education	2,33	0,44	0,14	0,03	0,02	0,09	0,31	2,32	5,72	-6,16	-0,44
Other Non-Intensive ICT users	3,12	0,53	0,07	0,01	0,02	0,04	0,46	1,57	1,31	-0,29	1,01
Agriculture and forestry	-1,29	0,38	0,01	0,00	0,01	0,00	0,37	-1,04	-0,05	-0,58	-0,63
Fishing	0,46	-0,66	0,06	-0,02	0,06	0,02	-0,73	-2,11	-0,10	3,34	3,24
Mining and quarrying	-0,35	1,01	0,19	-0,01	0,15	0,05	0,82	-0,78	-1,50	0,92	-0,58
Mineral oil refining, coke & nuclear fuel	1,53	3,37	1,35	0,32	0,62	0,42	2,01	-0,28	5,57	-7,13	-1,56
Construction	5,03	0,52	0,04	0,01	0,00	0,04	0,48	3,88	2,34	-1,72	0,62
Non-Market	2,22	0,90	0,32	0,04	0,03	0,25	0,58	1,86	1,87	-2,41	-0,54
Public education	2,46	0,17	0,09	0,00	0,01	0,08	0,09	2,36	3,52	-3,59	-0,07
Public health & social services	2,17	0,39	0,24	0,03	0,01	0,21	0,14	2,27	2,22	-2,71	-0,48
Rest of public administration	2,11	1,48	0,46	0,07	0,05	0,34	1,01	1,48	0,78	-1,63	-0,84

Source: FBBVA-Ivie and own calculations

Table A.12. Growth Accounting. 2000-2002. Labor Productivity
Percentages

	LP	Capital						Labor qualification	TFPR	Labor qualification + TFPR
		Total	ICT			Non-ICT				
			Total	Software	Communi- cations		Hardware			
TOTAL	0,71	0,67	0,38	0,10	0,11	0,17	0,29	1,32	-1,28	0,04
Intensive ICT users	1,16	0,88	0,66	0,23	0,20	0,22	0,22	1,34	-1,07	0,28
Electricity, gas and water supply	5,89	2,99	0,35	0,05	0,16	0,14	2,63	-0,36	3,26	2,90
Pulp, paper, printing & publishing	0,93	1,71	0,64	0,10	0,17	0,38	1,07	2,31	-3,09	-0,78
Electric, electronic & optic equipment	1,64	1,71	1,12	0,11	0,10	0,92	0,59	-2,81	2,73	-0,08
Transport and communications	1,93	1,74	1,23	0,61	0,50	0,12	0,52	0,62	-0,44	0,19
Financial intermediation	5,84	0,51	0,69	0,34	0,00	0,34	-0,18	-0,90	6,23	5,33
Business services	-1,99	0,46	0,21	-0,03	0,06	0,17	0,25	3,73	-6,18	-2,45
Private health & social services	-0,32	0,65	0,33	0,03	0,01	0,29	0,32	0,62	-1,59	-0,97
Other community, social & personal services	-0,34	0,37	0,46	0,03	0,24	0,19	-0,09	2,21	-2,92	-0,72
Non-Intensive ICT users	0,33	0,69	0,25	0,03	0,08	0,14	0,44	1,07	-1,43	-0,36
Food, drink and tobacco	0,88	0,91	0,32	0,01	0,11	0,20	0,60	0,72	-0,75	-0,03
Textiles, clothing, leather and footwear	0,71	0,35	0,16	0,02	0,07	0,06	0,20	-0,76	1,12	0,36
Chemicals	0,31	0,16	0,16	-0,03	0,08	0,11	0,01	6,31	-6,17	0,14
Rubber & plastics	1,54	0,89	0,26	0,00	0,13	0,13	0,63	1,62	-0,97	0,64
Other non-metallic mineral products	0,80	0,43	0,30	0,03	0,14	0,13	0,13	2,18	-1,81	0,37
Fabricated metal products	2,14	1,12	0,35	0,05	0,11	0,20	0,76	1,03	0,00	1,03
Machinery & mechanical equipment	0,78	0,25	0,14	0,01	0,05	0,08	0,11	1,86	-1,33	0,53
Transport equipment manufacturing	-3,14	1,19	0,33	0,02	0,12	0,19	0,86	2,17	-6,51	-4,33
Wood & products of wood & cork; Miscellaneous manufacturing	-0,94	1,01	0,26	0,03	0,11	0,12	0,74	-0,07	-1,87	-1,95
Wholesale & retail trade; Repairs	0,18	0,62	0,32	0,10	0,04	0,18	0,30	-0,30	-0,14	-0,44
Hotels & catering	-0,05	0,06	0,07	-0,01	0,05	0,03	-0,01	2,45	-2,56	-0,11
Real estate activities	0,03	0,39	0,26	-0,11	0,15	0,22	0,13	-0,82	0,46	-0,36
Private education	-0,09	0,35	0,12	0,02	0,01	0,09	0,22	5,72	-6,16	-0,44
Other Non-Intensive ICT users	1,21	0,20	0,06	0,01	0,02	0,03	0,14	1,31	-0,29	1,01
Agriculture and forestry	0,29	0,92	0,01	0,00	0,01	0,00	0,91	-0,05	-0,58	-0,63
Fishing	4,00	0,76	0,09	-0,01	0,09	0,02	0,67	-0,10	3,34	3,24
Mining and quarrying	1,09	1,67	0,24	0,00	0,19	0,06	1,43	-1,50	0,92	-0,58
Mineral oil refining, coke & nuclear fuel	2,16	3,72	1,39	0,32	0,65	0,42	2,33	5,57	-7,13	-1,56
Construction	0,81	0,19	0,03	0,00	0,00	0,03	0,16	2,34	-1,72	0,62
Non-Market	-0,13	0,41	0,28	0,03	0,02	0,22	0,13	1,87	-2,41	-0,54
Public education	-0,09	-0,02	0,07	0,00	0,00	0,07	-0,09	3,52	-3,59	-0,07
Public health & social services	-0,29	0,20	0,21	0,02	0,01	0,18	-0,01	2,22	-2,71	-0,48
Rest of public administration	-0,09	0,75	0,41	0,05	0,04	0,31	0,34	0,78	-1,63	-0,84

Source: FBBVA-Ivie and own calculations

Table A. 13. Change in the Sources of Growth (1990-1995)-(1995-2000)

Percentages

	Labor Productivity Growth 1990-1995	Labor Productivity Growth 1990-1995	Labor Productivity Change	Change of:								
				Capital per hour worked						Labor qualification	TFPR	Labor qualification + TFPR
				Total	ICT			Non-ICT				
					Total	Software	Communi-cations		Hardware			
TOTAL	1,53	0,48	-1,05	-0,65	0,12	0,01	0,01	0,10	-0,77	1,85	-2,26	-0,41
Intensive ICT users	-0,33	0,48	0,81	-0,20	0,24	0,01	0,07	0,16	-0,44	3,01	-2,00	1,01
Electricity, gas and water supply	1,47	6,18	4,71	1,13	0,22	0,18	0,05	-0,01	0,92	1,01	2,56	3,58
Pulp, paper, printing & publishing	0,59	0,25	-0,34	-1,08	0,09	0,03	-0,04	0,10	-1,17	0,56	0,18	0,74
Electric, electronic & optic equipment	4,49	1,17	-3,32	-0,50	0,44	0,05	-0,02	0,41	-0,95	7,46	-10,27	-2,82
Transport and communications	3,22	2,52	-0,69	0,21	0,65	0,15	0,34	0,15	-0,43	2,84	-3,74	-0,90
Financial intermediation	-4,14	1,22	5,35	-0,76	-0,38	-0,26	-0,02	-0,10	-0,38	3,81	2,30	6,11
Business services	0,41	0,15	-0,26	0,19	0,55	0,16	0,05	0,34	-0,36	4,12	-4,57	-0,45
Private health & social services	-1,61	-1,56	0,05	0,00	0,11	-0,02	0,01	0,11	-0,10	-5,44	5,48	0,05
Other community, social & personal services	-1,20	-0,87	0,32	-0,30	0,17	0,07	-0,13	0,23	-0,47	3,76	-3,13	0,62
Non-Intensive ICT users	1,58	-0,04	-1,63	-0,65	0,15	0,03	0,01	0,11	-0,79	1,82	-2,80	-0,98
Food, drink and tobacco	1,13	0,71	-0,42	-0,03	0,25	0,05	0,03	0,17	-0,28	4,18	-4,57	-0,39
Textiles, clothing, leather and footwear	3,61	0,44	-3,18	-1,15	0,00	0,01	-0,05	0,04	-1,15	-2,15	0,13	-2,02
Chemicals	4,79	0,80	-3,98	-0,46	0,15	0,05	0,00	0,10	-0,61	4,11	-7,63	-3,53
Rubber & plastics	2,75	0,92	-1,83	-0,98	0,06	0,01	-0,03	0,09	-1,04	-1,25	0,39	-0,85
Other non-metallic mineral products	2,83	1,37	-1,46	-1,89	0,00	0,02	-0,06	0,05	-1,89	1,73	-1,30	0,43
Fabricated metal products	1,18	-0,50	-1,68	-1,27	0,05	0,02	-0,05	0,08	-1,32	3,83	-4,24	-0,41
Machinery & mechanical equipment	9,95	1,86	-8,09	-0,66	0,02	0,03	-0,03	0,02	-0,68	-1,78	-5,65	-7,44
Transport equipment manufacturing	2,66	1,10	-1,55	-1,86	0,06	0,03	-0,06	0,08	-1,92	2,99	-2,69	0,30
Wood & products of wood & cork; Miscellaneous manufacturing	-0,41	1,43	1,84	-0,72	0,05	0,01	-0,02	0,05	-0,77	-0,31	2,87	2,57
Wholesale & retail trade; Repairs	0,77	0,12	-0,65	-0,11	0,28	0,07	0,02	0,19	-0,39	2,81	-3,34	-0,53
Hotels & catering	0,31	-1,58	-1,89	-0,38	0,07	0,01	0,03	0,04	-0,46	-0,16	-1,35	-1,51
Real estate activities	3,36	-6,69	-10,05	-9,72	-0,01	-0,06	0,02	0,03	-9,71	-2,82	2,49	-0,33
Private education	-0,81	-0,16	0,65	0,10	0,05	0,00	0,01	0,04	0,06	2,62	-2,07	0,54
Other Non-Intensive ICT users	3,47	0,80	-2,67	-1,08	0,02	0,00	0,00	0,02	-1,10	0,41	-1,99	-1,59
Agriculture and forestry	6,12	3,90	-2,22	-1,39	0,00	0,00	0,00	0,00	-1,39	-1,05	0,22	-0,83
Fishing	-2,62	1,13	3,75	0,01	0,09	0,02	0,05	0,02	-0,08	0,85	2,89	3,73
Mining and quarrying	9,14	-0,24	-9,38	-0,69	0,16	0,01	0,00	0,15	-0,84	0,96	-9,64	-8,69
Mineral oil refining, coke & nuclear fuel	2,41	0,80	-1,61	0,01	0,11	0,11	0,18	-0,18	-0,10	-1,90	0,28	-1,62
Construction	0,96	-1,16	-2,12	-0,58	0,02	0,00	0,00	0,02	-0,61	1,78	-3,32	-1,54
Non-Market	1,40	0,86	-0,54	-0,62	0,08	0,00	0,00	0,08	-0,70	1,42	-1,35	0,07
Public education	0,96	0,59	-0,37	-0,06	0,06	0,00	0,01	0,05	-0,12	1,76	-2,07	-0,31
Public health & social services	2,75	0,62	-2,13	-0,26	0,07	0,00	0,00	0,07	-0,33	-0,87	-1,00	-1,87
Rest of public administration	0,87	1,11	0,24	-1,00	0,10	0,00	0,00	0,10	-1,10	2,15	-0,91	1,23

Source: FBBVA -Ivие and own calculations

Table A.14. Change in the Sources of Growth (1995-2000)-(2000-2002)

Percentages

	Labor Productivity Growth 1995-2000	Labor Productivity Growth 2000-2002	Labor Productivity Change	Change of:								
				Capital per hour worked						Labor qualification	TFPR	Labor qualification + TFPR
				Total	ICT			Non-ICT				
					Total	Software	Communi-cations		Hardware			
TOTAL	0,48	0,71	0,23	0,17	0,00	0,02	0,02	-0,04	0,16	-0,77	0,84	0,07
Intensive ICT users	0,48	1,16	0,68	0,14	0,00	0,07	0,04	-0,11	0,13	-1,92	2,46	0,55
Electricity, gas and water supply	6,18	5,89	-0,29	1,77	-0,04	-0,18	0,04	0,10	1,81	-2,02	-0,04	-2,07
Pulp, paper, printing & publishing	0,25	0,93	0,68	0,98	0,19	0,05	0,07	0,07	0,79	0,67	-0,97	-0,30
Electric, electronic & optic equipment	1,17	1,64	0,46	0,53	0,08	0,04	0,02	0,02	0,46	-5,47	5,40	-0,07
Transport and communications	2,52	1,93	-0,59	0,11	0,10	0,27	-0,09	-0,08	0,01	-1,92	1,21	-0,71
Financial intermediation	1,22	5,84	4,63	-0,79	-0,42	-0,09	-0,01	-0,31	-0,37	-6,49	11,90	5,42
Business services	0,15	-1,99	-2,14	-0,46	-0,29	-0,07	-0,01	-0,21	-0,17	-0,93	-0,75	-1,67
Private health & social services	-1,56	-0,32	1,24	0,17	-0,01	-0,01	0,00	0,00	0,18	-3,72	4,79	1,07
Other community, social & personal services	-0,87	-0,34	0,53	-0,27	0,10	-0,02	0,22	-0,10	-0,37	0,38	0,42	0,79
Non-Intensive ICT users	-0,04	0,33	0,38	0,24	-0,01	0,00	0,02	-0,02	0,25	-0,53	0,66	0,14
Food, drink and tobacco	0,71	0,88	0,17	-0,61	-0,18	-0,07	-0,02	-0,09	-0,44	-2,18	2,96	0,78
Textiles, clothing, leather and footwear	0,44	0,71	0,27	0,17	-0,06	0,00	0,03	-0,09	0,22	1,29	-1,18	0,11
Chemicals	0,80	0,31	-0,50	-0,85	-0,25	-0,11	-0,03	-0,12	-0,60	3,89	-3,53	0,36
Rubber & plastics	0,92	1,54	0,62	0,71	0,02	-0,02	0,07	-0,04	0,69	2,97	-3,06	-0,09
Other non-metallic mineral products	1,37	0,80	-0,57	0,53	0,07	0,01	0,07	-0,01	0,46	1,49	-2,59	-1,10
Fabricated metal products	-0,50	2,14	2,64	1,73	0,19	0,02	0,10	0,06	1,54	-0,26	1,17	0,91
Machinery & mechanical equipment	1,86	0,78	-1,08	0,07	-0,08	-0,02	0,02	-0,07	0,14	0,24	-1,39	-1,15
Transport equipment manufacturing	1,10	-3,14	-4,25	0,57	0,05	-0,02	0,04	0,04	0,51	0,60	-5,42	-4,82
Wood & products of wood & cork; Miscellaneous manufacturing	1,43	-0,94	-2,37	0,74	0,08	0,02	0,06	0,00	0,66	-2,38	-0,73	-3,11
Wholesale & retail trade; Repairs	0,12	0,18	0,06	-0,12	-0,02	0,05	-0,01	-0,06	-0,09	-2,27	2,44	0,17
Hotels & catering	-1,58	-0,05	1,53	-0,08	-0,03	-0,02	0,00	-0,02	-0,05	0,81	0,80	1,61
Real estate activities	-6,69	0,03	6,71	4,41	0,17	-0,05	0,11	0,12	4,24	-2,01	4,32	2,30
Private education	-0,16	-0,09	0,07	0,14	0,04	0,01	0,01	0,02	0,10	2,55	-2,62	-0,07
Other Non-Intensive ICT users	0,80	1,21	0,41	0,27	0,00	0,00	0,01	-0,01	0,27	0,37	-0,23	0,13
Agriculture and forestry	3,90	0,29	-3,61	0,30	0,00	0,00	0,00	0,00	0,29	0,56	-4,47	-3,91
Fishing	1,13	4,00	2,87	1,12	-0,01	-0,02	0,01	0,00	1,14	1,06	0,68	1,75
Mining and quarrying	-0,24	1,09	1,33	-0,79	-0,17	-0,02	-0,02	-0,13	-0,62	-4,93	7,04	2,12
Mineral oil refining, coke & nuclear fuel	0,80	2,16	1,36	1,85	0,89	0,18	0,28	0,43	0,96	5,88	-6,37	-0,49
Construction	-1,16	0,81	1,97	0,17	-0,02	0,00	0,00	-0,02	0,19	-0,08	1,88	1,80
Non-Market	0,86	-0,13	-0,99	-0,06	0,01	0,00	0,01	0,00	-0,07	-0,63	-0,30	-0,93
Public education	0,59	-0,09	-0,69	-0,22	-0,05	-0,02	0,00	-0,03	-0,17	0,99	-1,45	-0,47
Public health & social services	0,62	-0,29	-0,91	0,04	-0,03	-0,01	0,00	-0,02	0,07	0,04	-0,99	-0,95
Rest of public administration	1,11	-0,09	-1,20	-0,02	0,07	0,01	0,03	0,03	-0,09	-1,86	0,68	-1,18

Source: FBBVA -Ivие and own calculations

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(2005)