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INGREDIENTS FOR THE NEW ECONOMY: HOW MUCH DOES FINANCE MATTER?

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Abstract

Both macro and (still scarce) micro evidence support the idea that a new economy is emerging in the US, not (yet) in Europe. Some have argued that the inadequacies of Europe's financial system are an important part of the explanation. This paper, after surveying the existing literature on the new productive paradigm and on the related financial aspects, both in the US and in Europe (in Italy in particular), claims that financing the new economy has more to do with traditional firms investing in ICT than with the creation of new firms in ICT-producing sectors. Saying that finance is a major obstacle in Europe to the development of the new economy may be an overstatement, though countries, like Italy, where the average size of firms is small are probably facing specific difficulties.

JEL classification: D24, G32, L23, O30, O16, O47.
Keywords: growth accounting, information and communication technologies, firm organization, human capital, financing policies.

Contents

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1. Introduction[1]

In the eighties, economists from the Industrial Organization field, as well as business school gurus, gave rise to a stream of studies aimed at assessing the effects on the US economy of the unprecedented diffusion of Information and Communication Technologies (ICT), on which a widespread anecdotal evidence was being gathered. The *a priori* was that dramatic efficiency gains were under way thanks to ICT. As a result, average productivity in the whole economy would certainly show a dramatic acceleration.

The findings of these studies, as well as reality, were highly disappointing: labour productivity growth remained low, if not declining, in the eighties and in the first half of the nineties. The discrepancy between statistical evidence and economists' expectations prompted Robert Solow to coin his universally renowned paradox that computers were visible everywhere but in productivity statistics.

In the subsequent years the puzzle received a variety of conflicting interpretations. In the end, smoke signals came from where nobody was expecting them: the business cycle. In the mid-nineties the expansionary phase which had started in the US at the opening of the decade was entering its fifth, sixth year with unchanged intensity, but without the usual symptoms of overheating that had always emerged at that stage in the past history of the US cycle. The Federal Reserve had been monitoring the business cycle with growing anxieties during the first half of the nineties, ready to detect early signs of an inflation upsurge: not registering any, in a phase when past experiences did suggest they would necessarily show up, was disquieting. The US central bank faced a dilemma: it could either tighten the monetary stance irrespective of available statistical evidence, risking to kill a healthy, non-inflationary, economic expansion; or it could come to believe that a structural break was occurring in the economy. Boldly enough, the Fed chose the second option. After a while, labour productivity started to show a dramatic acceleration, that lasted until a few months

[1] This paper draws on the preliminary work done by the authors for the research project "Technological Innovation, Productivity, Growth: Towards a New Economy?". We would like to thank Andrea Generale and Fabio Panetta for their comments on previous versions of the paper. Remaining errors are of course our own responsibility. The opinions here expressed are of the authors, and do not necessarily reflect those of Banca d'Italia.

ago. Such *direct* evidence confirmed the *indirect* clues of a change in the economic structure that had come thus far only from the unusual length of the expansion-without-inflation, in spite of unemployment decreasing below historical records. It proved that the Fed's decision not to rise interest rates too early was a far-sighted one.

The Fed's view – illustrated in a bunch of scientific papers written by its economists and in several speeches delivered by Chairman Greenspan and other members of the Board of Governors – is consistent with Paul David's approach. According to this view (David, 2000), modern economies have experienced a few big waves of technological innovation in their history, three in the last three centuries, whose final result has always been the diffusion of a new "General Purpose Technology" (GPT). Such GPTs have the property of being pervasively usable in every productive process, enormously increasing its efficiency. In order that the latter effect could materialize, however, the adoption of a GPT has to be followed by a thorough reorganization of each firm, one that has to be designed *ad hoc*. This needs time, much time. Learning processes by entrepreneurs, managers, and workers are lengthy and painful. Meanwhile, productivity may decrease. That – P. David reminds – was precisely what happened with the electric dynamo, at the end of the nineteenth century: it was indeed a GPT, able to revolutionize the functioning of the US (and world) economy, but it worked in terms of productivity gains only 20-25 years after its invention.

ICTs are the GPT of the 20th century. Introduced in the mid-seventies, they could apparently free their efficiency-improving potential throughout the economy only 20 years later, permanently increasing the rate of growth of productivity, and introducing a "new paradigm" in production.

Now, two fundamental questions can be asked.

1) Do available data confirm that a real "new paradigm", centered on the use of ICTs by the generality of productive firms, is at work in the US economy, or elsewhere in the world?[2]

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[2] A connected question, not addressed here but of paramount importance, is the following: are available data, in particular those measuring prices and quantities in sectors where quality is relevant and rapidly changing, reliable enough?

2) Why a new economy (a new productive paradigm) has apparently emerged in the US but not (yet) in Europe?

On the first question a growing army of economists and statisticians are currently working in many countries.

The second question has been less scrutinized. It leads us straight to the topic discussed in this paper. In order to explain why Europe has been so far apparently immune from the new economy, or at least severely lagging behind the US, one may claim that the geographical location of ICT goods production is for some reason relevant also for their usage as factors of production of other goods. Alternatively, one may explore the possibility that a GPT can take root in a productive system if and only if appropriate external ingredients are available in the economic environment, of a kind that is more probably present in the US than in Europe: for instance, competition-oriented market regulations; smooth industrial relations; in particular, a financial system inclined to award innovation. Is this the case?

In the following four sections both questions will be discussed, making reference to the existing literature, and to a number of studies which have been recently conducted in the Research Department of Banca d'Italia within the framework of a research project on "Technological Innovation, Productivity, and Growth (Towards a 'New Economy'?)", still under way. Some preliminary conclusions are drawn in the final section.

2. Is there a new economy? Tentative answers based on macro data

2.1 Is there a new economy in the US?

The US economy outperformed general expectations in the second part of the nineties (see table 1). GDP growth rates were significantly higher than had been projected by most forecasters; nonetheless inflation rates were significantly below expectations. The buoyant performance of the stock market increased families' net worth, pushing the net worth/personal income ratio to historic highs.

Two interpretations are competing to explain such phenomenon.

According to a “pessimistic” view, only the interaction of “temporary factors” led the US economy to outperform. The US dollar appreciation, the oil price fall, and more generally the commodity prices decline following the 1997 East Asian economies’ crisis contributed to dampen price pressures while the economic activity was significantly speeding up; the slowing down of health care benefits led to costs containment, moderating labour cost dynamics in spite of falling unemployment rate (Browne, 1999). Resulting low inflation rates contributed to raise real personal disposable income and consumption. They also allowed the Fed to keep interest rates low, positively influencing investment. The very same stock market “irrational exuberance”, irrespective of its origin, can be integrated into this view, because it could have significantly contributed to sustain consumption through wealth effects, and investment through its effect on the cost of capital.

According to an “optimistic” view, it was the rise of a “new economy” that boosted GDP. Let’s bet on this second hypothesis for a moment: our problem becomes to define a new economy. Most of the existing literature has identified four key elements, which have survived the careful screening of recent years: i) increased stability of GDP growth; ii) ICT progress; iii) ICT capital accumulation; iv) labour productivity acceleration.[3]

Changes in the stability of GDP growth in the US have been widely analysed. McConnel and Perez Quiros (1998) find that GDP volatility showed a structural break in the first quarter of 1984, mainly due to a fall in the volatility of consumption and inventories contribution to growth. Two different explanations are proposed: a more effective US monetary policy since the end of the 70s, and ICT accumulation; the latter would have particularly contributed to reduce inventory variability through the introduction of more advanced inventory management techniques. In a recent paper Kahn, McConnell and Perez-Quiros (2001) also find evidence supporting the ICT-related interpretation.

This evidence introduces us to the factors most frequently put as foundations of the idea of a new economy: ICT progress, ICT capital accumulation and labour productivity acceleration. Let’s consider the role of each of them in some detail.

[3] A fifth element linked to the previous ones, frequently cited but less screened, is the rise of competition intensity.

ICT progress is deeply scrutinised by Jorgenson (2001) in his Presidential address to the American Economic Association. He asserted that “the foundation for the American growth resurgence is the development and deployment of semiconductors”. In his analysis, one of the key elements supporting the 1995-2000 surprising expansion of the US economy is the shift, in 1994-95, of the semiconductor industry from a three-year to a two-year product cycle. Lacking direct productivity statistics for the semiconductor industry,[4] indications are obtained from the semiconductor price index; Jorgenson reports that the microprocessor price fell in 1995-2000 at an average annual rate of 90 per cent.

More generally the ICT industry can be defined as the set of the two main two-digits SIC industries involved in the production of semiconductors, computers, software and telecommunications: industrial and commercial machineries, and electrical and electronic equipment. In 1995-99 these industries recorded very high labour productivity growth rates, respectively 10.2 per cent and 14.3 per cent a year on average; the annual growth rate of Total Factor Productivity (TFP) was 6.9 per cent and 8.1 per cent, respectively.

ICT capital accumulation started in the first half of the '80s and has maintained since then a fast pace. In the period 1980-99 non farm business sector capital services grew at a 4.1 per cent average annual rate; in the same period ICT capital services grew at a 13.2 per cent annual rate; in the period 1995-99 the annual rate of growth of total capital services was 5.5 per cent, while that of ICT capital was 17.5 per cent. In most manufacturing and services sectors the ICT share of productive capital rose at an impressive rate.

Labour productivity average annual growth rate in the non farm business sector was 2.4 per cent in 1995-99; in the manufacturing sector it was as high as 4.4 per cent.

The essence of the new economy conjecture lies in the links between ICT progress, ICT capital accumulation and labour productivity acceleration. In recent years such links have been mainly explored through “growth accounting” exercises.

Two leading papers are worth mentioning in this connection, both related to the aggregate US economy: one by Oliner and Sichel (2000), and the already cited Jorgenson’s paper.

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[4] This is identified by Oliner and Sichel (2000) as a tiny 5 digits SIC industry (SIC 36741).

Oliner and Sichel set up a growth accounting framework whereby, among the labour productivity growth rate components, one is explicitly identifiable as ICT progress, and a second one as ICT capital accumulation. The non-farm business sector is broken down into two final-goods-producing industries (ICT capital goods, all other final goods) and one intermediate-goods industry (semiconductor); therefore, the average labour productivity (ALP) growth rate can be decomposed as follows:

$$ALP' = TFP' + \alpha_{ict} * ICTK' + \alpha_{nict} * NICTK',$$

where

$$TFP' = \mu_{ict}*TFP'_{ict} + \mu_{nict} *TFP'_{nict} + \mu_{scd} * TFP'_{scd}$$

and where TFP' denotes the non farm business sector TFP growth rate; ICTK and NICTK respectively denote ICT productive capital and non-ICT productive capital; α_{ict} and α_{nict} denote ICT and non-ICT capital income share; and μ_{ict} , μ_{nict} , μ_{scd} denote the ratios of total output of the ICT final goods, non-ICT final goods and semiconductor industries respectively, with respect to total non-farm business sector output, in current dollars.

Within this framework ICT progress is the sum of the contributions to TFP growth of the ICT final goods industry and of the semiconductor industry ($\mu_{ict}*TFP'_{ict} + \mu_{scd} * TFP'_{scd}$); Oliner and Sichel (2000) estimate that the ICT progress contribution to labour productivity growth rose from 0.28 to 0.65 between the first and the second half of the 90s. ICT capital deepening contribution to labour productivity growth ($\alpha_{ict} * ICTK'$) is estimated to have risen from 0.51 to 0.96 between the first and the second half of the 90s.

Jorgenson (2001) sets up a different framework which includes services flows from the durable goods employed in the households and government sector, and replaces productive capital stock with capital services. However, he reaches similar conclusions. ICT capital deepening contribution to average productivity growth in 1995-99 is estimated at 0.89 per cent (0.43 in 1990-95). ICT contribution to TFP growth in the same period is estimated at 0.50 (0.25 in 1990-95).

Oliner and Sichel (2000) and Jorgenson (2001) share the view that the productivity acceleration in the second half of the 90s cannot be attributed to ICT-producing industries only. The former authors estimate that non-ICT-producing industries' contributions to non-farm business sector TFP growth rose from 0.20 to 0.50 percentage points between the first and the second half of the 90s (Jorgenson's estimates ranges from –0.01 to 0.25 percentage points).

The acceleration of TFP outside the ICT-producing industries is considered as the best indicator of the existence of *spillover effects* from ICT-producing industries to non-ICT-producing industries. Gordon (2000), however, rejects the spillover hypothesis in his growth accounting exercise. He subtracts from the labour productivity growth rate 0.70 percentage points due to a cyclical component and to changes in price measurement methods. In a more recent analysis, including data for 2000, Gordon (2001) recognises a TFP acceleration outside the computer and computer related semiconductor manufacturing sectors in the order of 0.22 percentage points, though confined to durable goods.

The existence of spillover effects (i.e. TFP acceleration in non-ICT-producing industry) has recently been under scrutiny in many empirical works.

Caselli and Paternò (2001), using two-digits SIC industry level data, document some significant TFP acceleration in the second half of the nineties in ICT-intensive manufacturing industries, even controlling for cyclical effects. They also report evidence of a positive effect of ICT intensity on TFP growth in manufacturing, though limited to ICT-intensive industries. The evidence for the services industries is weaker; some TFP acceleration emerges, even controlling for cyclical effects, only including data on 1999 in the analysis, while ICT capital intensity is estimated to have a positive but weakly significant effect on TFP dynamics. The evidence of Caselli and Paternò (2001) cannot be opposed directly to Gordon's (2001) results, since all the industries recording negative TFP growth rates over long periods, which are likely to be those with the strongest measurement problems, are excluded from their sample.

The empirical evidence discussed above is consistent with lower volatility of GDP and higher potential GDP growth rate. The stability over time of a higher potential GDP growth rate will depend on the persistence of ICT progress, ICT capital accumulation and spillover effects.

Significantly lower-than-expected inflation rates, as reported in table 1, do not enter this picture in a convincing way. In equilibrium, real wages are expected to grow at the same pace as labour productivity: higher labour productivity growth rates should lead to higher real wage growth rates, i.e. to higher nominal wage growth rates for given inflation expectations. However, if labour productivity dynamics is underestimated when signing wage agreements, real wages can underperform it, pushing downwards unit labour cost and consumer price dynamics. Therefore, accepting the new economy paradigm conjecture should not bring about any "death of inflation" implication for the long run.

2.2 Is there a new economy outside the US?

The new economy conjecture has been widely explored for the US, thanks to the relative abundance of good quality data. Relatively little has been done for other industrial countries, because of the scarcity of data. The national statistical institutes in Europe are lagging behind in adjusting accounting methods and statistical practices to the new phenomena (hedonic prices, chained weighted index numbers, etc.). In particular, there is a serious lack of disaggregated series for ICT capital investment.

The OECD is coordinating a research project on growth that performs international comparisons of productivity growth rates. Bassanini, Scarpetta and Visco (2000) attempt at reconstructing homogenous series for productivity growth across countries. According to their results, while TFP growth in the US markedly accelerated in the nineties, it slowed down in the three major economies in continental Europe. In Italy, it went from 1.5 per cent in 1980-1990 to 1.2 in 1990-97.

The deceleration is more evident if changes in the labour force quality are taken into account. Brandolini and Cipollone (2001) carry out a growth accounting exercise for the Italian economy in the period 1981-2000, carefully accounting for changes in the quality of labour and for cyclical factors (tables 2 and 3). They find that the contribution of labour to output growth doubles when taking into account changes in the level of human capital. TFP growth decreases accordingly. In line with Bassanini et al. (2000), they also find that the deceleration is stronger in the nineties when considering human capital growth. In particular, in the period 1996-2000, TFP growth has been 0.3 per cent, compared to around 0.9 per cent for the period 1991-95 and 1.2 for 1986-1990.

As far as we know, no international comparison at the sector level is available as yet. However, some insights emerge from another study co-ordinated by the OECD. This study, still in progress, uses firm level data for ten OECD countries to produce a series of indicators on firms demographics and productivity growth at the sector level. Differences in the data collection procedures do not allow direct comparisons of productivity growth across countries. However, it is possible to consider how productivity in a given sector and country has changed with respect to the cross-country average, thus accounting for potential country biases. In particular, Romagnano and Schivardi (2001) find that labour productivity in the US in the period 1992-97 grew, in ICT producing sectors, at rates 4 to 8 times higher than in the manufacturing sector as a whole. In continental Europe, and particularly in Italy, on the contrary, the performance turns out to be much more modest: those same sectors have recorded productivity gains only marginally above those of the manufacturing sector as a whole; moreover, no clear signs of an acceleration with respect to the period 1987-1992 are found. These results confirm the hypothesis that the substantial increase in productivity recorded in ICT-producing sectors in the US have only marginally interested the similar sectors in continental Europe.

Other papers try to directly assess the role of ICT capital accumulation in output growth. The problem in carrying out such an exercise at the international level is the lack of data on ICT investment. Work in this area has so far been based on the data provided by International Data Corporation, a private consulting company specialized in high-tech industries that constructs estimates of ICT capital investments comparable across countries. Schreyer (2000) performs a growth accounting exercise using such data for the period 1980-1996. He finds that the contribution of ICT investment in 1990-96 has been roughly twice as large for the US (0.42 per cent) when compared to that of the European economies (0.17 for France, 0.19 for West Germany, 0.21 for Italy). Daveri (2001) finds that the contribution to growth of ICT capital accumulation in the second half of the nineties has been maximum in the US (1.45 per cent), the UK (1.17) and Ireland (0.96). In these countries, it has almost tripled with respect to the first half of the decade. The contribution has been more modest in continental Europe, where none of the major economies has recorded a value exceeding 0.5 per cent; more worryingly, no clear signs of acceleration in the second half of the nineties emerge. In Italy the contribution was 0.28 in 1991-95 and 0.35 in 1996-99, slightly below that of the other three major continental economies.

3. Total factor productivity and complementarity: technology, human capital and firm organization

3.1 Theory and rationale for micro data analysis

As seen before, TFP growth is usually associated with technical progress, and its acceleration in the second half of the last decade in the US has been linked to the diffusion of ICT, spurred by the marked decline in the price of computers.

As computers become cheaper and more powerful, their business value crucially depends on management's ability to reorganize firm business practices (Brynjolfsson and Hitt, 2000a). Indeed, the fundamental role of these technologies does not only rely on number-crunching, but also on cutting communication and co-ordination costs; in this sense, ICT is best described as a GPT, one that facilitates complementary innovations and enables firms to increase output, via both the introduction of new processes and the improvement of intangible aspects of existing products (e.g. quality). While early applications of ICT successfully lowered the cost of some specific functions (e.g., accounting), much larger and diffused gains can be realized thanks to the low costs of data exchange and processing; these new opportunities can be better exploited implementing internal reorganizations, establishing new structures to interact with customers and suppliers, offering new products and services.

In order to make the use of computers and related technologies more productive, firms need a well educated labour force (able to use or to learn how to use computers efficiently); this characterises the "ICT revolution" as a skill-biased technical change (Autor, Katz and Krueger, 1998; Johnson, 1997). Moreover, as emerged from US firms' reorganisations, the trend is toward firm vertical dis-integration, with a reduction of the number of managerial levels and more decentralised decision and productive processes. Thank to the cheaper monitoring over the entire production process made available by the new technologies, single workers are more autonomous and more frequently called to make crucial decisions. Inevitably, these workplace innovations induce a further increase in the demand for skilled labour, influencing also the pace of research activity and thereby the rate of growth.

To sum up, the new wave of technical change we are experiencing can be thought of as the offspring of the interaction among ICT, workplace organisation and human capital. Investing in ICT without appropriate organisational changes can create significant productivity losses: direct benefits from ICT would be outweighed by the negative interaction between ICT and existing organisational practices. Moreover, skilled workers are needed to efficiently use advanced technologies and to easily adapt to new, more flexible and more decentralised workplace mechanisms.

These aspects can emerge only from firm-level analyses. This is mainly because firm-level data can better measure specific aspects (intangible complements) that are very difficult to capture at the aggregate level: saving customer time, raising quality levels and offering new products to the market create welfare gains that are largely ignored by traditional measures of economic performance. The advantage of micro data-sets relies also on the huge heterogeneity in business population, both in size and performance. Large samples allow to control for a greater number of factors — such as size, industry, age, location, etc. — in obtaining more precise parameter estimates. Furthermore, firm-level data may help in analysing the crucial issue of causality from technology to productivity. It is well known that documenting the correlation between a factor of production, such as ICT, and productivity is not enough to understand causal mechanisms, and that this is somehow complicated by the fact that the use of ICT also depends on other variables correlated with productivity, such as human capital and managerial ability. At firm-level, all this is more easily accounted for.

3.2 The empirical evidence on complementarity in the US

In the last 15 years, various scholars have tried to empirically verify the relationship between ICT capital and productivity in the US in single firms. These studies, based on data not covering years beyond the eighties (Morrison and Berndt, 1990; Berndt and Morrison, 1995; Barua et al., 1995), found either a non significant relationship between ICT and the firm performance or, even, a negative one. Other researchers looked at firm level data for the nineties and questioned these results. Brynjolfsson and Hitt (1996) estimate a production function for 300 large US firms over the period 1988-1992; they find that the marginal product of ICT capital substantially exceeds its reported cost. Lichtenberg (1995) further finds that the marginal product of ICT capital is at least six times as great as the marginal product of other types of capital. Brynjolfsson and Hitt (1995), taking explicitly into account firm effects, conclude that the elasticity of ICT capital remains positive and significant, and find very limited differences between manufacturing and services.

In the last three years the empirical research has moved to a more general approach to ICT adoption within the firm, by addressing explicitly the complementary changes in organisation and human capital. Brynjolfsson and Hitt (1998) focus on 380 US firms for which they know various organisational and human resources practices: *employee empowerment or participation in decision making* (employees take over some tasks previously performed by supervisors), *teamwork* (autonomous teams take over some direct supervision and substitute for formal management structures), *job rotation and cross training* (employees within teams swap tasks and become more interchangeable), *total quality management* (work groups take over responsibility for many of the factors affecting product quality), *investments in training and education*. They find a greater demand for ICT in firms with greater decentralisation of decision rights, especially through the use of self-managing teams; these firms have also performed larger investments in human capital, including training and screening by education. Finally, they show that in decentralised firms ICT has a larger impact on output level.

In a different paper, Brynjolfsson and Hitt (2000b) use standard growth accounting and productivity measures to examine the relationship between growth in computer spending and in output for 600 large US firms in the period 1987-1994, finding evidence of a substantial and positive relationship between computers and total factor productivity growth. In the short run computers contribution to output is approximately equal to the direct user cost of computer capital; in the long run, however, the marginal product and the contribution of computers to growth rises significantly. This result can be attributed to the organisational changes carried out over several years: these changes turned out to be complementary to computers and therefore capable to enhance computers' impact on productivity. This conclusion may also help explaining why earlier studies did not find any positive contribution of ICT to growth: at the end of the eighties the necessary organisational changes were not still completed.

As time goes by, the information on workplace practices becomes wider and of better quality; Black and Lynch (2000) and Bresnahan, Brynjolfsson and Hitt (2001) repeat some of the previous exercises focusing on the "three factor complementarity" (ICT, workplace practices, human capital). Black and Lynch (2000) exploit the information contained in a survey they contributed to develop.[5] Using panel data, they find that high performance practices are associated with both higher productivity and higher wages. These new workplace practices (profit sharing, greater employee voice, teamwork) appear to explain a large part of the movement in total factor productivity over the period 1993-96.

Bresnahan, Brynjolfsson and Hitt (2001) conclude that the new workplace practices and the level of human capital are positively linked to the demand for ICT. Moreover, firms that have a higher degree of computerisation and have changed their internal organisation have also a higher demand for skilled labour.

3.3 What can we learn from the Italian case?

Bugamelli and Pagano (2001, henceforth BP) analyse a sample of about 2,400 Italian firms from the Mediocredito Survey of Manufacturing Firms which, among other things, provides information on investment in ICT (over the period 1995-97). In their whole sample, BP find the expected positive correlation between ICT investment, firm reorganisation and human capital. More precisely, since about one fourth of sampled firms claim no investment in ICT in 1995-97, on one hand BP estimate a probit model and find that having reorganised the production process significantly raises the probability of ICT adoption. On the other hand, the amount of investment in ICT turns out to be positively related to the level of human capital within the firm.

They then construct a measure of ICT capital stock at firm level. By a simple aggregation, they compute the ratio of ICT capital stock over value added for the Italian manufacturing industry: the resulting figure of 4.9 per cent in 1997 signals a 8 year

[5] The Educational Quality of the Workforce National Employers Survey.

technological lag with respect to US. However, as argued by the authors, this may be due to the different sector specialisation, in Italy relatively more unbalanced towards ICT less intensive sectors (e.g., textile and clothing, leather and leather products).

Based on such measure of ICT capital stock, BP estimate and identify the parameters of a standard Cobb-Douglas production function. For ICT capital the estimated output elasticity implies a very high marginal return, 80 per cent at the median of the sample distribution of the ratio between ICT capital stock and value added, much higher than the user cost of ICT capital, which roughly amounts to 46 per cent. As suggested by Brynjolfsson and Hitt (2000b), this excess return might mask unmeasured barriers to ICT investment. The marginal product of ICT may result higher than the relative cost if firms are bound to invest less because of such barriers.

Indeed, BP find that costly reorganisation and lack of human capital may explain the excess return to investment in ICT. Controlling for these factors, it actually disappears. Interestingly, it remains high for firms that have overcome just one of the two barriers, signalling the importance of both reorganisation and human capital for ICT investment.

The Bank of Italy has included a rich monographic section on ICT in its 2001 Survey of Investment in Manufacturing, that covers about 1,400 firms with 50 or more employees. The section has been structured in such a way to allow for a precise and multidimensional measurement of ICT capital stock, to provide some insights on the use of these new technologies and on firm organizational changes. This may represent a significant step ahead in the state of our knowledge: BP estimate ICT capital stock based on limited information, and the type of reorganization is not specified. The preliminary results of this first survey are summarized by Trento and Warglien (2001). Some relevant statistics are shown in tables 4 and 5.

A strong correlation between firm size and ICT adoption emerges among other interesting information. This is true for any measure of ICT, in particular for the number of PC per capita. Large firms have also adopted very innovative software packages that heavily impact on the internal organisation of a firm and on its relationship with suppliers. Firms in traditional sectors (textile, clothing, leather and shoes) have a smaller endowment of ICT capital. In general, the functional composition of the labour force is confirmed to be a crucial factor: the bigger is the share of white collars, the larger the number of computers. The level of ICT adoption turns out to be positively correlated with organisational changes. Though there is no convincing evidence of true structural changes – in particular of a reduction in the number of hierarchical levels – a significant dynamics in the organisational process is indeed evident: decisions are more frequently delegated to lower levels, workers are more often called to work in teams, firms tend to make a wider use of external suppliers. As before, these changes are concentrated in larger firms.

ICT adoption is one part of a complex process that requires drastic organizational changes within the firm, and the availability of skilled workers, capable to efficiently use the new technologies and to easily adapt to the new working models. Therefore any cost-benefit analysis on investing and using the new technologies can not leave aside these complementary factors.

The Italian case seems relevant from the point of view adopted in this paper for one more reason. As noted by Schivardi and Trento (2000), when asking whether Italian firms will be able to take advantage from a more diffused and deeper use of ICT, it is worth noticing two peculiarities of Italian manufacturing firms: sector specialization and size.

It is well known that Italy is specialized in sectors that are not information intensive: firms producing textile, clothing, leather and shoes have in principle little to gain from the new technologies. Small firms are probably in a similar situation: since these technologies typically allow to reduce co-ordination and communication costs within the firm, it is reasonable to think that the benefits from ICT are less important for small firms. This argument becomes even stronger when reorganization is taken into account: since the benefits go through a vertical disintegration of the firm, a small firm has, again, less to gain.

If we move our attention to the costs of ICT adoption, we can improve our understanding of the relatively low diffusion of ICT in the Italian manufacturing. First of all, the needed reorganization of the firm implies fixed costs that might be quite high for small firms, especially as compared to the limited benefits. More importantly, the positive impact of ICT on productivity depends on human capital, which is relatively low in Italy as compared to other industrialized countries. In particular, there is a shortage of engineers and ICT experts; moreover, they reasonably go to larger companies.

A third element that deserves some attention is the shortage of firms in the ICT-producing sectors. Their role in the Italian economy is limited when compared to that of other industrialized economies (Bugamelli, 2001). Figure 1 reports the share of high-tech products (aerospace, computer, office machinery, electronics, instruments, pharmaceuticals, electrical machinery, armament) over total export in 1991 and 1998. The US have the highest level, close to 30 per cent, followed by Japan at 25, while Europe is below 20 on average. More remarkably, high-tech products only account for 7.5 per cent of Italian exports; moreover, while all other countries excluding Spain have recorded an increase in the share during the nineties, for Italy the value has remained stable, showing a tendency of its specialization model to further deepen its peculiarities, rather than converging to that of the other advanced economies.

According to many commentators, the new technologies enter a firm through sophisticated software packages that *per se* impose a change in firm organization. Moreover, the development of the new technologies crucially relies on the interaction between producers and users: it is very important that the former develop packages that match users' needs. Therefore, due to the absence of a thick producing sector, Italian firms are forced to buy products tailored on the US demand; reasonably, these packages, that can be easily adapted to large firms, do not satisfy at all the specific needs of the numerous small Italian firms.

We shall come back on the relative merit position of big vs. small firms in a new economy when discussing the role of finance.

4. The role of finance

4.1 The finance-growth nexus

The existence of investment opportunities characterized by positive marginal rates of return is a necessary condition for economic growth. As it has been shown in the previous paragraphs, in the last decade fast technological progress has disclosed a large number of new ways to achieve high returns on investment, particularly in the information and biotechnology sectors. But investment opportunities in themselves are not enough. A number of other factors are needed for the economy to be capable of profiting from such opportunities, such as human capital, or an efficient legal and institutional environment.

One of the most important factors determining the ability of an economy to take on the most profitable investment opportunities is its efficiency in channeling funds from the sectors in financial surplus to those in deficit (typically, from households to firms). In fact, the study of the links between the real and the financial sectors of the economy has a centennial tradition, starting at least from the work of Schumpeter (1912).

In closer connection with the previous discussion on the recent surge in TFP growth in the US, at least three issues relating finance and growth are worth considering. The first is the existence in itself of a macroeconomic relationship between the degree of development of the financial sector and the rate of growth of the real economy. The second aspect relates to the different effects that bank-centered and market-centered financial systems can have on real economic growth. Finally, a more detailed analysis is needed to understand the peculiarities of financing hi-tech sectors and, more in general, firms of an economy where a "new" productive paradigm is being established.

The existence of a positive relationship between the degree of development of a country's financial sector and its aggregate growth performance is nowadays a widely accepted fact (see, e.g., King and Levine, 1993; Levine and Zervos, 1998; and the survey by Levine, 1997). A number of authors have in fact cautioned that the direction of causality may be the opposite of what is implicitly assumed in the finance-growth regressions, arguing that it may be faster real economic growth that generates a stronger demand for financial services. However, all the studies that have thoroughly addressed this issue conclude in favor of the existence of a relationship going from finance to growth (e.g., Jayaratne and Strahan, 1996; Rajan and Zingales, 1998).

In theory, more developed financial systems can foster real economic growth through an efficient intertemporal allocation of resources, increasing the equilibrium saving rate and the rate of fixed capital accumulation. An alternative view suggests that financial development does not alter the rate of accumulation of resources, but it helps allocating them more efficiently in each period. Wurgler (2000) and Beck, Levine and Loayza (2000) support this second interpretation, showing that more developed financial systems are associated with faster rates of growth of TFP (as if investments were done in sectors where productivity is higher), not with faster accumulation of inputs. Moreover, the development of the financial sector would have a more positive effect on investments in R&D, and therefore on the accumulation of intangibles, rather than on fixed capital formation (Carlin and Mayer, 1999).

But why do some countries have well-developed financial systems, while others do not? Rajan and Zingales (2000a) suggest that multiple equilibria may exist, due to the presence of externalities. Other authors have stressed the importance of institutional factors for the development of the financial system. La Porta et al. (1997) find that legal systems following the common law tradition are better in protecting investors' rights, and favor the development of capital markets. Rajan and Zingales (2000b) argue instead that a sufficient degree of political consensus is needed for financial development. What is certainly agreed upon, is that in order for the financial sector to develop, both favorable external conditions and a non-negligible amount of time are needed.

4.2 Bank debt and equity financing

A large body of empirical literature has been tested the relationship between financial development and real economic growth. Recently, some authors have suggested that what should be analyzed is not the relationship between finance and growth, but rather the nexus between the financial structure and the types of economic activities that are financed. For example, the dependence of an economy on bank credit may have different consequences for its ability of funding investment in hi-tech sectors, as opposed to financing the adoption of new technological and organizational structures for the production of traditional goods or services.

The economic literature has found a large number of arguments in favor of both debt-financing, in particular bank debt, and equity financing.

On one hand, by pooling the costs of screening and monitoring investment projects, banks can be more efficient than markets in financing productive activities. Moreover, financial markets can swiftly transfer new information to prices, thus reducing the incentives for agents to monitor the entrepreneurs. Banks can also be better than markets because they are capable of sharing the short-term risk of the investment, intertemporally cross-subsidizing those entrepreneurs that face temporary liquidity problems.

On the other hand, in some circumstances opaque debt financing can give the bank excessive market power in its relationship with the borrower, reducing the liquidity of her assets and harming her incentives to invest. Moreover, agency problems can intervene when banks own shares and can influence the management.

Despite the stark differences between bank-centered and market-centered financial systems, the empirical literature has failed to find clear evidence showing that one is better than the other. What matters for growth is not whether the financial system is bank-based or market-based, but instead the development of the financial sector as a whole (Beck and Levine, 2001). In fact, any difference in the structure of financial systems that is not accounted for by differences in the legal system has no significant effect on the equilibrium rate of real economic growth. Moreover, the enlargement of the financial system beyond what is explained by the level of efficiency of the legal system has no significant effects on economic growth (Demirgüç-Kunt and Maksimovic, 2000).

The fact that the equilibrium rate of growth of the economy is independent of the structure of financial markets does not mean that the country's productive specialization is also unaffected. Where stock markets are less developed, firms that are more dependent on external finance are on average smaller (Kumar, Rajan and Zingales, 1999). More transparent accounting standards promote investment in those industries where equity finance is most important and with a higher level of human capital, mainly by favoring research and development (Carlin and Mayer, 1999). At the opposite, the relevance of accounting standards is much smaller in bank financed industries: in countries where creditors' rights are more protected, a larger share of investments is financed with long term liabilities (Demirgüç-Kunt and Maksimovic, 1998).

One of the main problems in financing R&D investments is that output is typically in the form of intangible assets. More in general, all growth opportunities (e.g., specialized human capital) are highly intangible. Problems can be worse when funding comes from banks, because they typically need to limit their risk exposure and must justify such exposure to depositors and, often, to supervisory authorities. The difficulties in evaluating firm's assets are also more problematic when the accounting standards are not transparent and the legal system is not efficient in granting investors' rights. In this case it is more likely that a relationship-based system develops, such as a bank-centered system, financing mainly traditional investment in highly tangible assets.

5. The role of finance in a "new" economy

The emergence of innovative ways of financing entrepreneurial activity that has characterised the past decade of fast growth in the US economy has led some commentators to claim that finance is the fundamental engine of the new economy. According to this view the ICT revolution would have been produced mostly by new firms, characterised by a very high share of intangible assets with respect to "old economy" firms. Given the high risk/returns involved, such firms would require tailor-made financing, such as external equity financing and venture capital. Without radical innovation in the financial sector, the emergence of the new economy would be dwarfed, in that the productive system would not take full advantage of the wave of technological innovation.

This picture is missing one important aspect of the new economy paradigm, already emphasised in the previous sections: the role of the adoption of ICT capital by firms in traditional sectors. However, in particular when considering their financial needs, *upstream firms*, producing ICT goods, and *downstream firms*, adopting the new technologies for producing traditional goods and services, have to be clearly distinguished. In fact, investors in new firms, operating in a very dynamic and competitive environment, are likely to trade-off high average rates of returns with a significant degree of uncertainty. This is not necessarily the case for investors financing the adoption of new technologies by enterprises operating in more mature sectors, where expected returns are likely to be lower, but more certain.

5.1 Financing new firms in the ICT-producing sectors

New firms are typically small businesses that, even in a country with very efficient financial markets such as the United States, have their largest share of equity financing coming from the founder-owner-manager of the firm, from his relatives and friends, and from other initial stockholders (Berger and Udell, 1998). External equity financing, known as angel financing, accounts for a small share of total equity, venture capital for even less. Debt finance, mainly bank debt and commercial credits, accounts for about half of total liabilities.

Although this picture is probably accurate for the average small business in US, it is clear from previous discussion that financing firms investing in hi-tech sectors is not the activity that banks are most willing to undertake. These firms normally have few tangible assets that can be used as collateral, they make highly illiquid investments that depend on firm specific human capital and they have highly uncertain returns; all this is balanced by a high average profitability. At the same time, it seems difficult that small start-ups could raise funds directly from the markets, due to the presence of fixed costs, especially informational, that are likely to be relevant at the early stages of a firm's development. Moreover, moral hazard problems may require stricter control of the activity of young entrepreneurs in hi-tech sectors than what can be exercised by the market.

Anecdotal evidence puts much more emphasis on the role of angel financing and venture capital in the funding of hi-tech start-ups than of the average small business. Venture capital, in particular, is believed to be the key financial factor behind the development of innovative firms in the United States. This is because venture capitalists are prepared to take high risk in exchange for high expected-returns, much more than a bank can do, and they are actively involved in the management of the company that they finance.

The success of venture capital financing is largely due to its ability of merging the provision of funds with an active control on the firm's activity. Venture capitalists provide their human capital and expertise in the form of technological and organizational advice. They monitor the development of the firm and are prepared to stop projects that show insufficient profitability. They help the firm in marketing new products before competition erodes profit opportunities. Venture capitalists are typically located in physical proximity with the entrepreneurs they finance (normally at driving distance). They concentrate their activity in sectors where they have acquired specific knowledge and human capital. They stage their funding, and renew them only conditional on the results obtained by the firm that they finance.

The results are evident: firms financed by venture capitalists grow at higher rates than their average competitors, they accumulate more human capital, they are more innovative, they are faster in marketing their products (Hellman and Puri, 2000 and 2001).

The presence of external investors in the early stages of firm life can help its development also for another reason: angel and venture capital financing are a guarantee that the project has been carefully analyzed and that it is continuously monitored. This makes also bank financing easier to obtain (Berger and Udell, 1998).

A further aspect that has shown to be fundamental in determining the success of venture capitalists is their ability to help firms reaching a size such that they can go public (Black and Gilson, 1998). In fact, there are two ways for a firm of exiting the phase of venture capital financing: either being acquired (by the owner or by a larger firm) or going public. The option to go public is essential, as it guarantees that investors can obtain a fair price by selling their participation while giving the entrepreneur the opportunity of retaining control if she wishes so. Should such option be precluded, both the potential buyers and the original entrepreneur could profit from their market power, reducing the incentives for the entrepreneur to start new activities, and for the financiers to fund them. For this reason venture capital can only develop in presence of well-developed, efficient and liquid financial markets. The exit of venture capitalists from firms that have reached a sufficient level of development has another positive impact on growth: it frees human capital and financial resources that can be used in sustaining new projects in their early stages.

The expansion of the venture capital industry has been an important factor favoring investments in innovative firms. However, as with the other financial markets, its initial development was by no means natural. Hellman (2000) and Lerner (1995) suggest that at least two factors have helped the venture capital industry to settle up in the US. First has come an initial intervention by the government. This has been done directly, by helping access to cheap funds through the "Small Business Investment Companies" program, and indirectly, favoring hi-tech research and allowing institutional investors (insurance companies, investment and pension funds) to invest in venture capital firms. Then flexibility in the labour market and in liquidating procedures has helped a lot, facilitating early exit from non-profitable projects.

Clearly, this set-up is not the only one that can permit the development of hi-tech start-ups. One obvious alternative would be a public program for funding new firms with high growth opportunities, where the overall risk (already highly reduced by diversification) is spread across all taxpayers. However, the strong relationship that needs to be developed between entrepreneurs of hi-tech start-ups and their investors is likely to be difficult to replicate within a public agency.

Venture capital financing is showing to be yet another successful American story: outside the United States it is much less common (Israel is one of the few noticeable exceptions). A first possible explanation is the lower degree of development of the stock markets outside the US, limiting the ability of firms to go public and thus the incentives for venture capital to develop (Black and Gilson, 1998). However, even in the United Kingdom, where the stock market is well developed, funding of hi-tech firms is relatively less common then funding management buy-outs. Relative to start-up financing, Germany has the largest venture capital market in Europe, although it is basically controlled by bank subsidiaries.

In Italy the financial needs of firms operating in the hi-tech sectors have been fulfilled mainly by banks. Table 6 shows that on average, in the last five years, 32 per cent of total funds raised by new economy corporations[6] came from bank credit; the share for all non-financial corporations was 33 per cent. New economy start-ups have indeed a lower amount of physical assets that they can post as collateral with respect to other firms, but banks seem to compensate the larger risk of unsecured loans by limiting their size and increasing the level of the interest rates that they require (Pozzolo, 2001).

The availability of bank credit for new firms, though limited and expensive, may have partly crowded out the development of venture capitalists in Italy. Nonetheless, in recent years venture capital financing, in large part made by bank owned funds, has increased significantly. Between 1997 and 2000 the number of seeds and start-ups operations financed by venture capitalists (mainly in companies operating in telecommunications, internet and computer related businesses) have increased by about five times (table 7).

[6] Following the definition proposed by Antoniewicz (2001) and adopted by the BIS Working Group on the Financing of the New Economy, such corporations are: telecom service providers, telecom equipment manufacturers, computers and semiconductors manufacturers and internet related companies.

The characteristics of Italian firms financed by venture capitalists are similar to those of their American counterparts. Generale (2000) provides evidence that these firms are relatively younger and have a smaller share of intangible assets and of short term debt. There is also some weak evidence that, before obtaining the funding, they had a better average growth performance then their competitors. After being financed, they increase the size of their intangible assets and obtain bank credit at better conditions;[7] their growth performance improves in the short run, although not in the long run.

It has been previously argued that the main characteristics of venture capital is its capability of providing a whole set of services for the development of the firm, not just funds. Although in Italy this industry is growing rapidly, its future development is itself unwarranted. Despite the recent creation of the Nuovo Mercato, a stock market for young enterprises, there are still doubts that a venture capitalist could sell her participation at a fair price whenever she wants. In fact, this is one aspect of a much more general problem, that cannot be confined to the case of start-ups: the negative attitude of Italian companies to go public (see, in particular, Pagano, Panetta and Zingales, 1998).

The anecdotal evidence that strong credit constraints limit the development of potentially highly profitable hi-tech firms in Italy seems therefore somewhat overstated. The problem seems instead to be the lack of creation of start-ups in innovative sectors, as pointed out in section 2. Italy has in these sectors a clear disadvantage with respect to the US. The size of upstream sectors in Italy is too small to give the economy's TFP a contribution comparable to that recorded in the US. Moreover, both the dynamics of the last decade and the fact that ICT production is characterized by strongly increasing returns to scale – as in the case of software – and by first mover's advantage, suggest that the gap with respect to the US should not be closed within a short period of time.

5.2 Financing the old economy's effort towards the new paradigm

The adoption and diffusion of ICT capital goods throughout the productive system is the core of a new economy. The crucial issue over the next years will be the diffusion of ICT

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[7] De Bonis and Viviani (2001) find a similar result for firms listing at the Nuovo Mercato, the new stock market for young enterprises recently opened in Italy.

to downstream sectors. In this respect, it is of foremost importance to pinpoint any constraint that might slow the process of adoption.

Financial constraints are in general an obvious candidate to explain cases of under-investment. But is there any reason to believe that these problems might be more stringent in the specific case of financing the adoption of ICT capital goods?

Unfortunately, we are able to provide only a tentative answer to such a question; it is almost impossible, with the information available, to evaluate the constraints that firms may encounter in financing one specific type of investment, such as that in ICT capital. In principle, this should not differ significantly from investment in other equipment capital. Thus, there should be no significant discontinuities in the financial needs of downstream firms with respect to the adoption of ICT.

The notion of complementarity, that we have discussed in section 3, is highly relevant in this respect. A major problem of investment in ICT capital goods may be the high degree of uncertainty of the results: although computers and software are not much more intangible than many types of machinery, reorganizing the productive activities in a way that permits to fully exploit the possibilities offered by the new technologies can imply huge sunk costs. However, the uncertainty implied by investment in ICT capital is that typical of any large process innovation. What makes the ICT revolution so pervasive is that these new capital goods can be adopted in the production of virtually any good: they are a general purpose technology. This may turn out to be a great advantage, as it permits entrepreneurs to learn from the experiences made by firms operating in other sectors. Productivity improvements caused by the introduction of computers in warehouses' managing are likely to depend only in part on the types of goods that are stored. By observing the experiences of other firms, entrepreneurs can better evaluate the expected returns of their own investment. With a lower risk, such investment are relatively more likely to be financed.

Serious problems may arise if the productive system shows inappropriate structural features. This is the case of the Italian manufacturing sector, with the small average size of its firms.

ICT are flexible, but in order to fully profit from their adoption a minimum scale of operation is needed. Indeed, table 5 shows that there is a strong correlation between firm's size and ICT adoption. Moreover, small firms are in general more likely to be financially constrained, hence they may have more difficulties in obtaining the funds needed to significantly increase their scale in order to accommodate an ICT-driven reorganization.

In this respect, one of the typical limits of Italian firms, the failure to grow above a certain threshold (Pagano and Schivardi, 2000), could become even more stringent with the introduction of ICT capital goods, since it can alter the optimal size of the firm.

6. Conclusions

First symptoms of a "new" economy may well come from macroeconomic developments, but the essence of a new productive paradigm based on the adoption of a general purpose technology, such as ICT, is microeconomic: it lies on complementarity between investment in advanced capital goods, investment in human capital and *ad hoc* reorganization of each firm in the economy.

Both macroeconomic and (still scarce) microeconomic evidence support the idea that a new economy is emerging in the US, though not as fast as it was originally believed. No such evidence is available for Europe yet. Why? Some have claimed that the European economies lack some fundamental structural features conducive to the development of a new economy; the most likely culprit seems to be the financial system. Is this the case?

Addressing the issue is made arduous by the scarcity of available information.

The tentative answer this paper gives to such question, mainly drawing on the Italian experience, is that the charge against Europe's financial system may be partly groundless.

The financing of new firms in the ICT-producing sectors can indeed be constrained by an insufficient development of equity markets, especially in countries, like Italy, where banks remain central. But the relevance of these constraints may have been overstated in recent studies.

In any case, the main point is, as far as financing the new economy is concerned, funding investment in ICT capital, and complementary human and organizational capital, by traditional firms. On that ground, finance may only represent a "second order" problem. In principle, there are no reason to discriminate ex ante between different kind of capital from the point of view of funding. However, countries, like Italy, where the average size of firms is small, because of the existence of disincentives to grow, may face a specific problem, even of a financial nature, since ICT investment requires a minimum scale of operation to grant productivity benefits.

It is therefore not evident that the challenges of a new economy are essentially financial. Rather, the efficient exploitation of the opportunities offered by the new technologies is strongly connected with the redesign of firm organizational structures, with the human capital of the labour force, with the capability of firms to grow until they reach a sufficient scale of operation. Appropriate public policies in the field of market regulation, taxation, and public sector efficiency are of paramount importance.

Tables and figures

Table 1

US: EXPECTED AND ACTUAL GDP GROWTH AND INFLATION RATES
(percentage points)

	1995	1996	1997	1998	1999	2000
GDP growth rate						
Actual	2.7	3.6	4.4	4.3	4.1	4.1
IMF (May Outlook one year earlier)	2.6	1.9	2.2	2.2	2.2	2.2
Consensus (May one year earlier)	….	2.4	….	2.1	2.2	2.4
Inflation rate						
Actual	2.8	2.9	2.3	1.6	2.2	3.4
IMF (May Outlook one year earlier)	3.2	3.5	3.0	3.0	2.4	2.4
Consensus (May one year earlier)	….	3.5	….	3.1	2.5	2.5

Source: IMF World Economic Outlook, Consensus Forecasts, BIS.

Table 2

ITALY: CONTRIBUTIONS TO THE GROWTH OF REAL VALUE ADDED IN THE WHOLE ECONOMY

(Percentage points, average annual rates)

	1981-2000	1981-1985	1986-1990	1991-1995	1996-2000
Rate of growth of real value added	1.9	1.7	2.8	1.3	1.8
Contribution of the stock of capital	0.7	0.8	0.8	0.6	0.7
Contribution of labour					
Unadjusted	0.2	0.3	0.5	-0.5	0.5
Quality-adjusted	0.5	0.6	0.8	-0.2	0.8
Total factor productivity					
Unadjusted	1.0	0.6	1.5	1.2	0.6
Quality-adjusted	0.7	0.3	1.2	0.9	0.3

Source: Brandolini and Cipollone (2001)

Table 3

ITALY: CONTRIBUTIONS TO THE GROWTH OF REAL VALUE ADDED IN INDUSTRY

(Percentage points, average annual rates)

	1981-2000	1981-1985	1986-1990	1991-1995	1996-2000
Rate of growth of real value added	1.5	0.1	3.1	1.4	1.3
Contribution of the stock of capital					
Unadjusted	0.7	0.7	0.9	0.5	0.7
Adjusted for utilization	0.8	0.7	1.4	0.4	0.8
Contribution of labour input					
Unadjusted	-0.6	-1.9	0.4	-1.2	0.1
Adjusted for hours worked	-0.6	-2.4	0.8	-0.8	0.1
+ quality-adjusted	-0.3	-2.3	1.0	-0.3	0.4
Total factor productivity					
Unadjusted	1.4	1.3	1.8	2.1	0.5
Adjusted for capital utilization	1.3	1.3	1.3	2.2	0.4
Adjusted for hours worked	1.4	1.8	1.4	1.7	0.5
Adjusted for capital utilization and hours worked	1.3	1.8	0.9	1.8	0.4
+ quality-adjusted	1.0	1.7	0.7	1.3	0.1

Source: Brandolini and Cipollone (2001).

Table 4

ITALY: MANUFACTURING FIRMS WITH NET LINKS

	Diffusion (%)				Average year of installation			
	Intranet	Internet	Other nets	Web - site	Intranet	Internet	Other nets	Web – site
Size								
50– 99	96.1	95.9	23.2	79.7	1995	1999	1998	1999
100 – 199	96.9	97.3	27.1	83.2	1996	1998	1997	1998
200 – 999	97.1	98.4	39.9	84.8	1995	1998	1997	1998
> 1000	100.0	98.9	48.0	92.6	1994	1997	1995	1998
Area								
North – West	98.3	97.3	26.8	83.3	1996	1998	1997	1998
North – East	95.1	97.3	31.5	86.7	1995	1998	1997	1998
Centre	96.5	95.3	21.4	77.9	1995	1998	1998	1998
South – Islands	94.0	94.6	23.1	64.3	1996	1999	1998	1999
Sector								
Textile, clothing, leather and shoes	92.5	94.7	18.7	79.0	1995	1998	1998	1999
Chemicals, rubber and plastic products	99.0	96.0	37.2	77.3	1996	1998	1997	1998
Metal engineering products	97.0	97.2	28.0	84.5	1995	1998	1997	1998
Other manufactures	97.6	97.8	27.4	81.1	1996	1998	1997	1998
Other industries excluding construction	97.6	94.4	25.3	72.8	1996	1998	1997	1998
Share of exports								
Zero	91.1	94.6	20.6	65.7	1996	1999	1998	1999
< 1/3	97.6	96.6	31.6	79.0	1995	1998	1997	1999
> 1/3 and < 2/3	98.2	97.7	24.3	88.0	1996	1998	1998	1998
> 2/3	95.1	97.0	24.4	89.1	1995	1998	1998	1998
Turnover growth								
High	96.7	97.0	29.5	81.0	1996	1998	1997	1999
Low	96.3	96.4	24.8	82.1	1996	1998	1997	1998
Total	**96.5**	**96.7**	**27.1**	**81.6**	**1996**	**1998**	**1997**	**1998**

Source: Banca d'Italia's Survey on Manufacturing Firms.

Table 5

ITALY: COMPUTER PER EMPLOYEE AND SHARE OF PORTABLE PCS IN MANUFACTURING FIRMS

(units, percentage points, index: 1997 = 100)

	Firms		PCs per 100 employees	portable PCs per 100 PCs	PCs in 2000 versus 1997 (%)
	Population share (%)	Sample			
Size					
50-99	57.8	398	31.4	3.2	175.5
100-199	25.1	391	34.6	4.4	165.6
200-999	15.2	486	39.2	5.5	170.2
> 1000	1.9	116	49.5	7.8	133.3
Area					
North – West	43.6	516	44.4	6.9	159.5
North – East	31.0	338	32.9	4.1	168.1
Centre	14.6	298	41.8	4.2	128.4
South – Islands	10.8	323	29.3	3.3	176.3
Sector					
Textile, clothing, leather and shoes	18.9	234	25.1	2.4	185.9
Chemicals, rubber and plastic products	11.2	191	57.4	12.5	151.0
Metal engineering products	43.3	597	38.6	5.0	168.0
Other manufactures	24.9	407	32.2	4.8	163.1
Other industries excluding construction	1.8	46	63.3	2.0	106.2
Share of exports					
Zero	12.2	214	47.8	3.3	121.3
< 1/3	44.5	590	40.2	7.4	156.9
> 1/3 and < 2/3	26.0	405	34.1	4.1	175.9
> 2/3	17.3	266	39.8	4.8	165.3
Turnover growth					
High	49.0	737	40.0	4.4	154.3
Low	51.0	738	38.3	6.5	158.0
Total	**100.0**	**1.475**	**39.2**	**5.3**	**155.9**

Source: Banca d’Italia’s Survey on Manufacturing Firms.

Table 6

FUNDING AND CAPITAL EXPENDITURES OF "NEW ECONOMY" CORPORATIONS IN ITALY
(billions of euro)

	1996	1997	1998	1999
New Economy Corporations				
Funds raised (net)	544	3,536	2,622	1,674
Equity issuance (net)	823	838	1,482	1,994
Bond issuance (net)	114	13	-16	-41
Bank credit flows (net)	-431	2,249	1,144	-280
Other financial credit (net)	319	129	-325	57
Trade credit (net)	-281	307	337	-56
Memo Items:				
Capital expenditures (gross)	*6,942*	*7,026*	*8,429*	*8,850*
Total financial debt outstanding	*14,728*	*16,221*	*18,075*	*17,746*
Equity at book value	*22,133*	*25,992*	*28,005*	*29,408*
Non-Financial Corporations				
Funds raised (net)	16,925	34,841	10,674	26,308
Equity issuance (net)	11,460	13,455	22,388	21,227
Bond issuance (net)	2,485	817	592	-810
Bank credit flows (net)	-3,327	12,627	11,512	8,654
Other financial credit (net)	16,479	14,003	-20,701	5,702
Trade credit (net)	-10,172	-6,061	-3,117	-8,465
Memo Items:				
Capital expenditures (gross)	*50,295*	*51,725*	*58,914*	*74,556*
Total financial debt outstanding	*297,362*	*322,139*	*310,957*	*330,200*
Equity at book value	*24,958*	*27,582*	*28,617*	*32,010*

Source: Banca d'Italia and Centrale dei Bilanci.

Table 7

VENTURE CAPITAL FINANCING OF SEEDS AND START-UPS OPERATIONS IN ITALY
(number of operations and millions of US dollars)

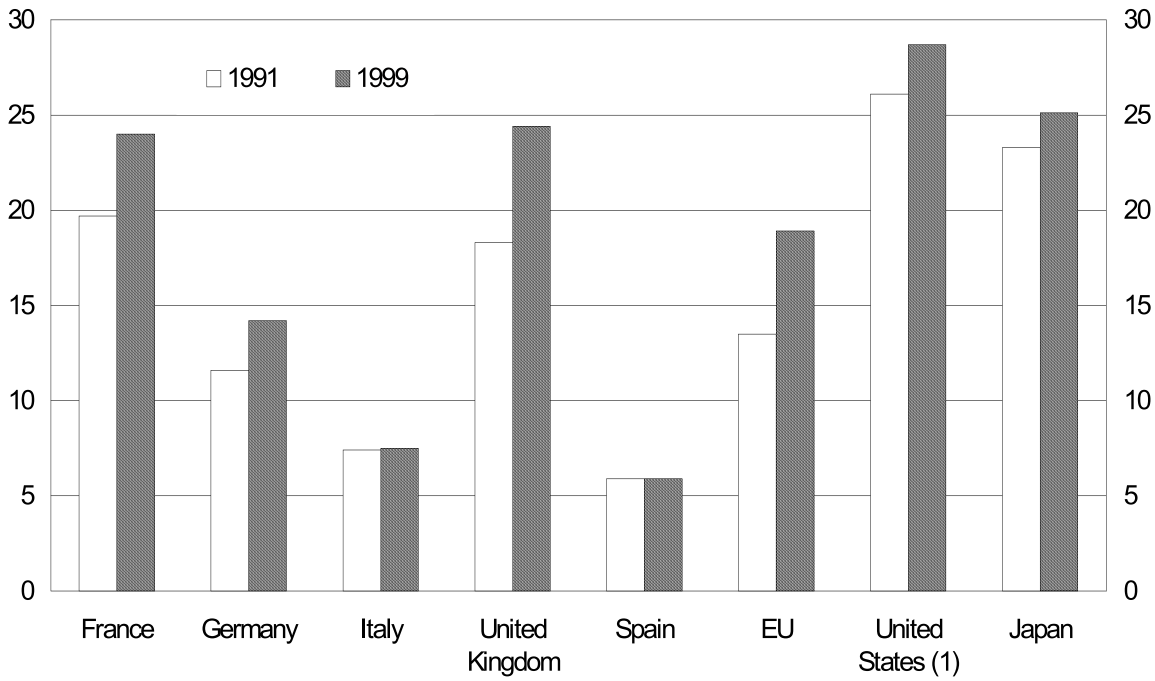
	Number	**Amount**
1997	93	84
1998	94	116
1999	153	157
2000	339	499

Source: AIFI (Associazione Italiana degli Investitori Istituzionali nel Capitale di Rischio).

Figure 1

SHARE OF EXPORTS IN HI-TECH PRODUCTS

(percentage values)



Source: Eurostat.

(1) Years: 1991 and 1998.

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