The determinants of Italian slowdown: what do the data say?

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Abstract

By considering growth accounts this paper discusses where the recent story of Italian labour productivity has diverged from the EU pattern.
Similarly to the major continental countries, Italy has taken only limited advantage of the growth potential of ICT because of a generally unfavourable environment for innovation. Nevertheless, the decline in total factor productivity is found to play a more important role in the deceleration of GDP per hour worked of the late 1990s.
Moreover, by scrutinizing industry performance, this paper shows the increasing weakness of traditional sectors, that is, where the Italian economy enjoys the major comparative advantages in international trade. Evidence is also provided on the acceleration of Italian de-specialization in ICT producing manufacturing as well as on the deterioration of TFP in several service industries.

Keywords: ICT; labour productivity, TFP.

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1. Introduction

The second half of the 1990s is usually referred to as the mirror image of the US productivity story of the two previous decades. Since 1995 GDP per hour worked has reversed the sluggish trend of the 1970s and 1980s when investments in ICT did not seem able to boost productivity growth. Whereas the United States has accelerated, the European Union has taken a slow growth track. For the first time in five decades US labour productivity has grown faster than in Europe for a consecutive number of years (Timmer et al., 2003; p. 12). This has fuelled the perception of a very wide gap in the development pace between the Atlantic regions (*Atlantic Divide*). In addition, the EU lagged response is expected to widen in the short-run as since 2000 a new extraordinary cycle in the United States output-labour ratio has overlapped to the business cycle that ended in 2001 (Gordon, 2003). In this respect, there is a risk for Europe that the core of the world's economy may move towards the Pacific area due to the rising competitiveness of Asian countries.

Several studies have shown that a less intensive development and deployment of ICT is at the basis of the difference in labour productivity growth between the EU and the US. However, ICT does not seem to be the sole factor responsible for the divergent pattern in GDP per hour[1]. Plenty of other hypotheses have been put forward in order to explain the EU-US gap (regulative infrastructures, innovative environment, human capital, monetary policy) but no single diagnosis and common cure have arisen due to the huge variation *within* Europe.

This paper aims at providing a detailed outline on the sources of the Atlantic divide and in particular the reasons behind the Italian slowdown, by reviewing a large body of studies and, when necessary, providing additional evidence from newly available data sets. The work is divided into two parts. After a brief summary of US revival (section 2), the former is devoted to illustrating the differences in labour productivity growth between Europe and the United States at an economy-wide as well as at the industry level (section 3). The latter part describes instead the fall in growth of GDP per hour in Italy, showing where it has diverged from the EU pattern (section 4). Italy is close to the major continental countries at the lower end of the distribution of growth contribution from ICT capital. However, the decline in total factor productivity is found to play a more important role in the Italian

[1] Feldstein (2003) argues that Information Technology has been the main tool employed by the United States to restructure the economy. This step has been imposed by the rising competitiveness and turbulence of the global market. In contrast, the European countries were unable to reform internal markets (and actors) as they were locked into more rigid regulations. Consequently, they perceived the constraint to invest in ICT as less binding.

slowdown. This outcome is worrying for its future growth, more than the slowed capital deepening that, by contrast, can be partly attributed to temporary factors. Moreover, by scrutinizing industry performance, this paper shows the increasing weakness of traditional sectors. These form the bulk of the Italian economy, and are where Italy enjoys the major comparative advantages in international trade, but are also the sectors more vulnerable to Asian competitors. Additional evidence is then provided on the acceleration of Italian de-specialization in ICT producing manufacturing and the deterioration of TFP in many service industries. Finally, section 5 concludes by discussing some policy implications. In particular, it focuses on the regulative-institutional reforms which are regarded indispensable to remove those burdens hampering the EU recovery.

2. American productivity in the Information age

Around the mid-1990s the growth rate in US GDP per hour worked changed gear after a long period of sluggishness, doubling the figures of the period 1973-95 (from 1 to 2% per year)[2]. Although the recession of 2001 has heavily mitigated the optimism of the late 1990s, the more recent dynamics in the output-labour ratio suggest that a change in the fundamentals of the American economy has actually materialized during the last decade (Gordon, 2003)[3]. A wide consensus has emerged that the development of information and communication technologies is the driving force behind the US resurgence and, thus, any residual doubt of sceptics has been dissipated. Now, it is debated how long the current growth rates can last and the reasons why this formula has been not working in Europe as well.

In the beginning the New Economy theorists met with much criticism. Most influentially, Gordon (2000) stressed that the massive spread of ICT did not solve the productivity puzzle at all. Labour

[2] The productivity slowdown was partly considered a statistical illusion. It depended on the difficulties in the measurement of services' output (hard-to-measure industries; Griliches, 1994), the explosion in the computing power of IT equipment adopted by firms (Baily and Gordon, 1988) as well as the substitution bias of fixed-weight indexes (Oliner and Sichel, 1994).
McGuckin and Stiroh (2001) estimate that the growth rate of aggregate productivity was understated by an annual 0.32-0.50% between 1990 and 1996 because of such measurement problems. Around two-thirds of the error derived from the growth of hard-to-measure industries (between effect), one third from the increasing mismeasurement in such industries due to the widespread uptake of computers (within effect).
Aside from the statistical matter, a number of other explanations were put forward on Solow's paradox: it was argued that a time lag was necessary before computers effectively impacting on productivity. They needed the development of complementary innovations (David, 1990), the dissemination of technical and managerial skills amongst workers (Bresnahan et al., 2002) as well as a new organizational structure of firms (Brynjolfsson and Hitt, 2000).
[3] Baily (2002) and Oliner and Sichel (2002) also remark the 'anomalous' performance of US labour productivity in the quarters following the slump of 2001.

productivity climbed up only across ICT producing industries (1% of total economy), mainly due to the explosion of TFP. In contrast, ICT using sectors (retail, banks, etc.) even showed a slower growth rate once it was corrected for the cyclical component. Nevertheless, a problem associated with Gordon's methodology is that TFP growth of some ICT using industries is offset (and hidden) by the negative rates of other users when the contributions of all non-ICT producers are combined. Indeed, more accurately, Jorgenson and Stiroh (2000) provide evidence of a pervasive productivity growth over the last decade, with electronic and electric equipment (semiconductors) showing the biggest gain. Oliner and Sichel (2000) attribute one fifth of the recent growth in aggregate TFP to computer producers and one third to semiconductors[4], remarking that a substantial fraction in the upsurge of PC production has its foundation in the advancement that occurred in micro-chips technology. Indeed, a fiercer competition among semiconductors producers between 1994 and 1995 gave rise to extraordinary innovative activity, leading to a changeover from a three-year to a two-year product cycle as well as spectacular efficiency gains. The exponential acceleration in the decline of semiconductors prices (90% per year) has then been transmitted to downstream industries, fuelling either the TFP growth of computer firms (*production effect)* or the deeper substitution of ICT assets for old and less efficient equipment (*usage effect*) [5]. These two direct effects are found to completely explain the post-1995 acceleration in the output-labour ratio (Jorgenson et al., 2003). This outcome is also confirmed by the econometric analyses carried out by Stiroh (2002a) across US industries; only ICT producers show a meaningful rise in TFP but this is uncorrelated with capital intensity (ICT and traditional assets). In this respect, capital deepening has been the main channel through which ICT has driven labour productivity acceleration in IT intensive industries (Stiroh, 2002b).

Nevertheless, it is important to point out that the debate on the existence of ICT spillovers (indirect channel) at an industry level is still only just beginning. Indeed, recently O'Mahony and Vecchi (2004) have presented some econometric proof of the external benefits from ICT adoption through an estimation technique allowing for a short-run sectoral heterogeneity. Relative to these econometric findings, the evidence provided by Mun and Nadiri (2002) stands in between. By looking at the inter-industry flows, they observe that a non-negligible fraction of TFP growth in service (and

[4] Oliner and Sichel (2000) decompose the economy into three sectors (non-ICT producing industries, computers and semiconductors), estimating an increase in the overall TFP of 1.16% between 1996 and 1999: 0.26 percentage points come from computers, 0.39 from semiconductors and the residual 0.50% from the remaining part of the economy (Oliner and Sichel, 2000; tab. 4, p. 17). Updates are provided in Oliner and Sichel (2002).

[5] Moreover, the rapid decline in prices of chips has also lowered costs (and improved efficiency) of a much broader host of non-ICT products (aircraft, automobiles, scientific instruments). See Jorgenson (2001) for a detailed description of the effects produced by the advances in semiconductors technology on the US economy.

few manufacturing) industries is associated with the ICT capital owned by their suppliers and customers of intermediate inputs. Also in this case, the major role played by the backward linkage effects is likely to reflect the prevalence of the pecuniary nature of such externalities[6].

3. The sources of the Atlantic divide

3.1. The role of ICT

Whereas US labour productivity accelerated in the second half of the last decade (+0.5%; table 2)[7], Europe's growth rate fell relative to the 1980s and early 1990s (-0.9%), fuelling the perception of a serious divergence in the development pace between the Atlantic regions (-1.4%). Indeed, for the first time since World War II, GDP per hour worked has shown a lower growth rate in the EU for a consecutive number of years.

During the 1990s the European Union was unable to close the technological gap with the United States: the difference in ICT capital stock widened between 1995 and 2001, from 1.8 to 2.4 current euros (table 1)[8]. Accordingly. the US benefited from a bigger growth contribution from computers, software and communication equipment (0.7 against 0.4 percentage points; table 2). The difference in ICT capital deepening thus accounted for much of the overall gap in labour productivity of 1995-2001 (-0.3 out -0.5%).

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[6] Evidence on the presence of IT spillover outside the United States is scarce (Pilat and Wolfl, 2004; p. 91) and findings rather controversial. For instance, Daveri and Silva (2004) show that the price decline of electronic components has been the driving force behind the efficiency gains of ICT producing firms in Finland as well. In contrast to what was previously argued, there is no proof of the non-pecuniary spillovers generated by the technologically leading firm (Nokia).
Gretton et al. (2004) find instead that in Australia the ICT uptake has generated remarkable productivity gains in trade sectors and financial intermediation.

[7] Tables 1 and 2 report the results by Timmer et al. (2003). This work covers all the EU countries (with exception of Luxembourg) before the enlargement (EU-15), relying upon National Accounts sources. Therefore, it is preferred to some earlier studies which are based on a smaller sample of countries or on private sources for ICT expenditure (Schreyer, 2000, Colecchia and Schreyer, 2002, Daveri, 2002, van Ark et al., 2002b).
Consider that Timmer et al. (2003) adopt a broad definition of IT equipment, including computers as well as peripherals, photocopiers, printers, etc. This relies upon the belief that such products share the same technological advance featuring computer manufacturing, that is the improvement in the efficiency of semiconductors (see also Triplett and Bosworth, 2004).

[8] Chinn and Fairlie (2004) find that the EU-US gap in computer adoption (PCs per 100 inhabitants) is mainly associated with the difference in income per capita and age of schooling (about 70%). The delayed technological infrastructure of Europe as well as the less favorable regulatory environment play a minor role.
See Pohjola (2003) for a survey of the studies investigating the determinants of the differential adoption of new technologies between industrialized and developing countries (*digital divide*).

Table 1**: ICT INVESTMENT AND CAPITAL STOCK IN EUROPE AND UNITED STATES** (1980-2001), current prices

		ICT investment in GDP (%)			ICT capital stock per hour		
		1980	**1995**	**2001**	**1995**	**2001**	
1	SWEDEN	1.6	3.4	4.7	3.1	4.8	*1*
2	FINLAND	1.1	2.9	4.3	2.1	4.6	*2*
3	BELGIUM	1.7	2.6	3.6	3.0	4.2	*3*
4	DENMARK	1.5	3.1	3.6	3.1	4.2	*4*
5	GREECE	0.7	1.7	3.3	0.8	1.5	*12*
6	UNITED KINGDOM	0.8	2.8	3.0	1.8	2.9	*8*
7	NETHERLANDS	1.6	2.1	2.9	2.4	3.3	*6*
8	GERMANY	1.3	2.0	2.5	2.7	3.3	*5*
9	**ITALY**	**1.5**	**2.0**	**2.5**	**2.0**	**2.9**	***9***
10	AUSTRIA	1.3	1.7	2.4	2.4	3.3	*7*
11	PORTUGAL	1.2	1.8	2.1	0.7	1.1	*14*
12	SPAIN	0.9	1.7	2.1	1.4	1.5	*13*
13	FRANCE	1.0	1.4	2.1	1.8	2.5	*10*
14	IRELAND	0.9	1.9	1.9	1.1	2.2	*11*
	EUROPEAN UNION	1.2	2.1	2.6	2.0	2.8	
	UNITED STATES	2.5	3.7	4.2	3.8	5.2	
	EU less US	-1.3	-1.6	-1.6	-1.8	-2.4	

Source: Timmer et al. (2003). Figures are expressed in current euros at 1999 official exchanges rates. Countries are sorted in a descending order of IT expenditure in 2001. Ranking on the right refers to the stock of ICT owned in 2001.

The decomposition of TFP growth into the contributions of ICT and non-ICT producing industries (panel D of table 2) reveals that the EU de-specialization in hi-tech production played a minor role in the EU lag. Indeed, the difference in the growth rate of overall TFP in the EU relative to the US (-0.3%) can be equally distributed between each section of the economy (ICT and non-ICT; -0.2%)[9]. Overall, the total contribution of ICT (capital deepening plus TFP growth from ICT producers) amounts to 0.7 percentage points in Europe and 1.1% in the United States, accounting for one half and two thirds of their annual GDP per hour growth respectively. Most importantly, this contribution explains the entire growth gap between the EU and the US of period 1995-2001 (-0.5%).

Nevertheless, if one looks at the dynamic pattern of labour productivity - how the growth rates have changed between 1980-95 and 1995-2001 - then the picture is different. Table 2 (panel C) shows that the acceleration in US labour productivity has been fuelled by any input (ICT capital, non-ICT capital and TFP). In contrast, in Europe hi-tech capital deepening (0.1%) has marginally outweighed the substantial reduction in the contribution of non-ICT inputs (-0.4%) and TFP (-0.6%). This is the reason

[9] Daveri (2004), p. 13, argues that the slight difference in the labour productivity of ICT producing industries depends on the technique adopted to deflate the EU ICT expenditure (price harmonization) that is based on the US price indexes. Such a result would confute Gordon's (2000) thesis on the key role of US specialization in ICT production for the recent upturn.

why the divergent dynamics in the growth pattern of the EU relative to the US (-1.4%) can primarily be traced to the poor performance of traditional inputs and smaller efficiency gains (-0.5 and -0.7%).

Table 2: **CONTRIBUTION OF ICT TO LABOUR PRODUCTIVITY IN THE EU AND US** (1980-2001).
annual average growth rates (%)

	A- 1980-95				**B- 1995-2001**				**C- 1995-2001 less 1980-95**				**D- 1995-2001**		
	ICT	**Non-ICT**	**TFP**	**GDP**	**ICT**	**Non-ICT**	**TFP**	**GDP**	**ICT**	**Non-ICT**	**TFP**	**GDP**	**TFP from ICT**	**TFP from Non-ICT**	**Total contri-bution of ICT**
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9=5-1*	*10=6-2*	*11=7-3*	*12=8-4*	*13*	*14*	*15=5+13*
IRELAND	0.2	0.7	2.9	3.9	0.7	1.2	3.6	5.5	0.5	0.5	0.7	1.6	3.6	0.0	4.3
GREECE	0.2	0.4	-0.5	0.1	0.5	1.1	1.7	3.3	0.3	0.7	2.2	3.2	0.0	1.7	0.5
FINLAND	0.3	1.0	1.4	2.7	0.7	-0.3	2.7	3.0	0.4	-1.3	1.3	0.3	0.7	2.0	1.4
AUSTRIA	0.2	0.8	0.6	1.7	0.4	1.0	1.3	2.7	0.2	0.2	0.7	1.0	0.2	1.1	0.6
BELGIUM	0.7	0.9	0.8	2.3	0.7	0.5	1.1	2.4	0.0	-0.4	0.3	0.1	0.1	1.0	0.8
PORTUGAL	0.2	0.8	1.2	2.2	0.3	1.2	0.5	2.1	0.1	0.4	-0.7	-0.1	0.3	0.2	0.6
SWEDEN	0.4	0.7	0.5	1.6	0.8	0.5	0.7	1.9	0.4	-0.2	0.2	0.3	0.6	0.1	1.4
DENMARK	0.5	0.7	0.8	1.9	0.6	0.9	0.3	1.9	0.1	0.2	-0.5	0.0	0.1	0.2	0.7
GERMANY	0.4	0.8	1.7	2.8	0.4	0.5	0.9	1.7	0.0	-0.3	-0.8	-1.1	0.2	0.6	0.6
FRANCE	0.3	1.2	0.9	2.4	0.3	0.5	0.9	1.7	0.0	-0.7	0.0	-0.7	0.3	0.6	0.6
UNITED KINGDOM	0.4	0.8	1.3	2.4	0.6	0.6	0.5	1.7	0.2	-0.2	-0.8	-0.7	0.4	0.1	1.0
ITALY	**0.3**	**0.8**	**0.9**	**2.0**	**0.4**	**0.6**	**0.1**	**1.1**	**0.1**	**-0.2**	**-0.8**	**-0.9**	**0.2**	**-0.1**	**0.6**
NETHERLANDS	0.3	0.5	0.9	1.7	0.4	-0.2	-0.1	0.1	0.1	-0.7	-1.0	-1.6	0.1	0.3	0.5
SPAIN	0.3	0.9	1.6	2.8	0.2	0.1	-0.6	-0.4	-0.1	-0.8	-2.2	-3.2	0.2	-0.8	0.4
EUROPEAN UNION	0.3	0.9	1.1	2.3	0.4	0.5	0.5	1.4	0.1	-0.4	-0.6	-0.9	0.3	0.2	0.7
UNITED STATES	0.5	0.2	0.7	1.4	0.7	0.3	0.8	1.9	0.2	0.1	0.1	0.5	0.4	0.4	1.1
EU less US	-0.2	0.7	0.4	0.9	-0.3	0.2	-0.3	-0.5	-0.1	-0.5	-0.7	-1.4	-0.2	-0.2	-0.5

Source: Timmer et al. (2003), tables 11, 10 and 15. Figures are expressed per hour worked.

The role of new technologies varies considerably *within* Europe. The share of ICT investment in GDP (table 1) ranges from 1.9% in Ireland to 4.7% in Sweden in 2001. Sweden and Finland stand out for a higher propensity to invest in ICT than the US. Instead, Belgium, Germany and Italy have gradually lost ground with respect to the early 1980s. If the extremely wide variation in the uptake of ICT closely mirrors the propensity to innovate (R&D intensity), it has also been strongly affected over time by the business cycle and credit market conditions (Guerrieri et al., 2004).

A closer examination of the sources of labour productivity shows the remarkable contribution of ICT capital in Sweden (0.8% per year between 1995 and 2001), Ireland, Finland and Belgium (0.6%). By contrast, it was minimal in Spain and Portugal (0.3 and 0.2%)[10]. Given the technological complementarity with computers, software has seen massive diffusion only more recently, providing

[10] See van Ark and Piatkowski (2004) for a picture of the role played by ICT capital in the catch-up of some Eastern European countries towards the EU-15 levels.

the major growth contribution among ICT assets in Scandinavian countries. Instead, Italy and Ireland have benefited considerably from communication equipment (see van Ark et al., 2002b). Moreover, the large share of IT production sectors has translated into huge contributions to aggregate TFP growth in Ireland (mainly for computers), Finland and Sweden (communication equipment).

Overall, two particular aspects of labour productivity growth in the late 1990s are worth mentioning (panel B of table 2). First, the rapid catch-up of the smaller countries (Ireland, Greece and Finland) towards the levels of the major economies. Second, the dismal growth rates in GDP per hour worked of Spain, Netherlands and, to a lesser extent, Italy which were depressed by the poor performance of TFP. At this point, it is important to note that in Timmer et al. (2003) the residual embodies the change in labour quality. Consequently, it may be 'influenced' by the effects of labour market policies adopted during the 1990s (wage moderation and higher flexibility) and not solely reflect the advances in technical efficiency. Indeed, by controlling for the quality profile of workers (gender, age, education, etc.) amongst the G7 countries, Jorgenson (2004) finds negative rates for TFP of Germany and Italy between 1995 and 2001 (-0.1 and -0.5%)[11].

Looking at the dynamic pattern of labour productivity growth, one can note that the slowdown is not merely a 'big country' problem (Daveri, 2004). If this fall was primarily dependent on the active labour market policies, then it could be virtually temporary and, consequently, less worrying. Nevertheless, Daveri (2004) stresses that if the European authorities aim at reaching a 70% occupation ratio before 2010, then the next policy measures are likely to hamper the recovery in EU GDP per hour worked. Therefore, at least in the short run, there would be an incompatibility between occupation and labour productivity growth (Mason et al., 2003).

3.2. The sectoral source of EU delay

The comparison of the sources of overall labour productivity has shown that the growth gap between the Atlantic regions can be primarily attributed to a delayed IT usage and the smaller share of hi-tech production sectors in Europe. Nevertheless, new technologies have negligibly affected the dynamic pattern that, probably, is more related to the 'ultimate' sources of growth (regulative infrastructures, innovative environment, human capital).

[11] In terms of levels, Canada was the most efficient country in 2001, ahead of Italy that gradually lost ground in favor of France. Japan ranked on the bottom, closely behind Germany.

This section gives a clear insight into the importance of industry specialization on the Atlantic divide by looking at the sector contributions to aggregate labour productivity. The European Union (EU-15) is found to lag behind the US not only across ICT producing manufacturing as illustrated above, but also in ICT using service industries (Inklaar et al., 2003; see table 3)[12]. The distinction between ICT producing and using industries has been dominant in the debate on productivity paradox, at least since Baily and Gordon (1988). Recently, this classification has been revived by Stiroh (2002b); he shows that the (pure) acceleration in US labour productivity (0.79%) is entirely imputable to sectors which produce and intensively use new technologies (0.17 and 0.83%) while non-ICT industries have provided a negative contribution[13]. This classification has implicit the indication that the promotion of ICT spread is the optimal growth strategy for countries with a relative disadvantage in hi-tech productions. In this way, they can gain to a greater extent the benefits from the usage of ICT. A large body of firm level studies have shown that such technologies are essentially a tool to promote further innovation by allowing a more efficient use of inputs, an expansion of the product range and the customization of services offered (Pilat and Wolfl, 2004).

As table 3 shows, across ICT producers Europe has strengthened its advantage over the US service industries in the late 1990s because of the difficulties faced by computer services firms in the US. Instead, the EU delay in ICT producing manufacturing has considerably worsened, despite the spectacular performance of electronic valves and tubes[14].

[12] This work is included in the report edited by O'Mahony and van Ark (2003) and decomposes the aggregate labour productivity of US, EU and any single member country into the contributions of 57 industries, grouped into ICT producing, using and non-ICT sectors.
It should be noted that in table 3 the average values for total economy differ from the figures reported in table 2 as Timmer et al. (2003) do not take into account rentals for housing (actual and imputed rents).

[13] Similar results are reported by Nordhaus (2002). Stiroh (2002b) defines users as any non-producing industry with an ICT share in capital services above the median.
Across the other OECD countries, Pilat and Wolfl (2004) point out that ICT producing industries have driven the upsurge in the aggregate labour productivity of Korea while ICT using sectors show remarkable growth rates in Australia and, to a lesser extent, Mexico.

[14] Similarly to the US, on average semiconductors registered an annual growth rate in value added per hour of above 50% in the second half of the 1990s.

Table 3: **LABOUR PRODUCTIVITY GROWTH ACROSS INDUSTRIES, EU vs US** (1979-2001), annual average growth rates (%)

	1979-90			1990-95			1995-2001		
	EU	**US**	***EU - US***	**EU**	**US**	***EU - US***	**EU**	**US**	***EU - US***
TOTAL ECONOMY	**2.2**	**1.3**	***0.9***	**2.3**	**1.1**	***1.2***	**1.7**	**2.2**	***-0.5***
ICT PRODUCERS	**7.2**	**8.7**	***-1.5***	**5.9**	**8.1**	***-2.2***	**7.5**	**10.0**	***-2.5***
Manufacturing	12.5	16.6	*-4.1*	8.4	16.1	*-7.7*	11.9	23.7	*-11.8*
Services	4.4	2.4	*2.0*	4.8	2.4	*2.4*	5.9	1.8	*4.1*
ICT USERS	**2.2**	**1.2**	***1.0***	**2.0**	**1.2**	***0.8***	**1.9**	**4.7**	***-2.8***
Manufacturing	2.4	0.5	*1.9*	2.4	-0.6	*3.0*	1.8	0.4	*1.4*
Services	2.1	1.4	*0.7*	1.8	1.6	*0.2*	1.8	5.3	*-3.5*
NON-ICT INDUSTRIES	**1.8**	**0.5**	***1.3***	**2.1**	**0.3**	***1.8***	**1.0**	**-0.2**	***1.2***

Source: Inklaar et al. (2003).

In Europe labour productivity has grown uniformly over time across ICT using sectors, in contrast to the United States where there has been a significant acceleration in the most recent years. This indicates that the US is ahead of the EU in terms of the productive application of ICT, especially in such services as wholesale trade (+5.8% relative to the EU average in labour productivity growth), retail (+5.4%) and financial intermediation (+9.6%). These industries have driven the US resurgence (van Ark et al., 2002a)[15]. The EU and the US present a similar deceleration in labour productivity growth of traditional (non-ICT) industries and, thus, Europe has been able to maintain a slight advantage.

If one looks at the position of individual countries, it is to highlight the brilliant performance of ICT producers in Ireland and Germany where the growth in value added per hour has been superior even to the United States. Across ICT using industries, the acceleration of small countries (Denmark, Greece and Ireland) and UK has been largely outweighed by the slowdown of major continental economies (Germany, France and Italy). Finally, in the old economy (non-ICT industries) the rise in labour productivity experienced by Greece, Ireland, Portugal and Sweden is consistent with catch-up of these countries towards the levels of the biggest economies.

The decomposition of industry labour productivity into the contribution of factor inputs allows Inklaar et al. (2003) to identify more distinctly the source of the EU-US gap and the role played by ICT[16]. The acceleration in labour productivity of ICT producing industries is found to be mainly driven by TFP growth on both Atlantic sides, even though technical efficiency has risen in the US at a speed a

[15] Gordon (2004) discusses the reasons for the productivity gap in retail, pointing to administrative barriers and land-use regulations as the main factors inhibiting the development of 'big boxes' in Europe. See also McGuckin et al. (2004).
[16] Because of the lack of data, the European Union includes only France, Germany, the Netherlands and United Kingdom (EU-4) which nonetheless represent a 70% of community GDP.

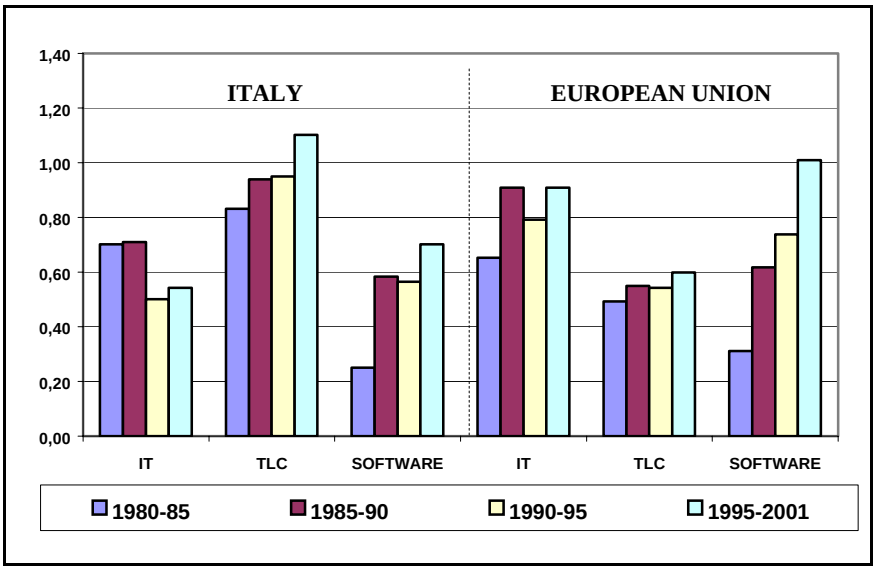
third higher than in Europe. IT capital deepening has accounted for much of the growth in value added per hour of ICT users in both Europe and the United States but the ICT contribution has been 50% larger in the latter. Finally, it is shown that labour productivity of non-ICT industries has been dragged down by the small contribution of traditional inputs in Europe and the fall of TFP growth in the US. Interestingly, IT capital deepening has been the main source of growth in US traditional sectors as well.

Aside from the issue of price harmonization for ICT goods, notably discussed by Schreyer (2002), the examination of the Atlantic divide through the ICT-related aggregation may potentially be misleading as it may be too sensitive to the criterium of classification adopted (Daveri, 2004). Indeed, if one takes into account the ICT share in capital services before the information shock (pre-1995), such industries as retail trade, clothing, paper and publishing, furniture and transport equipment cannot be considered IT intensive as their ranking was below the average. The consequent adjustment in the industry groupings leads to only 38% of the EU-US gap in labour productivity growth being attributed to IT users with respect to the original 60% estimated by Inklaar et al. (2003).

Daveri (2004) argues that the main reason for EU slowdown is not the delayed IT usage (IT irrelevance hypothesis)[17]. The bulk of European weakness comes from non-durable manufacturing whose reduction in labour productivity growth has represented nearly two thirds of the overall slowdown. This finding is very worrying because, in contrast to the US, traditional sectors still represent the core of the EU economy, where it enjoys the major comparative advantages, but also where pressure from Asian competitors is more intense.

[17] Daveri and Silva (2004) state that the Finnish case also confirms the irrelevance of IT hypothesis as the acceleration in labour productivity of ICT using industries was primarily dictated by cyclical forces which were particularly strong in the late 1990s.

Figure 1: **ICT INVESTMENT IN ITALY AND EU** (1980-2001),
average percentage in GDP, current prices



Source: Own elaborations on data from Timmer et al. (2003).

4. The slowdown of Italian labour productivity

4.1. Aggregate productivity and ICT capital

As noted earlier, Italian labour productivity followed a pattern similar to the major European countries[18] in the last part of the 1990s when its growth rate halved relative to 1980-95 (from 2% to 1.1%; table 4). Nevertheless, unlike Germany, France and the UK, in Italy, GDP per hour grew at a rate constantly inferior to the EU average over time (in average -0.3% per year between 1980 and 2001)[19]. Given that labour productivity determines living standards in the long run[20], this finding has strongly negative implications for welfare as demonstrated by the following simple numerical exercise. By assuming an identical initial level across countries (1980=100) and applying the average growth rates of table 4, it can be observed that the Italian labour productivity results equal to 138 in 1995 against an EU average of 146. In 2001 these values respectively climb up to 147 and 159. In practice, this

[18] In this section the average values of the European Union have been re-computed excluding Italy. Aggregate statistics rely upon the *GGDC Total Economy Growth Accounting Database* (October 2003; http://www.ggdc.net) that is at the basis of the results reported by Timmer et al. (2003) and, more recently, has been also adopted by OECD to estimate multi-factor productivity. Industry data are extracted from the O'Mahony and van Ark (2003) data set, available in the CD-ROM allegatum to the report.

[19] The difference in the growth rates of labour productivity was slightly wider in the early 1980s when Italy experienced a milder contraction in hours worked, while it narrowed in the first years of the following decade because of a more severe reduction in Italian occupation.

[20] Output per labour unit "...is an indicator of the prospective consumption; ...high productivity, then, is the key necessary condition for general prosperity of the populance" (Baumol et al., 1989; p. 227-228).

simulation illustrates that at the end of the period Italy has accumulated a six years delay in terms of labour productivity level with respect to Europe. This means that it has enjoyed only 93% of the welfare of other EU citizens.

When the focus is restricted to the sources of labour productivity, the first striking point is that during the 1990s Italian firms completely lost the high propensity to invest in ICT shown in the previous decade (see table 1). In 1980 Italy stood out for the highest rate of investment in ICT across the major EU countries (1.5% in GDP), closely behind the small nordic economies. Along with Germany, it even owned the biggest per capita stock of IT capital among the G7 countries (Jorgenson, 2004). As figure 1 illustrates, Italy presents a remarkable difference with respect to Europe in the composition of ICT capital at least since the mid-1980s when the share of communication equipment increased and, by contrast, computers fell sharply down.

Table 4: **CONTRIBUTION OF ICT TO LABOUR PRODUCTIVITY IN ITALY AND EU** (1980-2001), annual average growth rates (%)

	GDP	*ICT CAPITAL*			*NON-ICT CAPITAL*			TFP
		IT	Software	TLC	Non-IT equip-ment	Vehicles	Struc-Tures	
ITALY								
1980-95	2.00	0.13	0.07	0.10	0.27	0.08	0.43	0.93
1995-2001	1.12	0.15	0.08	0.16	0.28	0.16	0.16	0.14
1995-2001 less 1980-95	-0.88	0.02	0.01	0.06	0.00	0.08	-0.27	-0.79
EUROPEAN UNION								
1980-95	2.37	0.19	0.08	0.05	0.26	0.05	0.58	1.17
1995-2001	1.41	0.25	0.11	0.06	0.16	0.07	0.23	0.52
1995-2001 less 1980-95	-0.97	0.05	0.03	0.02	-0.10	0.03	-0.35	-0.65
ITALY less EU								
1980-95	-0.37	-0.06	-0.01	0.05	0.01	0.03	-0.15	-0.24
1995-2001	-0.29	-0.09	-0.04	0.10	0.12	0.08	-0.07	-0.38
1995-2001 less 1980-95	0.08	-0.03	-0.03	0.05	0.11	0.05	0.08	-0.14

Source: Own elaborations on data from Timmer et al. (2003). Figures are expressed per hour worked.

In terms of labour productivity growth (capital deepening), the contribution of communication equipment was three times higher than the EU average between 1995 and 2001 (0.16 against 0.06%; table 4) while computer deepening was moderately undersized (0.17% against 0.25%). Overall, in

terms of ICT capital deepening[21], Italy appears in line with the EU average (0.3-0.4% annually between 1980 and 2001) which, however, mainly reflects the low values of the major continental economies (France and Germany). The United Kingdom is the only big country to feature a considerable contribution from ICT assets, having risen to 0.6% from 0.4 of 1980-95 (see table 2). A closer look allows one to notice that Italy has mainly diverged from the European pattern for a slower growth rate of TFP (-0.4% relative to the EU average). As evident from the bottom panel of table 4, this explains the entire gap in labour productivity of the period 1995-2001 (-0.3%), balancing the Italian advantage in the deepening of TLC, non-IT and transport equipment. Moreover, the deceleration in total factor productivity between 1980-95 and 1995-2001 (-0.8%) has fully accounted for the slowdown in the growth of Italian GDP per hour (-0.9%).

At this point, in order to complete the outlook on the sources of aggregate labour productivity it is useful to examine the relative contribution of inputs[22]. Indeed, from this perspective it is possible to correctly understand the context where ICTs spread out and their possible synergies with the collaborative (low-tech) factors.

Table 5: **RELATIVE CONTRIBUTION OF ICT TO LABOUR PRODUCTIVITY GROWTH** (1995-2001), annual average percentages

	ICT capital deepening	**TFP from ICT producing industries**	**Total ICT**
	a	*b*	*a+b*
FRANCE	17	18	35
GERMANY	23	14	37
ITALY	**36**	**19**	**54**
UNITED KINGDOM	36	23	59
EUROPEAN UNION	29	20	49
UNITED STATES	38	24	62

Source: Own elaborations on Timmer et al. (2003). GDP per hour growth equals 100.

Table 5 shows that 54% of the growth in Italian GDP per hour between 1995 and 2001 is directly imputable to new technologies: 36% for *usage* (ICT capital deepening) and the remaining 19% for *production* (TFP growth in ICT producing industries). Therefore, in relative terms, Italy has taken greater advantage of ICT than the other major partners (France with 35% and Germany 37%) and is not far from the United Kingdom (59%). This finding highlights more accurately the size (and

[21] The sum of the contributions of computers, communication equipment and software; traditional capital deepening includes non-ICT equipment, transports equipment and non residential structures.
[22] The average growth rate of labour productivity is set equal to 100 (see van Ark et al., 2002b).

consequently the relevance) of the deterioration in the contribution of traditional inputs as well as in TFP growth of non-ICT industries which have severely dampened the labour productivity, amplifying the weight of ICT.

4.2. The performance of Italian industries

Consistently with the aggregate evidence, industry data reveal that the bulk of Italian weakness derives from traditional sectors, where the adoption rate of ICT is relatively low and technical progress is less pronounced than in IT production industries.

The last row of table 6 illustrates that the growth in value added per hour of non-ICT industries was nearly zero in the latter part of the 1990s (from 2.1 to 0.1%). Because of the size of these sectors (approximately two thirds of GDP), such decline has heavily influenced the dynamics of overall labour productivity (from 2 to 0.8%)[23]. Nevertheless, it has to be pointed out that Italy shows the most severe lag across ICT producing manufacturing. Despite the spectacular growth rates of electronic valves and tubes, this group has experienced a sizeable fall in value added per hour growth (from an annual 12.5% to a 4.5%) in contrast to Europe which has on average maintained a constant rate over time. Consequently, the Italian delay has significantly widened in the late 1990s, confirming the deterioration of its competitive capacity in these sectors.

Table 6: **LABOUR PRODUCTIVITY GROWTH ACROSS INDUSTRIES, ITALY vs EU** (1979-2001)
annual average growth rates (%)

	1979-90			**1990-95**			**1995-2001**		
	ITALY	**EU**	***ITALY - EU***	**ITALY**	**EU**	***ITALY - EU***	**ITALY**	**EU**	***ITALY - EU***
TOTAL ECONOMY	**2.0**	**2.4**	***-0.4***	**2.4**	**2.3**	***0.0***	**0.8**	**1.7**	***-0.9***
ICT PRODUCERS	**6.4**	**7.5**	***-1.1***	**5.6**	**6.0**	***-0.5***	**5.8**	**7.7**	***-1.8***
Manufacturing	12.5	13.0	*-0.5*	5.6	9.3	*-3.6*	4.5	12.9	*-8.4*
Services	3.1	4.6	*-1.5*	5.6	4.6	*1.0*	6.0	5.8	*0.2*
ICT USERS	**0.9**	**2.5**	***-1.6***	**2.7**	**1.9**	***0.8***	**1.6**	**1.9**	***-0.4***
Manufacturing	1.6	2.6	*-1.1*	3.9	2.3	*1.6*	1.9	1.9	*0.0*
Services	0.3	2.4	*-2.0*	2.2	1.7	*0.4*	1.3	1.9	*-0.6*
NON-ICT INDUSTRIES	**2.1**	**1.9**	***0.2***	**2.0**	**2.2**	***-0.2***	**0.1**	**1.1**	***-1.0***

Source: Own elaborations on data from O'Mahony and van Ark (2003).

[23] Labour productivity was particularly dynamic in any sector (ICT and non-ICT) in the period 1990-95 due to the severe, widespread reduction in hours worked. Note that the statistics in table 6 include housing with respect to the figures reported in table 4. See also footnote 12.

This disappointing result has partly been mitigated by the performance of communications and computer services (ICT producing services) which now account for 80% of the total value added of the ICT producer group. Looking at the labour productivity growth of ICT using sectors, one can notice either the substantial improvement of services relative to the 1980s or the catch-up of manufacturing industries towards the EU rates. Nevertheless, it should be underlined that the latter result may be affected by the criterium adopted to aggregate sectors, which could therefore overstate the relative performance of Italy. Indeed, amongst the sectors which cannot be classified as IT intensive users according to Daveri (2004), clothing and furniture both reveal a remarkable growth rate in labour productivity (3.6 and 3%) and a large share of the European value added is in such sectors (24 and 16%)[24].

At this point it is useful to specifically identify the industries which have largely diverged from the growth pattern of Europe[25]. This can be done by comparing the average difference in labour productivity growth between Italy and the EU for the period 1979-95 (the *x*-axis of figure 2) and 1995-2001 (*y*-axis). Taken individually, the relative performance of Italian industries has considerably worsened over past years; the number of sectors with a growth rate below the EU average has risen from 32 to 37 and, overall, 36 out of 52 slowed down between 1979-95 and 1995-2001[26]. In addition, only a handful enjoyed a substantial advantage over the community competitors (more than one percentage point) as can easily be seen by the very close position to the *x*-axis of the industries located on the upper quadrants.

A lot of attention has to be directed to the cluster in bottom-right panel of figure 2. It groups industries whose growth rate in labour productivity has fallen down below the EU average in the latter part of the last decade, reversing a long-lasting, favorable trend[27]. If the low rates of chemicals, basic metals and office machinery appears more 'moderate' (around 5% annually), on the other hand, the figures for non-inland transport (water, air and supporting activities) and the group of ICT producing manufacturing (electronic valves and tubes, communication equipment and radio-TV receivers)

[24] Across the other ICT users, it is also worth mentioning the good growth rates achieved by printing and publishing, financial intermediation and Research & Development (all above 3% per year).

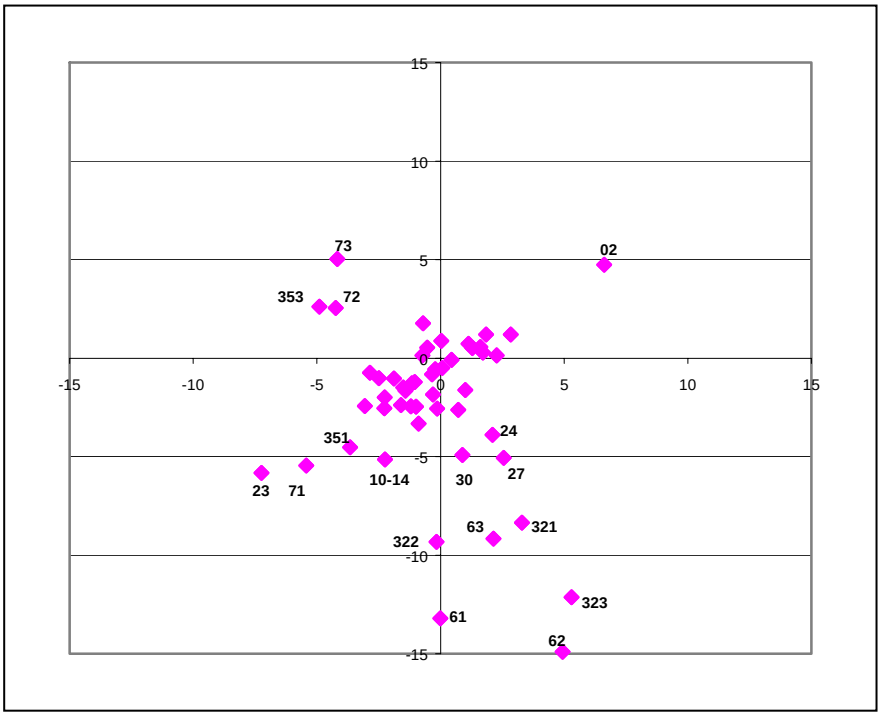
[25] This analysis is restricted to the market economy and, consequently, public administration (75, ISIC Rev. 3), education (80), private households with employed persons (95) and extra-territorial organizations and bodies (99) are neglected. In these sectors output is still measured rather heterogeneously across countries, usually by superimposing a mark-up on factors cost (hard-to-measure industries), and the international comparison may be partly misleading.

[26] The correlation between the industry difference between Italy and the EU of two periods is -0.20 (t-statistics 0.01).

[27] It is nonetheless important to stress the sensible acceleration experienced by computer services, Research & Development and aircraft which outperformed the EU average for the first time after nearly two decades (top-left panel).
Finally, on the remaining two quadrants one can find the sectors where the growth gap in between Italy and the EU has been relatively stable over time. Italian industries with a performance constantly above the community average are located in the top-right panel, those below the mean in the bottom-left.

unequivocally reveal the severity of the crisis in such industries. Indeed, the decline in labour productivity of this group has been primarily determined by a significantly slower growth of value added with respect to the other European countries, rather than an anomalous dynamics in occupation[28]. Nevertheless, these sectors have marginally depressed the aggregate productivity as accounting for a very small share of Italian GDP (2% between 1995 and 2001)[29]. In summary, the industry data show that Italy is mainly suffering from a negative trend in labour productivity in traditional sectors. In addition, it is also weak in such hi-tech production (endemically in ICT producing manufacturing) where the EU is already lagging behind the US.

Figure 2: **DIFFERENCE IN INDUSTRY LABOUR PRODUCTIVITY BETWEEN ITALY AND EU** (1979-95 and 1995-2001), annual average growth rates (%)



Source: Own elaborations on data from O'Mahony and van Ark (2003).
The difference between Italy and EU in labor productivity growth of 1979-95 is reported on the *x*-axis; figures relative to 1995-2001 on the *y*-axis. *Industry classification*: **02**- Forestry (*top-right panel*); **353**- Aircraft and spacecraft, **72**- Computer and related activities, **73**- Research & Development (*top-left*); **10-14**- Mining and quarrying, **23**- Mineral oil refining, coke & nuclear fuel, **351**- Building and repairing of ships and boats, **71**- Renting of machinery and equipment (*bottom-left*); **24**- Chemicals, **27**- Basic metals, **30**- Office machinery, **321**- Electronic valves and tubes, **322**- Telecommunication equipment, **323**- Radio and television receivers, **61**- Water transport, **62**- Air transport, **63**- Supporting and auxiliary transport activities; activities of travel agencies (*bottom-right*).

[28] The annual growth gap in value added between 1995 and 2001 varies from -8% of electronic valves and tubes to -15% of air transports.
[29] If the group of the main laggards is left out, the correlation in the industry gap between 1979-95 and 1995-2001 climbs up to +0.28 and, finally, jumps to +0.82 when any outlying sector located in the bottom-right and top-left panels are omitted.

4.3. The decline of Italian total factor productivity

This section illustrates in detail the decline in TFP that, as discussed above, arises as the main determinant of the Italian slowdown. This issue requires a lot of attention. Indeed, at least in the short run, the modest growth of efficiency cannot be attributed to the active labour market policies of the late 1990s which instead have caused an adjustment into the capital-labour ratio. In this respect, the decline in TFP growth is more worrying than the slowed capital deepening as it is likely to reflect the inadequacy of some structural features of Italian economy.

According to the most optimistic estimates TFP decelerated by 0.4%-points between the two halves of the 1990s (Brandolini and Cipollone, 2003, table 7)[30]. The official figures indicate a slowdown ranging between 1.3 and 1.8% (ISTAT and OECD) while, more pessimistically, Jorgenson (2004) even calculates negative rates between 1995 and 2001 (on average -0.5% per year).

Table 7: **DYNAMICS OF THE AGGREGATE TFP OF ITALY IN THE 1990s**, annual average growth rates (%)

	Timmer et al. (2003)*	**Jorgenson (2004)***	**Brandolini et al. (2003)**	**OECD**	**OECD***	**ISTAT**
1990-95	1.04	0.37[a]	0.90	2.02	2.06	1.87[c]
1995-2001	0.14	-0.49	0.50[b]	0.35	0.24	0.53
1995-2001 less1990-95	*-0.90*	*-0.86*	*-0.40*	*-1.66*	*-1.82*	*-1.34*

Notes: * employs the price harmonization for ICT goods; a=1989-95; b=1996-2000; c=1992-95.

There are at least three reasons indicating the importance of this issue[31]. First, the worsening of the technological performance characterizes only a restricted group of OECD countries (*geographic* or *international profile*): Japan (-0.1% between 1990-95 and 1995-2001), Denmark and United Kingdom (-0.9%), Spain (-1.4%) and, on the bottom of the ranking, Italy (-1.8%). Second, the decline of TFP seems rather persistent (*time profile*). Jorgenson (2004) estimates negative rates also during the 1980s

[30] Table 7 reports some of the recent estimates of Italian TFP growth. These works differ in the methodology followed to build series on output or inputs. For instance, Timmer et al. (2003) do not take into account labour quality while ISTAT (2004) and Brandolini et al. (2003) do not disentangle capital into ICT and non-ICT assets. Then, with regard to the deflation of ICT expenditure, some studies adopt the technique of price harmonization to adjust the quality improvement of such goods.
Nevertheless, when one looks at dynamic pattern of productivity –the change in the growth rate between the two halves of the 1990s, the methodological discrepancies only play a fractional role.
ISTAT data are available at URL http://www.istat.it/Economia/Continazi/index.htm. For a methodological note see ISTAT (2004). Instead, OECD estimations are included in *OECD Productivity Database, May 2004;* http://www.oecd.org/dataoecd/30/62/29863792.xls.

[31] See Hulten (2000) for a description of the properties of TFP.

while, more moderately, Brandolini and Cipollone (2003) find that the deceleration process started in that period, at least for manufacturing. The most optimistic works date the downturn in the mid-1990s[32]; however, they also indicate a moderate worsening in the most recent years, not taken into account in this work. For instance, ISTAT calculates a decrease in the level of TFP for the recessionary period 2002-03 (on average -1.2% per year). Finally, the last aspect to consider is the pervasiveness of the productivity slowdown (*industrial profile*). It characterizes the majority of Italian sectors (table 8), either non-exporting industries (like wholesale and retail) or exporters which enjoy a comparative advantage in international trade (textile, leather and footwear, mechanical engineering). More strikingly, in Italy even hi-tech production sectors show a fall in efficiency growth (electrical and electronic equipment), in contrast to what happened in the EU as well as in the US where these industries have boosted aggregate productivity.

Table 8 shows an improvement in TFP growth between the two halves of the 1990s for six industries only: food, wood, transport equipment, construction, hotels and health. Instead, textile, mineral oil refining and metal products show the most severe decline. Nevertheless, because of their size, aggregate productivity (-1.2%) has mainly been dragged down by the fall in trade, transport and communications (approximately 70% of the deceleration)[33].

A more complete outlook on the dynamic pattern of industry TFP can be obtained by contrasting the estimates for Italy with the figures relative to the European Union (EU-4) and the United States reported by Inklaar et al. (2003) (and included in the O'Mahony and van Ark data set)[34]. The main

[32] The econometric evidence provided by Islam (2003) supports the wisdom that the deterioration in Italian total factor productivity started in the 1990s. Although this work includes less developed economies (virtually more subject to the technological catch-up), Italy ranks among top-15 countries in term of TFP gains between 1960-75 and 1975-90, with a 14% reduction in the distance from the United States (the world's leading country for efficiency).
A consistent outcome can be found in the cross-country study on the 'revealed technological superiority'carried out by Bar-Shira et al. (2003).

[33] For a decomposition of the productivity slowdown according to the ICT-related classification see Pilat and Wolfl (2004), figure 5.6 p. 98.

[34] ISTAT (2004) and O'Mahony and van Ark (2003) present several methodological discrepancies. For instance, with regard to labour, the former adopts full-time equivalent employees while the latter employs hours worked. Moreover, ISTAT does not harmonize to the US deflators the price index for production of electrical and electronic equipment. Consequently, TFP growth of this Italian industry may be underestimated relative to EU-4 and US. In this respect, the growth rates of electrical and electronic equipment and, accordingly, total economy are also calculated considering the correction attributable to the use of price harmonization in the deflation of output. The quality-adjusted index is extracted from the O'Mahony and van Ark data set.
Overal, the two data sources present a good degree of comparability of results as demonstrated by the high correlation (+0.6) between the annual growth rates of labour productivity (per person employed) calculated by O'Mahony and van Ark and ISTAT's estimates of TFP.
The analysis has narrowed to 24 industries for the periods 1992-95 and 1995-2001. In case of Italy non market services includes only health while business services leave out rentals for housing. Moreover, as relying upon net output, ISTAT's data have been converted into a value added basis by multiplying each growth rate with its Domar's weight (see OECD, 2001; p. 138).

striking point is that Italy presents a diffused deceleration in TFP growth of many service sectors, contrary to the improvement that has taken place in Europe and US[35].

Table 8: **DYNAMICS OF INDUSTRY TFP IN ITALY, EUROPE AND UNITED STATES** (1992-95 e 1995-2000), annual average growth rates (%)

		ITALY			EU-4			US		
	ISIC Rev. 3	**1992-95**	**1995-2000**	**change post-1995**	**1992-95**	**1995-2000**	**change post-1995**	**1992-95**	**1995-2000**	**change post-1995**
Agriculture	**01-05**	6.2	3.7	-2.5	2.6	3.3	0.6	-3.6	8.8	12.4
Mining	**10-14**	-1.3	-4.0	-2.7	8.5	1.2	-7.3	6.3	-1.9	-8.2
Food & Tobacco	**15-16**	-0.3	-0.1	0.3	2.6	-0.2	-2.7	5.2	-7.3	-12.5
Textiles, Footwear & Clothing	**17-19**	5.4	0.2	-5.2	-0.2	1.5	1.6	0.1	1.0	0.9
Wood & Products of Wood	**20**	2.8	5.0	2.2	2.6	0.9	-1.7	-2.1	-1.5	0.5
Paper & Printing	**21-22**	0.6	0.4	-0.3	-0.1	0.7	0.8	-4.2	-0.4	3.7
Mineral Oil Refining, Coke	**23**	0.4	-4.7	-5.1	6.1	-0.3	-6.4	7.2	3.6	-3.7
Chemicals	**24**	3.1	0.3	-2.9	6.4	1.8	-4.6	2.4	0.0	-2.4
Rubber & Plastics	**25**	1.3	-0.5	-1.8	2.1	0.8	-1.3	2.1	3.3	1.1
Non-Metallic Mineral Products	**26**	1.0	0.8	-0.2	2.3	0.8	-1.4	0.9	-0.6	-1.5
Basic Metals & Fabricated Metal Products	**27-28**	5.3	0.0	-5.3	2.7	1.1	-1.6	3.7	0.9	-2.8
Mechanical Engineering	**29**	4.1	-0.5	-4.6	2.8	0.6	-2.2	1.8	-1.1	-2.9
Electrical and Electronic Equipment	**30-33**	3.3	1.8	-1.5	4.1	9.4	5.2	12.8	18.6	5.9
" *with US deflators*		*4.7*	*3.6*	*-1.1*						
Transport Equipment	**34-35**	2.4	3.5	1.1	0.6	-0.7	-1.3	3.0	0.3	-2.7
Furniture, Miscellaneous Manufacturing;	**36-37**	5.5	2.1	-3.5	-2.7	0.2	2.9	1.6	2.6	1.1
Electricity, Gas and Water Supply	**40-41**	2.2	1.2	-1.0	1.4	3.0	1.7	1.5	0.2	-1.3
Construction	**45**	-0.1	0.3	0.4	-0.6	0.0	0.5	-0.5	-0.8	-0.4
Trade and reparations	**50-52**	2.9	-0.6	-3.5	1.4	1.0	-0.3	-0.6	5.1	5.7
Hotels & Catering	**55**	0.0	0.2	0.2	-2.9	-2.4	0.4	-0.3	-0.4	-0.1
Transport & Communications	**60-64**	4.0	1.4	-2.6	3.3	5.2	1.9	0.1	2.1	2.0
Financial Intermediation	**65-67**	4.0	2.9	-1.1	-0.2	1.0	1.2	-1.2	0.8	2.0
Real Estate and Business Services	**71-74**	1.5	0.1	-1.4	-0.4	-0.1	0.3	-1.1	-1.0	0.1
Non-market Services	**75-85**	-1.2	2.3	3.5	0.0	0.3	0.3	-1.8	-1.3	0.4
Other Services	**90-99**	1.5	0.4	-1.1	0.1	-0.3	-0.4	-3.0	-3.5	-0.5
Total Economy	**1-99**	1.9	0.7	-1.2	1.0	1.1	0.1	-0.1	1.0	1.1
" *with US deflators*		*1.9*	*0.7*	*-1.2*						

Sources: Own elaborations on data from ISTAT(2004) and O'Mahony e van Ark (2003).

For Italy the major difference with respect to the EU emerges in transports and communications, probably due to the difficulties faced by non-inland transport (discussed in section 4.2), whereas with regard to the US it is considerably lagging in trade, more so than the other community countries. It should be noted that the positive trend of Italian non-market services is not matched by a similar performance elsewhere. This finding is likely to reflect the restructuring of health that occurred in Italy during the 1990s, based on the introduction of managerial practices. Nevertheless, the international comparison may be affected by the methodological differences in output measurement.

Another relevant aspect is that TFP has diffusely declined within manufacturing in Europe as well as in the US but in Italy this trend is more pervasive and significant. It characterizes all the industries of major specialization (textile, clothing and leather, mechanical engineering and furniture) whose growth

[35] See Triplett and Bosworth (2004) for a description of the upsurge in the TFP of US service industries.

rates essentially halved (or zeroed) relative to the early 1990s. Finally, particular attention has to be devoted to transport equipment, which has consolidated a positive trend more favorable than its foreign competitors (probably due to a lower starting level), and to electrical and electronic equipment that, instead, has irremediably lost ground with respect to the EU and US.

The downgrading in the efficiency growth of ICT producing manufacturing does not merely reflect the lack of a qualitative adjustment of output. Indeed, when the price index for value added of this industry is harmonized to the US deflator, one can find higher growth rates of TFP in both periods but its dynamics remains nearly unchanged (-1.1%). This outcome further confirms the almost irreversible process of Italian de-specialization in such hi-tech production that has accelerated a result of the rise in international competition and the formidable technical advancement of recent years.

5. Concluding remarks and policy implications

This paper has presented a parallel survey on the sources of the labour productivity slowdown experienced by the European Union and Italy during the 1990s. In contrast to the United States, the EU has shown a lesser ability in exploiting the potential of Information Technology due to a lower rate of adoption and an inferior specialization in the production of such goods. This outcome has also been confirmed by the industry analysis which has outlined the weakness of EU labour productivity in ICT producing manufacturing and ICT using service sectors. Narrowing the focus to Italy, it has been illustrated how its ICT capital deepening is close to the lower end of the distribution in EU countries, similar to France and Germany. Italy is likely to have taken only limited advantage of ICT because of a generally unfavourable environment for innovation.

At an industry level, Italy mainly reveals an increasing weakness in traditional sectors (especially non-inland transport). In addition, it is also weaker than the community partners in those hi-tech sectors (ICT using service and, in particular, producing manufacturing sectors) where Europe, by its own, is already lagging behind the US. Italy has primarily diverged from the EU pattern with a more severe, pervasive and persistent fall in the growth rate of TFP that arises as the key factor behind the slowdown in labour productivity.

As the efficiency can be improved by adopting new technology, innovative activity and eliminating slacks in the use of inputs (Nicoletti and Scarpetta, 2003; p. 20), a brief mention of the non-ICT explanations of the productivity slowdown is warranted in conclusion of this work. The fall in efficiency growth is likely to reflect the inadequacy of the innovative activities of firms. While Europe

was far enough from the technological frontier (Unites States), it was able to achieve enough efficiency gains from learning-by-doing, imitating and buying technological advances generated elsewhere (Daveri, 2004; p. 36). Nowadays, this is no longer sufficient and Europe needs to develop an autonomous innovative capacity based on R&D activities. According to Sterlacchini (2004) in Italy there is a need to re-stimulate in particular the innovative effort of the big groups (mainly utilities) in light of the knowledge spillovers it may produce on the system of small-medium sized enterprises. In order to close the gap with the United States, European countries should develop a new, general innovation policy based on a pool of interventions such as more fiscal incentives (tax credits), more funds available (re-directed from agriculture) and a general coordination by an independent agency (Daveri, 2004).

TFP growth may also be declining because of excessive regulation on the products market. In the presence of administrative barriers, the competitive pressure is minimal and, thus, there are less incentives to exploit resources efficiently and adopt leading technologies. Aside from the lower rates of adoption relative to the US, the smaller evidence on the externalities from ICT in Europe may reflect the greater rigidity of markets which hampers innovative firms to emerge and spillovers to materialize (Pilat, 2004). Bassanini and Scarpetta (2002) also state that the less favorable normative and institutional environment has limited the economic impact of ICT in Europe. For instance, regulatory barriers have probably hindered the entrance of start-ups which have a substantial growth potential due to an ICT-tailored organization. In the United States these firms have been found to significantly boost the productivity of several industries. Because of the lack of an exposure to foreign competition, administrative barriers should primarily be lowered in services (Nicoletti and Scarpetta, 2003). This measure has a twofold, positive impact on aggregate efficiency. One effect is direct and reflects the share of service industries in GDP; the indirect effect derives instead from the improvement in the efficiency of manufacturing sectors which use services. Nicoletti and Scarpetta (2003) show that Italy is one of the most regulated markets across OECD countries with regard to electricity, gas and water supply, retail trade and transports. As has been demonstrated in section 4.3, these industries have experienced the more pronounced deceleration in the growth rate of TFP during the 1990s. Nicoletti and Scarpetta (2003) estimate that a liberalization of such sectors would enhance aggregate productivity by 0.2-0.4 percentage points in the long-run. Blanchard (2004) also argues that deregulation of the products (and financial) market is the most important reform to implement in Europe to create the right conditions for a fast recovery. In this respect, there is room for optimism on

the future of the EU in light of the strong commitment of community authorities in anti-trust policy and harmonization of product standards.

References

Baily, M. J. (2002). "The New Economy: Post Mortem or Second Wind?" *Journal of Economic Perspectives*, 16(2): 3–22.

Bar-Shira, Z., Finkelshtain, I. and Simhon, A. (2003). "Cross-Country Productivity Comparisons: the "Revealed Superiority" Approach". In *Journal of Economic Growth*, vol. 8, pp. 301-23.

Baily, M. N. and Gordon, R. J. (1988). "The Productivity Slowdown, Measurement Issues and the Explosion of Computer Power". *Brookings Papers on Economic Activity*, 2: 347-420.

Bassanini, A. and Scarpetta, S. (2002). "Growth, Technological Change, and ICT diffusion: Recent Evidence from OECD Countries". *Oxford Review of Economic Policy*, 18(3): 324–344.

Baumol, W. J., Blackman, S. A. and Wolff, E. N. (1989). *Productivity and American Leadership:The Long View*. MIT Press.

Blanchard, O. (2004). "The Economic Future of Europe". *Journal of Economic Perspectives*. Forthcoming.

Brandolini, A. and Cipollone, P. (2003). "Una Nuova Economia in Italia?" In *La Nuova Economia: i fatti dietro il mito* (edited by Rossi, S.), ch. III, pp. 71–92. Il Mulino.

Bresnahan, T., Brynjolfsson, E. and Hitt, L. (2002). "Information Technology, Workplace Organization and the Demand for Skilled Labour: Firm-level Evidence". *Quarterly Journal of Economics*, 117: 339–376.

Brynjolfsson, E. and Hitt, L. (2000). "Beyond Computation: Information Technology, Organizational Transformation and Business Performance". *Journal of Economic Perspectives*, 14: 23–48.

Chinn, M. D. and Fairlie, R. W. (2004). "The Determinants of the Global Digital Divide: a Cross-Country Analysis of Computer and Internet Penetration". *NBER Working Paper n. 10686*, August.

Colecchia, A. and Schreyer, P. (2002). "ICT Investment and Economic Growth in the 1990s: is the United States a Unique Case? A Comparative Study of Nine OECD Countries". *Review of Economic Dynamics*, 5(2): 408–442.

Daveri, F. (2002). "The New Economy in Europe, 1992-2001". *Oxford Review of Economic Policy*, 18(3): 345–362.

— (2004). "Why is There a Productivity Problem in Europe?" *CEPS Working Document n. 205*.

Daveri, F. and Silva, O. (2004). "Not only Nokia: What Finland Tells Us about New Economy Growth". *Economic Policy*, 19(38) : 119–163.

David, P. (1990). "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox". *American Economic Review (Papers and Proceedings)*, 80(2): 355–361.

DeArcangelis, G., Jona-Lasinio, C. and Manzocchi, S. (2004). "Sectoral Determinants and Dynamics of ICT Investment in Italy". *Rivista di Politica Economica*. Forthcoming.

Feldstein, M. (2003). "Why is Productivity Growing Faster?" *NBER Working Paper n. 9530*, January.

Gordon, R. J. (2000). "Does the New Economy Measure up to the Great Inventions of the Past". *Journal of Economic Perspectives*, 14(4): 49–77.

— (2003). "Exploding Productivity Growth: Context, Causes, and Implications". *Brookings Papers on Economic Activity*, 2: 207-298.

— (2004). "Why was Europe Left at the Station when America's Productivity Locomotive Departed?" *NBER Working Paper n. 10661*, August.

Gretton, P., Gali, J. and Parham, D. (2004). "The Effects of ICTs and Complementary Innovations on Australian Productivity Growth". In *The Economic Impact of ICT Measurement, Evidence and Implications* (edited by OECD), ch. 6, pp. 105–130. OECD.

Griliches, Z. (1994). "Producitvity, R&D and the Data Constraint". *American Economic Review*, 84(1): 1–23.

Guerrieri, P., Jona-Lasinio, C. and Manzocchi, S. (2004). "Searching for the Determinants of IT Investment: Panel Data Evidence on the European Countries". *LLEE Working Document n. 4*.

Hulten, C. R. (2000). "Total Factor Productivity: A Short Biography". *NBER Working Paper n. 7471*, January.

Inklaar, R., O'Mahony, M., Robinson, C. and Timmer, M. (2003). "Productivity and Competitiveness in the EU and the US". In *EU productivity and competitiveness: An industry perspective. Can Europe resume the catching-up process?* (edited by O'Mahony, M. and van Ark, B.), ch. III, pp. 73–148.

Islam, N. (2003). "Productivity Dynamics in a Large Sample of Countries: A Panel Study". *Review of Income and Wealth*, 49(2): 247–272.

ISTAT (2004). "La Produttività Totale dei Fattori. Anni 1993-2003". *Conti Nazionali, Statistiche in Breve*, Luglio.

Jorgenson, D. W. (2001). "Information Technology and the U.S. Economy". *American Economic Review*, 91(1): 1–32.

— (2004). "Accounting for Growth in the Information Age". In *Handbook of Economic Growth*, (edited by Aghion, P. and Durlauf, S.). North-Holland, Amsterdam. Forthcoming.

Jorgenson, D. W. and Stiroh, K. J. (2000). "Raising the Speed Limit: U.S. Economic Growth in the Information Age". *Brookings Papers on Economic Activity*, 1: 125–211.

Jorgenson, D. W., Ho, M. S. and Stiroh, K. J. (2003). "Lessons from the U.S. Growth Resurgence". *Journal of Policy Modelling*, 25(5): 453-70.

Mason, G., O'Mahony, M. and van Ark, B. (2003). "The Policy Framework: Does the EU Need a Productivity Agenda". In *EU productivity and competitiveness: An industry perspective. Can Europe resume the catching-up process?* (edited by O'Mahony, M. and van Ark, B.), ch. VI, pp. 209–226.

McGuckin, R. H. and Stiroh, K. J. (2001). "Do Computers Make Output Harder to Measure?" *Journal of Technology Transfer*, 26: 295–321.

McGuckin, R. H., Spiegelman, M. and Van Ark, B. (2004). "The U.S. Advantage in Retail and Wholesale Trade Performance: How Can Europe Catch up?" Paper presented at EPKE Final Conference on *Information Technology, Productivity and Growth*, London, 28-29 October 2004.

Mun, S. B. and Nadiri, M. I. (2002). "Information Technology Externalities: Empirical Evidence from 42 U.S. Industries". *NBER Working Paper n. 9272*, October.

Nicoletti, G. and Scarpetta, S. (2003). "Regulation, Productivity and Growth: OECD Evidence". *Economic Policy* 18(36): 9–72.

Nordhaus, W. N. (2002). "Productivity Growth and the New Economy". *Brookings Papers on Economic Activity*, 2: 211-244.

OECD (2001). *Measuring Productivity- OECD Manual: Measurement of Aggregate and Industry-Level Productivity Growth*. OECD, Paris.

OECD (2004). *The Economic Impact of ICT Measurement, Evidence and Implications*. OECD, Paris.

Oliner, S. D. and Sichel, D. E. (1994). "Computer and Output Growth Revisited: How Big is the Puzzle?" *Brookings Papers on Economic Activity*, 2: 273–334.

— (2000). "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?" *Journal of Economic Perspectives*, 14(4): 3–22.

— (2002). "Information Technology and Productivity: Where Are We Now and Where Are We Going?" *Federal Reserve Bank of Atlanta Economic Review*, Third Quarter, 87(3): 15–44.

O'Mahony, M. and van Ark, B. (2003). *EU Productivity and Competitiveness: an Industry Perspective. Can Europe Resume the Catching-up Process?*, European Commission, Enterprise publications.

O'Mahony, M. and Vecchi, M. (2004). "Is There an ICT Impact on TFP? A Heterogenous Dynamic Panel Approach". *Economica*. Forthcoming.

Pilat, D. (2004). "The Economic Impacts of ICT - What Have We Learned Thus Far?" Paper presented at *4th ZEW Conference on the Economics of Information and Communication Technologies*, Mannheim, 2-3 July 2004.

Pilat, D. and Wolfl, A. (2004). "ICT Production and ICT Use: What Role in Aggregate Productivity Growth?" In *The Economic Impact of ICT Measurement, Evidence and Implications*, ch. 5, pp. 85–104. OECD, Paris.

Pohjola, M. (2003). “The Adoption and Diffusion of ICT across Countries: Patterns and Determinants”. In *The New Economy Handbook*. Academic press ed.

Schreyer, P. (2000). “The Contribution of Information and Communication Technology to Output Growth: a Study of the G7 Countries”. *OECD, STI Working Papers 2000(2).*

Schreyer, P. (2002), “Computer Price Index and International Growth and Productivity Comparisons” *Review of Income and Wealth*, 48 (1): 15-31.

Sterlacchini, A. (2004). “Ricerca ed alta tecnologia in Italia: le basi per un rilancio”. Paper presented at XXVIII Convegno Nazionale di Economia e Politica Industriale, Ancona, 24-25 September 2004.

Stiroh, K. J. (2002a). “Are ICT Spillovers Driving the New Economy?” *Review of Income and Wealth*, 48(1): 33–57.

— (2002b). “Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say?” *American Economic Review*, 92(5): 1559– 1576.

Timmer, M., Ypma, G. and van Ark, B. (2003). “IT in the European Union: Driving Productivity Divergence?” *Groningen Growth and Development Centre Research Memorandum GD-67*.

Triplett, J. E. and Bosworth, B. P. (2004). “Baumol’ s Disease has been cured: IT and Multifactor Productivity in U.S. Services Industries”. In *The New Economy. How New? How Resilient?* (edited by Jansen, D.W.), University of Chicago Press. Forthcoming.

van Ark, B., Inklaar, R. and McGuckin, R. H. (2002a). “ ‘Changing Gear’ Productivity, ICT and Service Industries: Europe and the United States”. *Groningen Growth and Development Centre Research Memorandum GD-60.*

van Ark, B., Melka, J., Mulder, N., Timmer, M. and Ypma, G. (2002b). “ICT Investments and Growth Accounts for the European Union 1980-2000”. *Final Report on “ICT and Growth Accounting”* for the DG Economics and Finance of the European Commission, Brussels (March 2003 Revision).

van Ark, B. and Piatkowski, M. (2004). “Productivity, Innovation and ICT in Old and New Europe”. *Groningen Growth and Development Centre Research Memorandum GD-69.*