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What Drives Productivity Growth and How to Improve It in Europe

While it is possible to change without improving, it is impossible to improve without changing.

—Anonymous

Economic growth is the result of increases in hours of work combined with increases in output per hour, or labor productivity. As described in chapter 2, there may be a synergy between these two elements of growth. Productivity increases can fuel employment growth by some combination of making employers more willing to hire workers, making workers more willing to work, and allowing governments to reduce the labor tax burden without facing budget deficits.

This chapter considers how Europe could improve its rate of productivity growth. The key is to increase the intensity of competition in product markets, encourage business and industry restructuring, and adopt regulatory reforms that facilitate these. Both product and labor markets are important in this respect, but this chapter focuses on the product-market side. We make the case that European product markets are not as open and competitive as they need to be and point to ways in which this can change.

First, we review the findings of a major Organization for Economic Cooperation and Development (OECD 2003f) study, *The Sources of Economic Growth in OECD Countries*, that looked directly at steps to improve productivity. It drew policy implications for all OECD countries, but many focused particularly on Europe. The OECD study found that trade openness has a very positive influence on productivity. Therefore, we include box 3.1 to describe important recent work on price comparisons among manufactured goods. Bradford and Lawrence (2004) suggest that manufacturing industries in Europe are not fully open to competition when based on in-

Box 3.1 Prices of manufactured goods: Evidence that Europe still has trade barriers

Because the single market in Europe is opening up it is sometimes assumed that there is strong competitive intensity in manufactured goods in the region. Research by Scott Bradford and Robert Lawrence (2004) for the Institute for International Economics suggests otherwise. Every three years the OECD collects final-goods price data across countries as part of their program to construct purchasing power parity (PPP) exchange rates. As far as possible, the OECD compares the prices of the same or comparable goods across economies.

In order to compare producer prices, Bradford and Lawrence stripped out the impact of taxes and distribution margins to estimate the factory gate prices for a detailed list of manufactured goods.[1] As a way of presenting their findings, they then found the lowest price for each good anywhere among the countries and set this price equal to unity—the "world" low price of that good. Then each country's prices for individual manufactured goods were expressed as a ratio to the world low price, comparing like good to like good. The result is a set of indexed manufactured-goods prices for each country that consists of values equal to or above unity for all the goods. *The extent to which the prices for a given country exceed unity—on average—then is a measure of the extent to which its manufacturing price level is above the lowest world prices.* Since some goods are obviously more important than others, a weighted average of the prices for each country was calculated. The weight or relative importance given to each good depended on its importance in total expenditure. The weighted average price index for a given country is then a measure of the extent to which its manufacturing sector has limited competition from the lowest prices in the world.

The results of the calculation, which are striking, are shown in the table on the next page. US prices, on average, were 16 to 24 percent above the world's lowest prices during the 1990s. In other words, the US manufacturing sector is not completely open; it maintains prices around 20 percent above the world's lowest prices. Notably, however, its prices are the lowest among the countries studied in the 1990s. The European economies are much less open. For Germany the gap to the world's lowest prices ranges from 98 percent to 48 percent, and the other European economies' gaps are

1. The Bradford and Lawrence data included agricultural goods, but these do not change the averages significantly.

(box continues next page)

ternational price comparisons. *Therefore, there seems to be great potential for increasing competitive intensity in Europe even in manufacturing.*

Next, we examine the US economy, where productivity growth accelerated after 1995. Understanding the reasons for this acceleration could provide important lessons for Europe. In particular, we study how information technology (IT) was one driver of US productivity growth.

Next, we review a set of industry case studies of France and Germany. These case studies identified specific barriers to productivity growth and stressed the importance of a high degree of competitive intensity in driving innovation. The case studies identify restrictions that limit competition in Europe, but they also highlight examples where barriers to growth have been removed and productivity has improved rapidly. These show

Box 3.1 *(continued)*

similar. Japan's prices, on average, were even higher than Germany's. By this measure, Australia and Canada are noticeably more open than Europe.

Bradford and Lawrence's earlier work covered fewer comparison years and therefore could have been sensitive to exchange rate movements. But that is not the case here. The US dollar has been both strong and weak against European currencies over the 1990s and yet the same basic result holds. There are fluctuations across the 1990s, but, strikingly, there is no clear tendency for the European price premium to get smaller. Despite a single market, Europe did not open up to the lowest-price competition worldwide in a consistent way through the 1990s—although there is some sign of improvement in this respect in Germany, Italy, and the Netherlands in 1999.

The Bradford and Lawrence results are based on final-goods prices so it is not certain that manufactured intermediate goods are included in the calculations. These results may apply only to a subset of all manufacturing in a given economy. For large economies like Germany this is unlikely to be a serious problem. However, it could account for the surprisingly large price relatives for small economies such as Belgium and the Netherlands that produce a great amount of exported intermediate goods.

Producer prices in sample countries relative to world's lowest prices

Country	1990	1993	1996	1999
Belgium	1.66	1.82	2.04	1.70
Germany	1.61	1.75	1.98	1.48
Italy	1.57	1.85	1.62	1.34
Netherlands	1.62	1.80	1.90	1.65
Britain	1.60	1.72	1.68	1.78
Australia	1.50	1.45	1.47	1.33
Canada	1.62	1.47	1.32	1.25
Japan	1.96	1.96	2.28	1.93
United States	1.19	1.16	1.24	1.24

Note: Data are expenditure-weighted average ratios of imputed producer prices to the lowest price in the sample.

Source: Bradford and Lawrence (2004).

that when product-market reforms are adopted in Europe, they have been successful.

Policy Implications of the OECD Growth Analysis

The OECD has been at the center of economic and policy analysis relevant to improving Europe's economic performance. Although the OECD studies all member countries it gives particular focus to the issues that arise in Europe since a majority of members are from the region. The OECD recently completed an extensive project focusing primarily on economic growth in the 1990s (although the 1980s is often used for comparison).

The study (OECD 2003f) draws from a wide range of economics literature for its substantive new analysis.

The OECD report starts with a general review of facts. Widening disparities in rates of GDP per capita growth occurred in the 1990s. Some disparity is a result of continued catch-up of low-income countries in the sample. For the most part, however, widening disparities were the result of high growth rates in some already affluent countries such as the United States, Canada, Australia, the Netherlands, and Norway, combined with low growth rates in much of continental Europe (OECD 2003f, 31). The OECD study also notes that disparities in growth have arisen greatly from differences in labor utilization, with low-growth countries experiencing slow growth or declines in employment and hours worked. Furthermore, weakness in labor utilization was not offset by faster productivity growth. The study also finds that "labor upskilling"—a shift to a more experienced or better-educated workforce—contributed to some fraction of overall growth, but notes that in the slow-growth countries "this was partially due to the fact that the low-skilled were kept out of work." In general terms, therefore, the story told earlier in this book is reinforced by the parallel findings in the OECD growth study, with its broader sample of countries.

The study next analyzes the sources of economic growth, basing it on aggregate data and cross-country regression analysis. The report also pays particular attention to how policies affect outcomes. The causal variables it reviewed apparently explain much of the observed growth differences over time and across countries. For example, it discovered that investment in both physical and human capital is important to growth; sound macro policies yield higher growth; and the level of government involvement in the economy may hinder growth (particularly if it becomes too large, although the pattern varied). Some government spending was conducive to growth, while high levels of direct taxation (taxes on wages and profits) discouraged growth. Business-sector research and development (R&D) activities yielded high social returns, and hence contributed to growth, but there was no evidence in this analysis of any positive effect from government R&D. The study found some evidence that financial markets are important to growth, by encouraging investment and channeling resources toward the most rewarding growth opportunities (OECD 2003f, 89–90).

An interesting result from the aggregate regression analysis is that "exposure to international trade" is an important determinant of output per working-age person. The analysis finds that an increase of 10 percentage points in trade exposure (an adjusted average of exports and imports as percentages of GDP)[1] raises output per person by 4 percentage points

1. The variable is described as a "weighted average of export intensity and import penetration. In the empirical analysis this measure was adjusted for country size (log(Trade exp)adj). It was achieved by regressing the crude trade exposure variable on population size and taking the estimated residuals from this exercise as the adjusted trade exposure" (OECD 2003f, box 2.3, 78).

(OECD 2003g, table 1). This result is remarkable because of its magnitude—the report states that between the 1980s and 1990s trade exposure on average increased by about 10 percentage points. This result, if taken at face value, strongly supports the view that increased globalization improves economic performance. It suggests that Europe should aggressively remove remaining barriers to trade, both within its region and with the rest of the world, for its own sake.

The OECD study does not highlight the conclusion about trade in its main report, perhaps because it is difficult to interpret. The issue is whether trade leads to stronger growth or whether stronger growth leads to more trade. Since trade is so concentrated in manufacturing, which is only a modest fraction of GDP, the implied effect on the industry would have to be four or five times as large as the effect on GDP—a result that may be hard to swallow. Nevertheless, the fact that this result appears in the regression analysis so strongly is reassuring to those who believe trade and other forms of globalization are important factors in improving productivity. After all it is easier to think of scaling back an effect that looks too big than trying to rationalize why an effect considered to be important does not show up in the regression.

In the OECD study, some of the limitations that apply to the coefficient on trade exposure in their regressions also apply to other aggregate findings. There is always the possibility that correlations at the aggregate level are not reaching the underlying causal structure. For example, rapid growth in a country will require fairly high levels of capital investment and will benefit from an ample supply of educated workers. But it is just as plausible that a high rate of, say, capital investment is more the result of rapid growth than the underlying cause. An increase in business opportunities in an economy will spur both growth and investment.

Acknowledging the limitations of aggregate regression analyses, the OECD study then turns to a more micro focus, looking both at growth by industry and at company dynamics. The industry analysis determines what fraction of productivity growth within the OECD countries is the result of shifts among industries. Historically this has been important, as workers move from low-productivity jobs in agriculture into much higher-productivity jobs in industry and services. As we saw in chapter 2, Denison's analysis (1967) argued that this shift accounted for an important part of the rapid growth in Europe and Japan after World War II. In the 1990s, however, industry shifts had less importance in France, Germany, Italy, Britain, the United States, or Japan. Most of the disparity in overall growth rates is accounted for by differences in productivity performance within industries. The industry analysis also revealed that productivity growth differences across countries *within* manufacturing industries were not large. However, the larger US high-tech sector gave it an advantage in productivity growth in the manufacturing sector as a whole.

The data in this OECD study end in 1998 and are not focused on a US-Europe comparison. But the findings are consistent with those in van Ark, Inklaar, and McGuckin (2002), who compare the United States to individual European economies and find that the productivity growth gap that emerged after 1995 was associated with faster growth in US service industries together with the larger contribution of high-tech production.

The OECD regression analysis of industry productivity starts by estimating multifactor productivity (MFP) growth for each industry in each membership country between 1984 and 1998—a huge data exercise. MFP growth in a given industry/country/year then depends on the productivity leader's rate of MFP growth (a measure of how fast the frontier is moving out); the MFP gap from the productivity leader (a measure of the potential for catch-up); and a set of policy variables. Tests check the effect of industry and country dummy variables and additional regressions are run to assess the role of R&D, corporate structure, and industrial relations systems.

The conclusions—particularly the policy implications that emerge—from this effort are as follows. The most important conclusion is that "stringent regulatory settings in the product market, as well as strict employment legislation, have a negative bearing on productivity at the industry—and, therefore, macro—levels" (OECD 2003f, 121).[2] This broad finding is qualified, however, by the argument that the effects of regulation[3] depend on the nature or position of an industry. In particular, product-market regulation has a larger impact on productivity the further an industry is from the productivity frontier. This finding makes sense since the structural changes needed to reach the frontier will be larger in those cases and presumably more sensitive to barriers to change created by regulation.

The impact of labor-market regulation also varies. Hiring and firing restrictions have a negative effect on productivity performance when they are not offset by lower wages or by internal training. Thus, the adverse effect of labor-market rigidity is mitigated, according to these findings, if workers are willing to pay for it through lower wages, or if firms respond to it by providing additional worker training.

The OECD study also finds some support for the view that R&D contributes to growth, but the effects depend on "market structures and in-

2. See also Nicoletti and Scarpetta (2003).

3. Although not part of the OECD study, the World Bank (2003) carried out some related work on the impact of business regulation on productivity. Using a broader base of countries, the World Bank compiled a set of regulatory indicators based on ease of starting a business. The index considered hiring and firing, contract enforcement, obtaining credit, and closing a business. Their results indicate a rather clear relation between the level of labor productivity and the ease of starting a business. These results are driven in part by developing economies, but still they support the view that the wrong kind of regulation can have a very negative impact on productivity performance.

dustry regimes" (OECD 2003f, 121) and therefore seem inconclusive. This dataset does not provide clear guidance on R&D's role or importance to growth. There is one intuitive result that is linked to innovation, however. The OECD study finds that a German-style company structure does well in making incremental innovations in industries with a stable dominant technology (one thinks of the success of German capital-goods producers). In contrast, a more relaxed structure without institutionalized labor relations is more innovative with rapidly evolving technologies (one thinks of IT and Silicon Valley).

This finding may explain, in part, the problems with job creation in Europe. Innovation in large firms with established technologies will often result in productivity growth that reduces employment. This is the picture in industries such as steel and automobiles. Innovation in new firms or new establishments is more likely to involve new products and services.

The study's final step is to incorporate findings from a large volume of new work based on data from individual firms or establishments. Data at this level have revealed a very large degree of heterogeneity among firms in productivity growth rates and levels. This is consistent with a "creative destruction" view of the economy in which new firms enter, weak firms exit, and incumbent firms struggle for market share and profits. There is also, of course, the problem that data errors introduce spurious differences across firms or over time. It is easy to see the heterogeneity, but discerning clear patterns in the data is much harder. The OECD and the academics involved in the study worked at length to clean the data and capture their insights. The study examined Finland, France, West Germany, Italy, the Netherlands, Portugal, Britain, and the United States, and the productivity growth calculations were based on two five-year intervals, 1987–92 and 1992–97. The results for manufacturing are more extensive than those for the service sector.

For these OECD countries, the first insight is that the bulk of labor productivity growth comes from improvements within firms rather than from reallocation of output or inputs among firms. The entry and exit of firms into the market is important, however, accounting for 20 to 40 percent of total growth. For most of the countries examined the entry of new firms adds to productivity growth, but the United States offers a different experience. Entrants in the US market start with productivity levels well below the average and grow from there. The positive contribution to productivity growth in the United States comes from the exit of low-productivity firms. Inevitably, the contribution of entry to growth is greater over longer periods of time.

The findings for MFP are a bit different. Productivity growth within a firm is a smaller part of the total growth, and the impact of entry, exit, and reallocation are larger. Tentatively, therefore, the conclusion is that incumbent firms, which are generally larger, are able to invest and raise labor productivity while new firms bring more innovative technology or new business processes.

An important and very surprising finding is that entry and exit rates for the United States and the European countries are not too different. Despite the similarity in average turnover rates across countries, the regression analysis does tease out a negative effect of both product- and labor-market regulation on entry rates of firms. Controlling for other determinants of entry and exit, the impact of regulation does show up in the data.

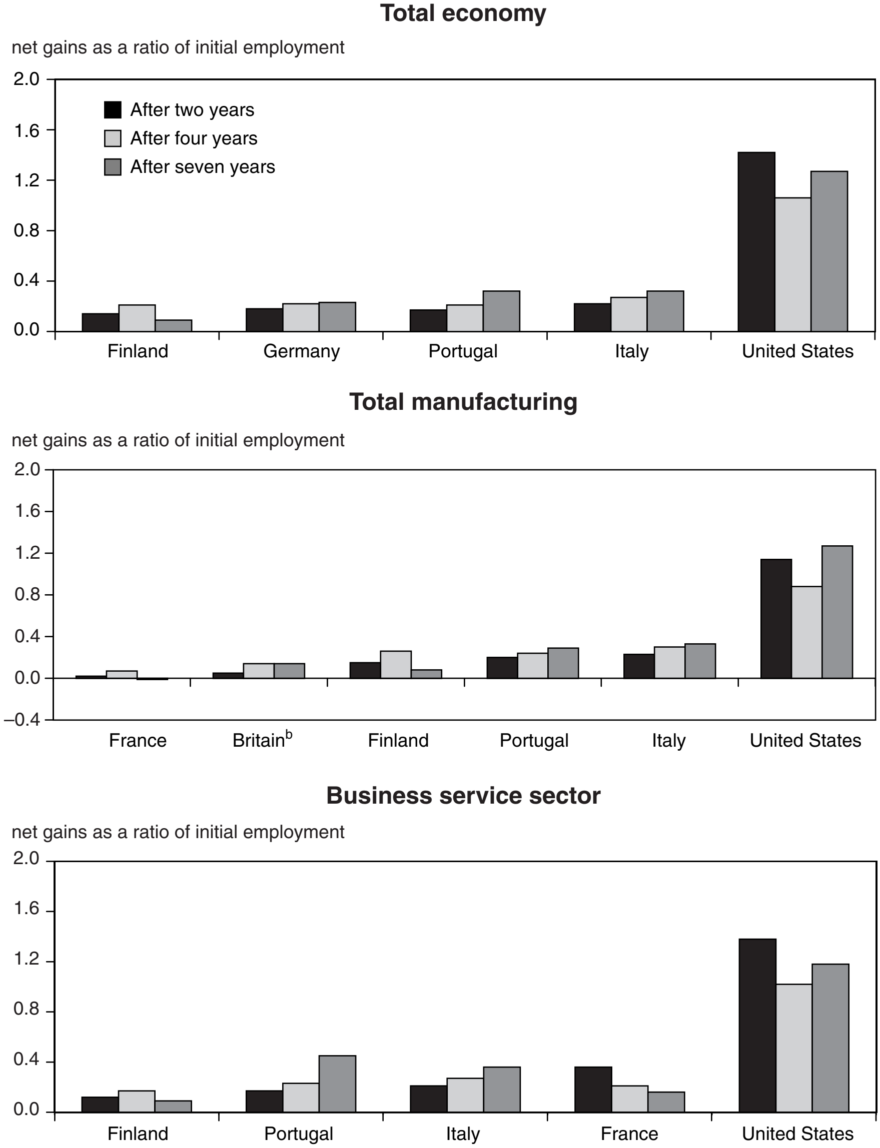
There is a compelling argument that rigidities in Europe discourage the entry of new firms and restrict the exit of old firms. If this is correct, it is very surprising that it does not show up as lower overall entry and exit rates in Europe, relative to the United States, either in manufacturing or in the broader business sector. How can this puzzle be resolved? One likely answer is that rigidities in Europe *delay* adjustment and the exit of firms, but over time they cannot override the market forces that force uneconomic firms to leave. In fact if the discussion in chapter 2 is correct and real wages are stuck at too high a level in Europe, then the economic pressure on firms to exit, over this period, was even higher than in the United States.

Regardless, there is a vital lesson that emerges from the firm-level analysis for European policymakers. First, current policies to preserve employment by discouraging the exit of firms are not working. The rate of firms exiting the market is just as high in Europe as in the United States. Second, the argument is made that Europe lacks entrepreneurial talent or ability, which is the reason its growth is so sluggish. The very high rate of firm entry in Europe does not support that view.

There is another important finding that concerns the success of those firms that do enter an industry. The most dramatic difference between the United States and Europe that shows up in the OECD's firm-level analysis is the extent to which entering firms increase jobs over time. This finding has received a good deal of attention and understandably so. Figure 3.1, using data from Bartelsman, Scarpetta, and Schivardi (2003), illustrates net employment gains for new firms in selected countries. It shows that entering firms in the United States have dramatically increased their employment after two, four, or seven years relative to their initial size. US entrants overall are smaller in initial size, have an above-average probability of survival, and grow employment much more than entrants in the other countries. The weakness of employment growth among entrants in Europe may be a sign of weaker entrepreneurial performance. However, it may also reflect barriers to hiring and expansion in Europe.[4]

4. Brandt (2004), using a newer and "cleaner" European firm-level dataset, finds a somewhat higher two-year employment growth among European firms from 1998 to 2000 than did Bartelsman, Scarpetta, and Schivardi (2003) and thus indicates a smaller US advantage

Figure 3.1 Net employment gains among surviving firms at different lifetimes[a]



a. The survival rate at duration (j) is calculated as the probability that a firm from a population of entrants has a lifetime in excess of (j) years. Figures refer to average survival rates estimated for different cohorts of firms that entered the market from the late 1980s to the 1990s.

b. After six years for Britain. Data for Britain refer to cohorts of firms that entered the market in the 1985–90 period.

Note: Key same for all 3 figures.

Source: Bartelsman, Scarpetta, and Schivardi (2003).

In summary, the firm-level analysis does provide some intriguing insights, if not yet complete answers. The study stresses, correctly, the high degree of churning (entry and exit) in all countries. The importance of the creative destruction process and market experimentation is clear. Compared to Europe, entering firms in the United States are smaller and of lower relative productivity. If successful, however, new firms in the United States grow employment much more rapidly than entrants in the other countries.

In the policy arena the firm-level analysis supports the idea that excessively stringent regulation in both product and labor markets will hinder growth. It shows that even though many European countries have barriers to prevent economic change, the change happens anyway. Instead, these barriers may slow the pace of innovation and the creation of employment opportunities among those firms entering the market.

The OECD growth study provides a valuable perspective on drivers of growth in the industrial economies it examined. It makes it clear that not all European economies had the same growth experience in the 1990s. Some showed growth and productivity accelerations after 1995 just as the United States did. Some non-European economies also performed very strongly over this period—Australia, for example. But the United States is worth a separate look, not only because it is such a large economy but also because it has the advantage of a large body of detailed data and economic studies to draw from.

Understanding What Drives Productivity Improvements Based on US Experience

According to the Bureau of Labor Statistics,[5] labor productivity growth in the nonfarm business sector of the United States grew by 2.4 percent at an annual rate from the fourth quarter of 1995 to the first quarter of 2001 (the National Bureau of Economic Research [NBER] has dated March 2001 as the peak of the expansion). However, even stronger productivity growth, on average, has prevailed from the first quarter of 2001 through the fourth quarter of 2003, despite the economic weakness for much of that time. Output per hour grew at an annual rate of 4.4 percent. Preliminary productivity data are notoriously fickle, and in recent years downward revisions have followed initial reports of startling increases, so it is wise not to overinterpret the latest numbers. Nevertheless, barring unusually large

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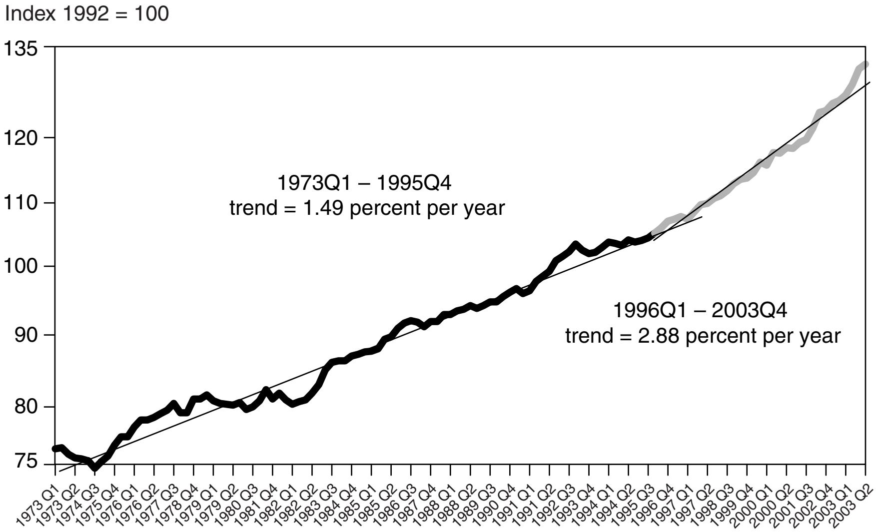
in this area. However, she notes that this difference might stem from the fact that her new data were collected during a cyclical boom period only. Despite this and other differences, Brandt concludes that the finding that new entrants in the United States have higher employment growth is likely to be a robust one.

5. BLS data are drawn from the BLS Web site at www.bls.gov (accessed February 2004).

Figure 3.2 US labor productivity (nonfarm business, output per hour), March 1973–December 2003



Q1 = March of year
Q2 = December of same year
Q3 = September of next year
Q4 = June of second year

Source: Bureau of Labor Statistics.

revisions, it does appear as if the trend of labor productivity growth in the nonfarm business sector in the United States has ranged between 2.5 and 3 percent a year since 1995, compared with a trend of around 1.5 percent from 1973 to 1995 (see figure 3.2). The speed of productivity growth since 1995 is not an unprecedented phenomenon in US experience. Labor productivity increased by nearly 2.7 percent a year from 1947 through 1973, so the current trend seems to be a return to a pace closer to the postwar trend of productivity growth.

This section examines the latest evidence about the causes of productivity growth in the United States and its acceleration. Particular emphasis is given to understanding the importance of IT to growth, relative to other sources. To anticipate the answer: IT is undoubtedly an important enabling technology that has allowed many companies to increase productivity growth; however, it is important not to exaggerate its importance to productivity or to assume that increases in IT capital will automatically raise productivity.

IT can enable important business innovations, which are the basic source of productivity increase. But adding IT without those innovations is generally worth little. The sources of many business innovations are not directly linked to IT. Other technological changes are equally important as is product and process redesign. Furthermore, diffusion of innovation is as essential to productivity growth as the creation of brand new inventions. Innovations and their widespread adoption are both fostered by a high level of competitive intensity.

Can Growth Accounting Track US Productivity Trends and Reveal the Role of IT?

Economists have stressed IT capital as the key source of the productivity acceleration because the results obtained from applying the "growth accounting" framework to the 1995–2000 time period. So it is important to look at what this framework says and how much weight can be placed on its findings.

The growth-accounting approach examines a period of years to see how well input growth can explain output and productivity growth. Although the precise timing of shifts in the trend rate of productivity growth is not known with certainty, a frequent practice in the productivity literature is to evaluate the sources of growth prior to 1973, 1973–95, and 1995–2000.[6] Growth accounting uses the framework of a neoclassical production function to estimate the contributions to nonfarm business output per hour coming from increases in capital per hour worked, labor quality, and MFP, with the MFP estimated as a residual.

Table 3.1 gives estimates made by the Bureau of Labor Statistics (BLS) covering the periods 1948–73 and 1973–95. The findings are remarkable. They indicate that the contributions of capital services and labor quality to labor productivity growth changed little or not at all in the periods before and after 1973. Therefore, the sharp slowdown in labor productivity growth that occurred after 1973 does not seem to be explained by a drop in the pace of capital accumulation. Instead, it comes from an equal decline in the unexplained residual item of MFP growth.

6. Statistical tests show a decline in the trend rate of labor productivity growth in the early 1970s (in nonfarm business although not in manufacturing) and an increase (in both sectors) in the early 1990s. However, there is uncertainty around the exact timing of the trend shifts (see Roberts 2001 and Hansen 2001). Many statistical tests use the Hodrick-Prescott filter, but this is not an ideal approach. The algorithm for this filter looks at future data when deciding when and by how much the trend has shifted. Since slope discontinuities are penalized, the method tends to anticipate a trend change before it actually happens—a questionable procedure. The common alternative of reviewing the data and picking different trend periods also has pitfalls. There is a tendency to date the change in the trend at a quarter with a particularly large disturbance. This same problem also arises in more formal statistical methods that search for the best fit of a piecewise linear trend. Dating trend changes at times of business-cycle peaks and dips has the virtue of being objective to the researcher, but productivity trends do not always match business cycles.

Table 3.1 Productivity growth accounting pre- and post-1973 in nonfarm business (percent per year)

	1948–73	1973–95	Difference
Output per hour[a]	2.9	1.4	–1.5
Contributions from:			
Capital	0.8	0.7	–0.1
Information technology	0.1	0.4	0.3
Other	0.7	0.3	–0.4
Labor quality	0.2	0.2	0.0
Multifactor productivity (MFP)	1.9	0.4	–1.5
MFP from research and development	0.2	0.2	0.0

a. Contributions do not add exactly to the total (output per hour) because growth rates compound multiplicatively and the numbers are rounded.

Source: Bureau of Labor Statistics (2001).

But although the overall contribution of capital services to growth in output per hour barely changed, the composition of these capital services shifted substantially. As table 3.1 shows, IT capital accumulation became more important while all other types of capital lost importance. In this period economists were puzzled as to why productivity growth was so slow despite widespread use of IT. This was the time of the famous paradox highlighted by Robert Solow, which said that computers were everywhere except in the productivity statistics. The growth accounting framework, therefore, did not provide a satisfactory explanation of the 1970s growth slowdown, nor did the rapidly increasing investment in IT seem to show up in faster labor productivity in the 1980s.

Did the growth accounting framework better capture the increase in productivity growth after 1995? Table 3.2 shows three estimates of the decomposition of the increase of productivity growth after 1995. Although updates of these numbers are now available, we have used the 2000 end point because recent data—as noted earlier—are subject to greater error and to cyclical effects. Each estimate in the table calculates the growth accounting decomposition of the level and sources of growth for 1995–2000 and then subtracts the level and sources of growth for 1973–95. The first column updates the results of Oliner and Sichel (2000),[7] the second column updates the estimates reported in the *Economic Report of the President* (Council of Economic Advisers 2001),[8] and the third is from Jorgenson, Mun, and Stiroh (2001).

According to the results in the first and third columns, IT is primarily responsible for the acceleration in labor productivity growth after 1995. The rapid accumulation of IT capital provided a large boost to labor productivity—more than offsetting the slowdown in other capital contribu-

7. The figures in table 3.2 were supplied by Daniel Sichel.

8. Revised figures were provided by Steven N. Braun at the Council of Economic Advisers.

Table 3.2 Accounting for the post-1995 productivity speed-up (percent per year)

	Oliner-Sichel[a]	*Economic Report*[b]	Jorgenson-Mun-Stiroh[c]
Output per hour[d]	1.15	1.39	0.92
Contributions from:			
Capital services	0.34	0.44	0.52
IT capital	0.59	0.59	0.44
Other capital	–0.25	–0.15	0.08
Labor quality	0.04	0.04	–0.11
Multifactor productivity (MFP)	0.77	0.91	0.51
Computer-sector MFP	0.47	0.18	0.27
Other MFP	0.30	0.72	0.24

a. Updated figures (nonfarm business) provided by Daniel Sichel.
b. Updated (nonfarm business) by the authors using data provided by Steven N. Braun.
c. Business sector plus consumer durables and owner-occupied housing.
d. Contributions do not add exactly to the total because growth rates are compounded multiplicatively.

Note: Difference in growth (1995–2000 minus 1973–95).

Sources: Oliner and Sichel (2000); CEA (2001); and Jorgenson, Mun, and Stiroh (2001).

tions. There was also a boost from faster IT MFP within the information technology sector. Of course, this still means that a change in output per hour is assigned to an MFP residual effect, but this case is much less mysterious than the traditional MFP residual. It is well known that the computer and semiconductor industries increased the rate of introduction of new generations of chips as a result of an increased pace of technological advance and intense competitive pressure. Both studies also find an increase in other MFP, which suggests a modest boost in innovation outside the IT-producing sector.[9]

The estimates used in the 2001 *Economic Report* give a picture that is partly the same and partly different. In this analysis, the combined impact of increased IT capital accumulation and increased IT MFP is also large. But this approach finds a larger overall acceleration of productivity growth and a smaller estimate of the direct impact of the IT sector. As a

9. Neither study made any adjustments for the business cycle. Productivity tends to grow rapidly in booms and grow slowly in downturns, so the economic boom of the late 1990s may have pushed up productivity growth. Therefore, the faster pace of other MFP may have simply been a short-term business-cycle effect. Under that scenario the acceleration in productivity growth after 1995 is "explained"—or at least easily described: After adjusting for cyclical effects, faster labor productivity growth was solely the result of faster MFP in the IT sector. The rapid growth of labor productivity since the end of the boom has modified ideas about the business cycle's role in the late 1990s. The adjustment equations that attributed a big part of the 1990s productivity boom to cyclical effects no longer yield the same conclusion when the most recent data are added in. More intuitively, an important question about the post-1995 productivity acceleration was whether it would simply vanish once the boom ended. Clearly it has not. See Gordon (2002).

result, about half of the overall acceleration in labor productivity comes from the residual term of increased MFP growth in non-IT sectors of the economy. These estimates suggest that the faster productivity growth after 1995 included a partial reversal of the unexplained collapse of MFP growth that occurred after 1973.[10] This unexplained surge in other MFP after 1995 may or may not be independent of IT advances.

The different approaches used by the three studies in table 3.2 are important, but less important than their similarities. Regardless of which set of estimates are used, the growth accounting framework applied to the pre- and post-1995 periods strongly suggests that IT played a very large role in the acceleration of labor productivity. Is that a valid conclusion? There are several reasons for concern that this general approach might provide a misleading explanation of the productivity resurgence of the late 1990s.

The BLS methodology for estimating the rise in IT investment has raised questions. The amount spent on computer investment certainly rose in the 1990s (nominal investment), but it was real (price-adjusted) investment that really took off. The capability of computers and related equipment rose dramatically, and this surge was captured by rapid declines in the quality-adjusted price index for computers.

The central question is then whether or not these measured price declines accurately captured the use value of the purchased IT equipment. There are two methods used to determine the extent of price changes for computers. One method is to "match models." In this approach, the price of a computer of given capability (CPU speed, memory size, and so on) is compared to another with the same or very similar capabilities in a prior period. Typically the price of the computer of a given capability is lower in the second period, giving a measure of price decline. The alternative approach is applied when there are no good matches over time. A statistical regression is used to determine how different attributes of a computer are valued in the market—for example, what is the cost differential for a computer with faster CPU speed. This so-called hedonic approach creates, using statistical methods, an effective match of computer models over time even when the development of new generations of computers precludes a literal match.[11]

10. The 2001 *Economic Report* suggests the business cycle did not cause faster productivity growth because the level of productivity was already about 2 percent above trend by 1995. Recent estimates from the same cyclical adjustment model, developed by Steven N. Braun, now indicate that actual productivity growth in 1995–2000 was slightly slower than the structural trend, because of the sharp drop in the rate of growth during 2000.

11. There are technical issues raised about the hedonic approach. The theory behind the approach assumes the industry that produces computers is perfectly competitive. This is not necessarily true, given the very large fixed costs of developing new chips and other components. Nevertheless, alternative approaches that use a more realistic market structure still show very rapid rates of computer price decline. See Pakes (2002).

On the face of it, this two-prong approach provides the reliable and well-known result that quality-adjusted computer prices have fallen very fast indeed. But how valid are they as indicators of how effectively computers are used in practice? Skeptics point out that current personal computers have greater functionality than those of five years ago, but the basic office tasks of word processing and spreadsheet analysis have not changed significantly. Furthermore, a banking industry case study found that despite placing high-powered new computers on the desks of bank tellers in the 1990s, there was little evidence that the tellers used them more productively (MGI 2001).

Supporters counter this skepticism by stating that the price indexes reflect what customers are willing to pay to add more and newer computers to their production processes. If faster CPU speed commands a price premium in the marketplace, then business customers must believe the extra speed is worth its contribution to their productivity. The benefit of hindsight is that we can find examples where IT investment did not pay off, but that is true of all types of investment. The growth accounting analysis simply assumes IT capital had a productivity payoff that is the same as any other capital, with some uses yielding above-average payoff and some below average.

More detailed data analysis is needed to resolve this debate (we will look at industry and case study evidence shortly), but, at the conceptual level, the important issue is whether or not there are systematic reasons why the payoff to IT capital might not have been as large as is implicitly assumed in the growth accounting estimates. One obvious possibility is that businesses got carried away with enthusiasm for IT and overinvested. We turn to that point below. But first there is an alternative possibility that is linked directly to measurement. Do the network characteristics of IT make it a different kind of capital—making it hard to measure the effective use value of new generations of IT investment?

In most business uses of IT the value of a computer depends heavily on whether it is similar to or very different from all the other computers used in the same company. To a degree, it is also based on how similar it is to computers in general use in the economy. When bank executives in the 1990s upgraded the computers of their tellers, was this because of an irrational or mistaken belief that the tellers would be able to profit from the faster computers? Or was it largely because the existing IT systems had become obsolete and worn, and there was a companywide decision to follow a replacement cycle on a uniform basis? Low-power replacement computers were not an option, even if they had been available on the market. Why? Because hardware replacement cycles are often accompanied by software replacement, and company uniformity demands it for daily operations. In the case of IT replacement cycles, the technological capability of the installed computer systems may be largely dictated by the needs of the prevailing software standards and the high-end IT users—not by the needs of tellers or other less computer-savvy employees. The entire convoy must move at the same speed, which is often determined by the fastest, not the slowest, ships.

Older computer models or computers with low CPU speed or memory capacity command very low prices in the market, because they are not compatible with the latest software and networked office systems. Hence, computer buyers often find themselves on a treadmill where they are "forced" to purchase a new computer in order to run current software for the same basic office tasks.

Therefore, IT's network character makes it hard to infer from market-price data what effect the surge in IT investment had on productivity in the late 1990s. This leaves a great deal of uncertainty about how much growth causality can be determined from the growth accounting framework.

The second issue has already been alluded to. The coincident timing of the surge in productivity and IT investment in the late 1990s is the main reason for thinking the latter caused the former. But correlation does not determine the direction of causality or even whether a causal relation exists. And that is particularly true when we are talking, basically, about one observation. Instead of asserting that a surge in information technology caused the productivity surge, the reverse causality is also possible. With strong demand and strong productivity, profitability was high. The stock market was also experiencing a massive boom, so there was plenty of corporate cash flow and cheap financing available for investment. Great rewards were promised from IT investment, and the Y2K problem made computer upgrades an imperative in many companies. Chief information officers had the upper hand in struggles with chief financial officers. Thus, to a degree, the broader economic boom of the late 1990s and groupthink approach to investment caused the explosion of IT investment.

There is a third important issue relevant to assessing the contribution of IT to productivity growth. As already noted, productivity growth has been very rapid over the past three years—possibly even more rapid than during the late 1990s. But this period has coincided with a bust in technology spending. The rate of growth of IT capital stock has slowed sharply. So the simple correlation between productivity acceleration and rapid growth of IT capital has now broken down. During 2001–03 there seems to have been productivity growth everywhere except in the IT investment—the opposite situation from the Solow paradox of the 1980s.[12]

12. There is a historical parallel here. The slowdown of productivity growth in the early 1970s coincided with a sharp rise in oil and energy prices. Many economists drew a connection and said that the rise in energy prices had caused the productivity growth slowdown. There was even a convincing story to go with this hypothesis. Labor productivity growth, it was argued, is generated by the substitution of machine power for muscle power. But machines use energy, so that when energy became much more expensive, this process slowed

The data are uncertain and some of the time periods are very short, but *the simple inference from reviewing the growth accounting framework over the past 15 years or so is that the link between trends in productivity growth and IT investment is weak*. There was the period of the Solow paradox in the 1980s when computer investment was picking up but productivity growth was not. Then we had the five-year period 1996–2000, when IT investment and productivity moved in sync. But since then we have had a three-year period when IT investment and the productivity trend seem to have parted company again.

At the risk of arguing both sides of every issue, it is important to bring in yet another viewpoint on this issue. Economists who take the view that IT is really the key driver of productivity in the modern economy provide another explanation for what has happened over the past 15 years. IT capital alone does not allow companies to raise productivity. What it does is create the opportunity for companies to make changes in the way they conduct business, to innovate, and to change their business processes. They argue that these business process innovations take time to occur. That is why productivity growth did not do much in the 1980s, because companies had not yet figured out how to really take advantage of their increasing IT investments. This also explains why productivity growth continued apace after 2000, because companies were taking advantage of the IT capital that they had already put in place.

This explanation is plausible and surely has a lot of truth to it; it is an idea we will return to later. But accepting this story comes with a price—namely, it reveals that the growth accounting framework is too simple because there are lags that are not captured. There is also intangible capital accumulation associated with business process innovation that is not captured in the data used in the framework.[13]

In order to go beyond aggregate growth accounting numbers and supplement our understanding of the causes of productivity acceleration, we turn to industry data and case studies.

Industry Data and Case Studies: How Much More Do They Explain?

Table 3.3 shows estimates of labor productivity growth by industry from 1989–95, from 1996–2000, the difference between these two periods, and then the growth rate from 2000 to 2001 based on updated data from

down and labor productivity growth slowed down. There were skeptics about this hypothesis and they were vindicated when energy prices fell sharply in the mid-1980s and productivity growth did not accelerate. The simple correlation between energy prices and productivity growth broke down over time.

13. For further discussion of these issues, see Gordon (2003b).

Table 3.3 Labor productivity growth by industry, 1989–2001
(GDP originating per person engaged in production, average annual percent changes, selected periods)

Industry	1989–95	1995–2000	Difference	2000–01
Mining	4.72	–0.48	–5.20	–1.51
Construction	–0.13	0.05	0.18	–1.40
Manufacturing	3.14	4.43	1.29	–1.61
Durables	4.30	7.10	2.80	–0.37
Nondurables	1.61	0.94	–0.67	–3.38
Transportation	2.44	1.79	–0.65	–4.32
Trucking and warehousing	1.89	0.77	–1.12	–4.15
Air	4.54	2.11	–2.44	–6.82
Other	1.62	2.75	1.13	–2.28
Communication	4.86	2.59	–2.27	9.97
Electric/gas/sanitary	2.36	2.00	–0.36	–9.80
Wholesale trade	2.85	7.48	4.63	4.27
Retail trade	0.91	5.19	4.28	4.32
FIRE	1.64	3.44	1.80	2.51
Finance	2.96	7.65	4.70	6.13
Insurance	–0.27	1.29	1.57	–1.88
Real estate	1.59	2.67	1.08	2.05
Services	–0.79	0.13	0.92	0.52
Personal	–1.39	0.70	2.09	0.81
Business	0.81	0.40	–0.42	3.37
Health	–2.13	0.01	2.14	–0.04
Other	–0.61	0.06	0.66	–0.62
ICT-intensive half	2.44	4.12	1.69	2.13
Non-ICT-intensive half	–0.01	1.42	1.42	–0.76

ICT = information and communication technology

Source: Bureau of Economic Analysis data, NIPA tables and GDP by industry revised, October 28, 2002.

October 2002. Each industry's output reflects its value-added and labor input as measured by the number of persons working, including full-time equivalent employees (FTEs) and the self-employed (the number of FTEs). Table 3.3 shows a wide range of rates of growth and decline, and some of this variation surely reflects noise in the data. But the overall picture suggests there was a broad acceleration of productivity growth across a range of industries including durable manufacturing and service industries.[14]

14. Some earlier data had indicated little or no acceleration of labor productivity in service industries after 1995—including major purchasers of IT capital. However, the picture subsequently changed when new data on industry output was released, which incorporated new price deflators for many service industries.

The resurgence of productivity was especially strong in a few industries.[15] For example, there was a surge in productivity in wholesale and retail trade and in the finance sector. The surge in retail is particularly important because it is such a large sector. Although not shown in table 3.3, a more detailed industry breakdown reveals that much of the productivity acceleration in finance is driven by a small niche—security and commodity brokers—where measures of productivity are questionable. But depository institutions (banks) now show a solid acceleration of labor productivity of 1.22 percent a year, in contrast to earlier estimates. Within durable-goods manufacturing, a more detailed breakdown shows that a large portion of the gain was due to computers and semiconductors.

Nordhaus (2001) showed that in looking at the sources of productivity gains, both within-industry effects and mix effects can be important in particular cases. For example, the telecommunications industry contributed to overall productivity acceleration even though it did not accelerate its own productivity growth. It did so because the telecommunications industry already has an above-average level of labor productivity, so when the industry expanded its share of aggregate employment, it pulled up the average level of labor productivity. Overall, however, the productivity acceleration is the result of accelerations occurring within industries, not because of major shifts among industries (Nordhaus 2001).

What about the link from IT capital to productivity in the industry data? Table 3.3 reports, in the last two rows, the results of a simple exercise. The industries were divided into those that were more IT-intensive and those that were less so, measured by information technology capital in 1995 relative to value added. The IT-intensive group had much faster productivity growth throughout and larger productivity acceleration.

Stiroh (2002) explores the links from IT capital to productivity acceleration by industry using gross output per FTE as his labor productivity measure (table 3.3 reports value added per FTE), and his strongest results come from defining the intensity of information technology based on how large the share of information technology capital is in total capital for each industry in 1995. If that proportion is high, Stiroh argues, it "identifies industries expending tangible investment on information technology and reallocating assets toward high-tech assets" (2002, 10). He finds that industries that are above the median in their IT intensity, by his measure, have much larger increases in labor productivity after 1995. His findings are robust to the exclusion of outliers and certain other tests. However, one area that produces weaker results is when IT intensity in 1995 is calculated as IT services per full-time equivalent employee.

15. Using gross output per FTE rather than the value added per FTE shown in table 3.3 reinforces the conclusion that the productivity recovery was broad-based across industries.

Stiroh's findings give new support to the connection from IT capital to productivity growth and acceleration, but a study by Triplett and Bosworth (2002) points away from this view. They focused on service industries and evaluated the extent to which the industries that had experienced a surge in labor productivity growth had also had a surge in IT capital accumulation. They found no such correlation. According to Triplett and Bosworth, it was a surge in the residual MFP growth that accounted for most of the acceleration of labor productivity in service industries.

Industry Case Studies

One way to drill down further to the sources of productivity increase and the role of IT is to do case studies of individual industries. There have been two studies released by the McKinsey Global Institute (MGI) (2001, 2002a) that have utilized this approach. The first study was a series of eight industry case studies, looking in detail at what happened to US productivity in the 1990s and what caused its acceleration. The second study was more specifically focused on IT and on the ways that it does or does not improve productivity, without particular regard to explaining the productivity acceleration.

In the first MGI report, case studies of eight industries were included. Six of these industries had contributed disproportionately to productivity acceleration: wholesale and retail trade, computers and semiconductors, telecommunications, and securities. Retail banking and hotels were included as two industries that had invested heavily in IT but had experienced no surge in productivity (McKinsey constructed its own banking productivity measure and did not use the measure given in table 3.1).

Based on these case studies, the report concluded that competitive pressure was the main driver of productivity acceleration, because it forced improvements in business operations. In the retail trade case, they found that Wal-Mart played a pivotal role, because its large size and high productivity put competitive pressure on other retailers. In the semiconductor industry, Intel came under competitive pressure from AMD, which resulted in an accelerated decline in the price of microprocessors but translated into productivity acceleration in this industry. Conversely, the study found that hotels and retail banks faced less competitive pressure and were able to earn profits without pushing as hard to improve efficiency.

The case studies also make clear that productivity improvements come from a variety of sources, not just from IT. Improvements in retail productivity came about through organizational improvements, the advantages of large-scale "big box" stores, and by a shift to higher-value goods associated with the growth in the number of high-income consumers.

The case studies reveal the complex relationship between IT and productivity.[16] In some cases, investments in IT yielded little payoff. As noted earlier, for instance, banks invested heavily in powerful computers that were negligible for the tasks that most bank employees were performing.[17] Generally "customer-relations management" systems that were intended to track customer use patterns and generate new sources of customer revenue did not succeed. In other cases, IT contributed substantially to productivity. The telecommunications industry is a direct application of IT, and the explosive growth of the mobile-phone sector was made possible by technological advances. The Internet allowed much higher productivity in the securities industry, and IT is used heavily in the wholesale and retail sectors. Wal-Mart, for example, has relied on IT to operate its efficient supply chain—indeed, Wal-Mart operates the largest commercial database in the world. In still other cases, IT systems developed prior to 1995 were vital facilitators of productivity improvements after 1995.

The second MGI study (2002a) further investigated the ways in which IT affected productivity at the industry level. It confirmed that IT contributes to productivity growth only when it is accompanied by business-process innovation. Large amounts of IT hardware and software were sold in the 1990s based on their dazzling technological promise. If companies had not applied the technology to improve operating processes or create new value-added goods or services, then the investment was a failure.

This conclusion helps us understand why the link between IT and productivity growth was hard to unscramble from the industry data. Some companies and industries were successful in making business innovations, and the IT provided an important tool. Other companies invested in the IT, but failed to make the required business process innovations.

The MGI study also found that the way IT contributes to productivity varies significantly across industries. Even though much of the IT investment in banks did not pay off, there were examples of particular investments in this industry that did succeed. For example, voice response units (VRUs)—automated devices that handle customer inquiries—allowed banks to field a 21 percent annual rate of increase in customer inquiries (1994–98) with only a 13 percent rate of increase of personnel. Many of us dislike these devices and would prefer a real per-

16. The 2001 study calculated IT contribution to growth differently from standard methodology. Most economists (Jorgenson, Mun, and Stiroh 2001; Oliner and Sichel 2000) have included the entire acceleration of productivity in the IT-producing sector as part of the contribution of IT to the overall acceleration. However, the 2001 MGI study attributed only the amount that IT itself contributed to the productivity acceleration within its own sector.

17. Although not stressed in the MGI study, it is also reported that bank consolidations meant inconsistent IT platforms had to be reconciled—a costly task with limited payoff, at least in the short run.

son, but would be outraged if we were asked to pay the true cost of receiving that service. Since such calls are not paid for directly, productivity measures did not capture the output created by responding to 2.3 billion such calls in 1998.

In the semiconductor industry, design capabilities have not kept pace with Moore's law, so that design has been the bottleneck to better chips, rather than the ability to put more transistors on a given chip. In the 1990s, new EDA (electronic design automation) tools allowed companies to reduce "real" design time—that is, the amount of design time per gate.[18] In 1995, a complex chip design took 15 months, had a team of 60, and included 6 million gates per new design. By 2001, the design time had increased to 24 months and the team size to 180, but the average gate count per design had risen to 94 million.

There were differences in how IT was used even within a given industry. For example, in retail, mass-market discount stores such as Wal-Mart were able to improve their distribution logistics and improve their operational effectiveness. Stores like Sears that offer low-price promotional specials were able to more effectively monitor their sales trends and schedule labor to take advantage of them. The specialty apparel chains, such as Gap and The Limited, used "vendor-management systems" to shorten the time to market and improve sourcing. The study found that companies with effective IT performance measurement tools in place were the companies that obtained the greatest productivity improvement. The study also found that successful companies developed their use of IT in a sequential pattern and built their capabilities at each step.

These conclusions are helpful as a cautionary tale for economists who think a simple model or parable will illustrate how IT affects the economy. There is no one simple way to characterize IT's effect on the economy because it depends on the specific conditions and business methods of a particular industry, or even of a subsector of an industry. In a sense, IT is not what actually improves productivity at all. It is the improvement in business processes—facilitated by IT—that accomplishes this. The results are also helpful in understanding the long lag time that seems to have occurred between the development of computers and the appearance of productivity gains. The effective uses of computers have to be customized to specific activities. Companies and even an industry itself may have to evolve in order for the full benefits of IT to be realized. Additionally, the right performance measures have to be found.

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18. In a semiconductor, the basic building block is a transistor. A group of transistors put together is called a gate. There are three types of gates: AND, OR, and NAND. They are used to create logical functions. For example, the rider in a microcontroller in an elevator would use the OR gate to program a command to open its doors. The function would read: "if the button is pressed to floor 11, OR if a person in floor 11 presses the button, open the door of the elevator at floor 11."

A Summary Explanation for the Post-1995 Improvement in US Productivity Growth

There is no consensus among US economists about what caused the improvement in productivity growth. The following is an attempt to bring together the different strands of evidence into a reasonable summary view—one that is also consistent with the productivity slowdown after 1973.

The innovations made during the 1930s and in World War II were exploited during postwar recovery. The rapid productivity growth of the 1950s and 1960s in the United States reflected the economy's ability to translate these innovations into improved performance, and the large US market provided a level of competition that encouraged this growth.[19] The macroeconomic environment was stable (a sharp change from the 1930s). There were regulated monopolies in the utilities and telecommunications industries, but the companies were privately held and the nature of regulation encouraged productivity increase. The consolidation of previously fragmented industries allowed productivity gains from increases in scale in the industrial sector, but also in services where, for example, there was a shift from traditional grocery stores to supermarkets.

Once the easier ways to raise performance had already been exhausted, a productivity lull occurred. In many industries stable oligopolies developed, and the full force of global competition was not yet felt. The rise in oil prices triggered a period of greater macroeconomic instability, including steep recessions in 1975 and in the early 1980s. Such economic downturns can stimulate productivity improvement in some companies as they downsize and restructure, but the economy as a whole only benefits if the resources released in this process find productive new uses. That did not seem to happen in the 1970s and 1980s. A period with oil shocks and stagflation is not one that favors risk taking and the development of new products and services.

Despite the economic difficulties, there was an ongoing push of economic change and innovation during the 1970s and 1980s. The IT revolution was moving forward, even though the benefits were not showing up in measured productivity. The makings of a stronger competitive environment were also under way with the deregulation movement and the expansion of global competition. In the 1990s, a new flow of productivity-enhancing innovations emerged in a very favorable macroeconomic environment and in a strongly competitive microeconomic environment, and this allowed a return to faster productivity growth. The 1990s economy experienced heightened competition in an increasingly deregulated environment with strong international competition. In particular, US service industries, which often compete on a global scale, sought out new tech-

19. See Baily and Gordon (1988) for an analysis of alternative reasons for the post-1973 productivity slowdown.

nologies to improve their productivity. Business innovation in IT is driven by the demand for improved technologies in the industries that can take advantage of it. Silicon Valley was the creation of a group of extraordinary IT innovators, but was possible only because the markets were demanding new products and services.

High competitive intensity in a market raises productivity growth for four reasons. First, it will increase static efficiency and drive out slack (sometimes called X-inefficiency), and this will raise productivity growth for a period of time. Second, research on individual firms and establishments reveals that productivity growth over extended periods is driven by the expansion of high-productivity enterprises and the contraction or closure of low-productivity enterprises, a process that is sustained by competition. For example, recent research based on census data of US retailing establishments revealed the following: "Our results show that virtually all of the productivity growth in the US retail trade sector over the 1990s is accounted for by more productive entering establishments displacing less productive exiting establishments. Interestingly, much of the between establishment reallocation is a within, rather than between firm phenomenon" (Foster, Haltiwanger, and Krizan 2001). Third, in many industries competition encourages the adoption of innovation within establishments as companies are forced to change in order to survive. The fourth reason, which is related to the three above, is that competitive intensity forces companies to establish incentive programs that encourage productivity improvements throughout their operations.

Another reason the 1990s was a particularly favorable time is that rapid advances in computing power, software, and communications capabilities formed a set of powerful complementary innovations. When complementary innovations occur, the effects can be much greater than the sum of each innovation separately. These complementary innovations made IT user-friendly and enabled it to be applied by a much broader group of persons and for a much wider group of activities.

There is no solid reason for the rather *abrupt* shift in the productivity growth trend after 1995, but it seems clear that economic conditions in the 1990s favored improved productivity performance. The most important source of sustained productivity increase is business process innovation, and this accelerated in the 1990s for reasons that seem linked to the high level of competitive intensity that developed in the US economy.

That conclusion provides a lead into the next section, where the focus shifts back to Europe. Detailed industry case studies from France and Germany are examined to identify barriers to productivity improvement in these economies. The industry cases also reveal a number of examples where regulatory reform and increased competition have yielded a strong payoff in faster productivity growth. Europe does not have to look only to the United States for examples of how increased competitive pressure strengthens productivity. It can look at its own examples.

Case Study Evidence on the Importance of Regulation and Competition in Europe

In 1997 the MGI completed a study of the levels of productivity in France and Germany, adding the United States in order to make comparisons among the three countries. In 2002 a second productivity analysis was carried out, motivated in large part by the acceleration of productivity growth that had occurred in the United States and the slowing in France and Germany. The project did look at productivity levels, but its focus was on productivity growth over the 1990s (MGI 1997 and 2002b).[20] The role of IT in growth in France and Germany was an important concern of the second project and the findings in that regard are discussed in the next section.

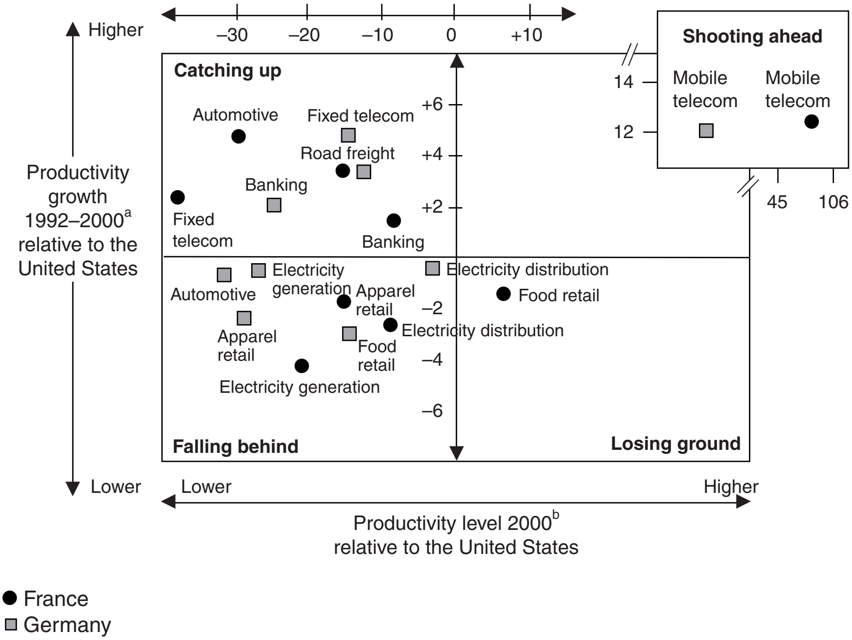
The approach in both studies was to use industry case studies. The first report tackled automotive, housing construction, telecom, retail banking, retail trade, and software. The second looked at telecom, retail banking, automotive, road freight, retail trade, and electricity and gas utilities and the results from this second study of growth will be the ones discussed here.

The pattern of productivity performance that emerges is as follows. First, there remains a significant gap in the level of labor productivity in France and Germany relative to the United States in most of the industries studied. The weighted average of the productivity levels of the industries studied was, for both France and Germany, 20 percent below the productivity of the benchmark industries (the US industry was the benchmark except for Japanese autos). The only industries where the labor productivity levels were higher than in the United States were food retail in France and mobile telephony in both France and Germany. This conclusion suggests there is a substantial potential for productivity increase in the private business sectors in these two countries.

Second, over the decade of the 1990s as a whole, productivity grew more rapidly in the United States in about half of the industries and more slowly in the other half. More of the industries in France were growing faster (French industries were often catching up), while more of the industries in Germany were growing slower (German industries were often falling behind). The French productivity lead in food retail was getting

20. In order to avoid the reunification problem in Germany, "the 1990s" generally refers to the period 1992–2000. Largely because of the short time period of available data, not to mention the difficulty of analyzing second derivatives, the study did not make a comparison of growth pre- and post-1995 in Europe. Both studies were carried out by teams of business consultants from the Paris and Germany offices of McKinsey & Company. Bill Lewis directed the 1997 study and Diana Farrell the 2002 study in collaboration with the Paris and Germany office managers. The working teams in both studies were from France and Germany. There were academic advisers for both studies, the first chaired by Robert Solow and the second by Olivier Blanchard. Martin Baily participated in both studies.

Figure 3.3 French and German productivity performance relative to the United States, 1992–2000



a. Automotive and utilities 1992–1999; banking 1994–2000; retail 1993–2000.
b. 1999 for automotive and utilities.

Source: MGI (2002b).

smaller over time. Productivity in mobile telephony in France and Germany not only had a productivity lead but also was growing much faster than the US industry.

These conclusions are illustrated by figure 3.3, in which individual industries are positioned on the vertical axis depending on how fast they grew in the 1990s and on the horizontal axis depending on their relative level of productivity.

These industry results are consistent with aggregate data in that the growth of GDP per hour in France and Germany is similar to that in the United States for the decade of the 1990s as a whole. They differ from the aggregate data in finding a lower level of labor productivity in France and Germany than in the United States. Previous studies at MGI as well as other authors have also concluded that a productivity gap exists at the industry and sector level (van Ark, Inklaar, and McGuckin 2002). Evidence from a sample of industries is never conclusive, but since the pattern shows up in different studies, this makes it more likely to be correct. The obvious explanation is that the PPP exchange rate estimates made at the

OECD (using Eurostat data for EU countries) somehow build in the assumption of low relative productivity in the United States for sectors such as government services, health care, and education that are large in overall GDP but are not covered in the private industry case studies. Another possibility is that the case studies used industry-specific PPP exchange rates developed by the McKinsey teams, or physical output measures. These can give productivity measures different from those implied by the OECD's PPP prices.[21]

The next step is to understand this productivity pattern, why there are productivity-level differences among the three industries, what drove the growth, and why some of the industries were falling behind. The comparisons between France and Germany can be as illuminating as those with the United States. The first broad answer is that restrictive or badly designed regulation held back productivity performance in many cases. Regulation can hurt productivity performance by limiting competitive intensity in an industry and discouraging industry restructuring and innovation.

The second reason for productivity performance differences was shown by several cases where scale or network effects are important. In these industries, the intensity of utilization had a major impact on productivity and US industries often operated at a higher scale or had a higher rate of utilization capacity. There is an interaction between these first two causes of productivity performance differences—regulation can affect utilization by restricting industry consolidation. But it is also the case that the United States, having higher income overall, tends to use the industries where scale is important more intensively than does Europe (the United States sends a lot more electricity per capita down its power grid than Europe, for example).

As noted earlier, however, there are important positive stories in France and Germany associated with deregulation, privatization, and the increased competition coming from a single market. In the case studies, deregulation and privatization were often reasons for rapid productivity growth in a sector and often accounted for the sectors that were rapidly catching up to the US level of productivity.

The first example where poor regulation reduces the level and growth of productivity is automotive. Until recently, there were volume restric-

21. The OECD must rely on individual-country statistical agencies to collect the price data. In the United States, these data are supplied by BLS, but there is no specific appropriation for this task and no price survey that is tailored for this purpose. In carrying out industry comparisons across a range of countries, the McKinsey teams have often concluded that the individual, micro PPPs from the OECD are surprising and at variance with the firm's knowledge of global pricing behavior. One hopes that more aggregate PPPs benefit from an averaging or "law of large numbers" effect that reduces the overall error. But it does raise a concern about the aggregate comparisons.

tions on non-European imports into the European Union. In Germany there was an "understanding" that kept the share of Japanese autos in Germany at 16 percent in 1993 and explicit limits that kept the share in France at 5 percent. The European companies were also able to enforce exclusive dealer relations that made it more costly for foreign autos to enter. In addition, the European Union has a 10 percent tariff on autos.

Over the 1990s, competitive intensity did strengthen within Europe as a single market emerged in this sector. The German industry had a substantial advantage in product quality and productivity relative to its competitors in France at the start of the decade and introduced several successful new products in the 1990s. Since it lacked intense pressure to improve its productivity, however, and since it faced substantial adjustment costs if it downsized its labor force, the German industry made only modest progress in improving its manufacturing productivity. In France, by contrast, Renault was largely privatized and faced a battle for its very existence. In response it was forced to make massive restructuring efforts and increase its productivity. Making large layoffs is costly in France but the French government, recognizing that the industry had to restructure or die, was willing to allow the layoffs to take place and absorbed some of the costs by subsidizing early retirement for older workers. As a result, productivity grew much more rapidly in the French industry than in Germany and the level of productivity overtook the German level by 2000.[22]

As a comparison, the US industry faced its own intense competitive struggle as the highly productive Japanese industry expanded its market share in autos. GM, Ford, and Chrysler responded by closing the least productive plants, making productivity improvements in the remainder, and successfully expanding the market for SUVs, pickups, and minivans. The high markups on these vehicles show up as high measured productivity.[23] Transplants from Japan operate at high productivity levels in the United States and increased their productivity strongly in the 1990s. So the combined industry (Big Three plus transplants) in the United States also achieved rapid productivity growth and its level remained above that in France and Germany in 2000.

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22. This good-news story for France is qualified by the fact that the workers released as the industry downsized were placed in early retirement programs. They did not, for the most part, move to new jobs. See chapter 5 for a discussion of labor-market policies.

23. Regulation also shaped the US industry. Fuel economy standards are set differently for SUVs and pickups, allowing the Big Three to sell large vehicles to consumers where they had a competitive advantage over the Japanese nameplates. Gas prices were low for much of the decade. Depending on one's view of the policy issue, one can argue that regulating fuel economy standards was a distortion that depressed productivity in the US industry until the companies found a way of evading the regulation. Or one can argue that productivity is overstated in the US industry because the impact of high gas consumption on the environment or US energy dependence is ignored.

Privatization and the increased competitive intensity resulting from the European Union are working in this industry to raise productivity. The French industry, which had resisted restructuring, was forced to improve its productivity under competitive pressure. The German industry, including the subsidiaries of US companies in Germany, is now faced with the same pressure, as the industry in France has become more competitive and the Japanese transplants in Europe expand their supply. The prospects for employment in this industry, particularly in France and Germany, are not strong, however. Some new plants are being built, such as the Toyota plant in France, but existing plants face employment reductions and new investment is seeking lower labor costs in other parts of Europe, notably Eastern Europe.

Mobile telecom is a case industry where regulation in the United States has resulted in lower productivity, in both level and growth. In an effort to promote competition, the US regulators sold spectrum to many different companies who set up competing networks and a variety of incompatible standards. In 2000 in the United States there were 50 mobile companies with fewer than 200,000 subscribers and the average size of mobile telephone companies was 561,000. In France there are competing service providers, but their number has been limited, so each one uses its network much more effectively. The average number of subscribers is 900,000 to 1 million. Labor productivity in France is about twice the US level. Labor productivity in Germany is higher than in the United States, but much lower than in France, because Deutsche Telekom was allowed to dominate the market. In the United States there were too many competitors, while in Germany one company was allowed to dominate the market.

This is a new industry where there was no incumbent workforce and where private companies were used from the start and used competitively, especially in France. The industry illustrates the subtlety of achieving the right competitive environment. Having too few companies results in an oligopoly or monopoly that will raise prices and fail to increase productivity. But a fragmented industry fails to achieve economies of scale. It is likely that over time there will be consolidation in the US industry and the right number of competitors will emerge. Going for a competitive industry was not a foolish strategy, if flawed in its execution in the United States. Regulating this industry correctly is a moving target.

In fixed-line telephony, the United States retains a productivity advantage. This is particularly the case relative to France where France Telecom has been slow to reduce its workforce despite being privatized. Germany has been more effective in raising competitive intensity and encouraging innovation in the fixed-line segment. An important reason for the productivity-level differences, however, is the fact that the United States makes vastly more calls per subscriber. This is in part due to differences in income levels and different pricing strategies, but it may also reflect cultural differences and different business practices.[24] Internet use in the United States was also much higher than in France and Germany as of 2000.

In comparing France and Germany, again there is a clear case that regulation and institutional rigidities are at work in explaining differential performance. France Telecom has not been faced with strong competition and has a workforce that is able to resist restructuring and the elimination of excess employment.

In retail banking, the industries in France and Germany made substantial productivity gains in the 1990s but still lag behind the US level in productivity. The US industry does not have world best-practice productivity because of its own legacy of regulation. Restrictions on interstate banking created a fragmented and somewhat inefficient industry. It has also been slow to shift to electronic funds transfer, and instead kept a paper-based check system that is labor intensive. Despite these factors limiting productivity, the US industry has become very competitive and uses labor much more flexibly, particularly compared with Germany. German banks have been unable to take full advantage of back-office automation and other innovations because they cannot lay off unneeded workers. The German industry is also very fragmented and small Landesbanken are given access to favorable mortgage guarantees that protect them from competition from more productive larger banks. Labor productivity in retail banking in Germany is 36 percent lower than in the United States. It is also much lower than in France, where the French industry is more consolidated than in Germany, and both back-office and retail branch operations are more efficiently run. France uses paper checks much more than does Germany, which gives it a productivity disadvantage that is more than offset by greater efficiency.

The current regulatory environments in the three countries, and the legacy effects of past regulation, account for much of the gap to best practice productivity in all three economies. In particular, because of the importance of banking to overall economic stability, and the banking problems of the 1930s, bank regulatory systems developed that discouraged all-out competition. Over time, it has become apparent that good regulation can combine a sound financial system with efficiency-enhancing competition. Competition got started earlier in the United States, when money market accounts were permitted in the 1970s. The increased intensity of competition even overcame some of the regulatory barriers as small banks outsourced activities such as check clearing in order to take advantage of economies of scale. German banks are an example where the lack of intense product-market competition combined with labor-market rigidity have hampered productivity improvements.

24. Most US customers face zero marginal cost for local calls. However, the disparity in the number of phone calls extends to long distance calls. The United States permits businesses to make marketing calls to consumers that account for a significant fraction of total phone traffic.

The road freight sector is one where there was rapid productivity growth in both France and Germany in the 1990s, around 5 percent a year, enough to reduce if not close the gap to the United States, although the level of productivity remained below the US level at the end of the decade. One of the most important reasons for the productivity improvement in Europe is that deregulation in the European Union, including the abolition of tariffs and the relaxation of market access rules, allowed freight companies to be more competitive and cover a wider geographic area. The competition forced companies to make operational improvements and encouraged consolidation in the industry. Companies benefited from economies of scale in terms of increased capacity utilization, although the full benefits of the opening of the single market are yet to be realized. In addition, there was an easing of truck size restrictions and speed restrictions. The remaining productivity gap to the United States was attributable to higher utilization rates in the United States, linked to better use of IT. Also, deregulation occurred earlier in the United States, so consolidation and operational improvements have gone further in the United States. The United States has longer haul lengths than Europe (output is measured by ton-kilometers).

The case study of retail trade focused on food retail and specialized apparel. In food retail, labor productivity was 7 percent higher in France than in the United States in 2000, resulting from a 19 percent advantage in modern food retail formats (supermarkets and "hypermarkets"). This is a situation where the industries in both France and the United States are competitive with high operating efficiency both in US stores and in French stores such as Carrefour. Regulation in this industry is actually raising labor productivity in France. There are tight zoning restrictions that limit the number of locations where hypermarkets can be built. There is 50 percent less retail space in modern food retail stores per unit of sales in France compared to the United States. There are limits on opening hours in French retail, and very high minimum wages. The combined effect of this regulatory environment is that throughput per square meter and per employee is very high in France. Retailers in the United States stay open longer hours when relatively few people are in the stores (130 hours per week compared to 72 in France). Staying open more hours is not economic in France because of the high wage rates even when there is no regulation preventing it. Retail food stores in the United States also offer customer services, such as grocery bagging, that are not economic to provide in France, given the wage structure. Eight percent of employment in the US industry is at wage rates below the French minimum wage.

Food retail is a case where the impact of wages on productivity and employment is quite visible. The difference between France and the United States comes partly from capital labor substitution (fewer stores that are used more intensively). In addition, there is a reduction in the service level in France as low-productivity activities are eliminated in response to high wage rates. Partially offsetting the productivity advantage in modern food retailing formats is the fact that traditional stores make up a larger fraction of total food retail employment in France—40 percent of the total, as compared to 8 percent in the United States. The greater share of traditional stores in France is also a consequence of the zoning laws that limit the number of hypermarkets.

Although the level of productivity was higher in France in food retail, the growth rate was slower, 0.2 percent a year, compared to 1.6 percent in the United States. The growth in the United States was driven by innovative business processes, notably those in supply chain management and the use of IT. Wal-Mart became the largest food retailer in the United States over this period.

Competitive intensity in food retailing in Germany is lower than in France or the United States as zoning regulations and labor laws limit the ability of the industry to evolve. A much smaller proportion of food retail throughput is sold at large-scale supermarkets and hypermarkets, which have the highest productivity levels and which can make best use of IT and integrated supply management systems. The amount of retail space per unit of sales is high in Germany, concentrated in smaller supermarkets, so that sales per employee and sales per square meter are lower than in France. Labor productivity in Germany in food retail is 86 percent of the US level (with France at 107 overall). The lower productivity in modern formats accounts for this gap.

In specialty apparel retailing, such as Abercrombie and Fitch or the Gap, competitive pressure is high in the United States because these retailers are under constant threat not only from each other but also from discounters like Costco, Wal-Mart, and Target. In France, the hypermarkets do put competitive pressure on the specialty retailers, but this sector of retailing is less developed because land use restrictions have limited the growth of shopping malls. There are more traditional stores remaining in France, where labor productivity in France is 85 percent of the US level in specialty retailing. In Germany, the competitive pressure is lower still because there are fewer hypermarkets and discounters because incumbent retailers use their influence with zoning authorities to make sure desirable locations for new stores are not given to potential best-practice entrants. Labor productivity is 71 percent of the US level. Productivity in the United States also has an advantage because the United States has higher income levels and so more high value-added items are sold in specialty apparel stores.

The electricity and gas utility industries are gradually being transformed in Europe, and indeed in the United States also, as a result of privatization and/or competition. In electricity generation, labor productivity growth in Germany was 5.2 percent a year 1992–99 compared with 1.3 percent in France and 5.5 percent in the United States. Growth was even faster in Britain at 7.0 percent a year. The pattern of multifactor productivity, taking account of capital and fuel inputs, was slower, but had a similar pattern across countries (MFP was not computed for Britain). The level of MFP in France was 87 percent of the US level and in Germany was 90 percent.

The higher level of productivity in generation in the United States was related to capacity utilization. The margin of spare capacity in generation was reduced as the industry transitioned to deregulation. Historically, better use of capacity has been a strength of the US industry, but in some states in the 1990s the margin dropped too low, causing brownouts or blackouts. Electricity demand is more variable in the United States because of the peak air conditioning season. At least for California, the problems encountered with deregulation are well known, even if the causes and cures of the problems are subject to disagreement.

The strong growth of productivity in Germany and in Britain over the 1990s was driven by market liberalization. Britain privatized the industry in the early 1990s, while Germany opened up the wholesale and retail electricity markets at the end of the 1990s. The impact of this opening up in Germany was felt well before the event, however, as generators prepared for the new competitive environment starting in the mid-1990s. They greatly improved their operating efficiency and eliminated excess labor. The productivity of plants in East Germany was substantially improved.

France, by contrast, did not open its generation market and the plants are state owned. The industry did not have an incentive to eliminate excess employment or to increase the standardization of processes, which would have improved efficiency. The level of labor productivity in France is very high and MFP is pretty high because of the extensive use of nuclear technology in France, so its productivity potential is actually quite a bit higher than that in either Germany or the United States. Concerns about safety in Germany and the United States (exaggerated perhaps) have resulted in regulatory barriers to the use of nuclear technology.

Electricity distribution is a natural monopoly and has been regulated in all the countries throughout the 1990s. The United States has a substantial productivity advantage, as noted earlier, coming largely from the high volume of electricity distributed to each customer. In part this is because electricity is much cheaper in the United States, but in addition, higher incomes and air conditioning give rise to different demand patterns. What is most interesting in the analysis of this industry, however, is that the way in which this sector is regulated, including changes in the 1990s, shows up in higher or lower productivity. Britain started with very low productivity but has privatized the industry and forced price declines through several rounds of regulation (see also chapter 4). The result has been very large increases in productivity. France, by contrast, did not regulate aggressively for productivity by, for instance, requiring equal network access for new third-party entries at regulated prices and growth has been much less. *Aggressive productivity-forcing price regulation can have a large payoff in, for instance, natural monopoly sectors, where it is not feasible to just use competition as a forcing device.* (See box 3.2.)

Box 3.2 National regulatory barriers limit competition within the European Union—but the European Commission is fighting back

The creation of a single market was an idea that was central when the European Union (and its predecessor, the EC) was created. The Treaty Establishing the European Union (Article 14(2)) described the internal market as "an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured. . . ."

In practice, however, the countries of the union have kept in place national regulations that limit the intensity of competition and partially thwart the original intent of the founders of the common market—a point that has been made in this chapter using industry case examples. This box, which includes information that became available to us as this book was being prepared for publication, documents some additional barriers beyond those described earlier. But it also notes efforts now being made by the European Commission to overturn these restrictive rules and regulations.

The first three examples are relevant to this latter point and are based on cases where the European Commission is taking individual countries to the European Court of Justice (ECJ).

- In April 2003, the European Commission took Italy to the ECJ because its national highway code regulations on agricultural trailers require that fixtures for coupling trailers to tractors must comply with national technical rules. As a result, most trailers manufactured outside Italy are not accepted, constituting (in the opinion of the Commission) an obstacle to the free movement of goods.[1]
- Simultaneously, the Commission brought charges against the Netherlands at the ECJ for its requirement of non-Dutch private security services companies to (for a fee) obtain a prior Dutch authorization. As this authorization does not take into account the obligations companies have already fulfilled in their own member state, nor recognizes non-Dutch professional qualifications, it (in the opinion of the Commission) constitutes an unjustified limitation on the freedom to provide services.[2]
- In December 2003, the Commission, as a first step prior to referring the case to the ECJ, requested that Germany modify its legislation on supplying hospitals with medicines. Currently German hospitals are required to obtain supplies from local pharmacies, subject to control by a local pharmacist. Germany's opinion that the legislation is needed to ensure the safety of pharmaceutical products and thus to human health seems an obvious example of regulatory capture that grossly distorts the market in favor of local suppliers.[3]

Next, there are five examples where, in principle, regulations have been harmonized across the EU but where individual countries have not implemented this harmonization in practice, providing a barrier to EU-wide trade. While it is mandatory for member states without delay to implement nationally European Commission Directives (these will have been negotiated with member states prior to adoption), implementation sometimes occurs only late, or in a way that is not on a sound legal basis.

- Safety procedures to prevent workers from falling are mandatory under EU law for working heights above 2.5 meters. A Dutch machine tool company producing personal fall arrestor devices, certified in the Netherlands, is excluded from the British construction market, because British standards in this sector require what is termed a "fall prevention cushion."

(box continues next page)

Box 3.2 *(continued)*

- Harmonized EU regulation exists in the markets for locks and security systems. However, a Norwegian exporter of such items reports that these are overruled by national requirements for fire protection. For instance, Germany has fire protection regulation making mandatory control and testing by German fire inspectors.
- A Spanish producer of upholstered furniture in principle is covered by mutual recognition rules that should allow it to export its furniture to Britain. In practice British fire protection rules for the foam and textiles used in the furniture impose additional testing and costs of production.
- A Dutch food producer encounters barriers from the lack a common interpretation of what constitutes "a sauce." What in some countries is "a sauce" is in other countries "vegetables based on solids." Predictably, this complicates testing and marketing in export markets.
- A Spanish meat manufacturer describes how British authorities do not accept Spanish sanitary certifications, and demands that the company at its expense use a private British company to annually carry out the "European Food Safety Inspection Service."

The latter five examples are from a recent survey by the Union of Industrial and Employers' Confederations of Europe (UNICE) of 200 European businesses (2/3 small and medium-sized enterprises with fewer than 250 employees) that export products covered by harmonized EU regulation to other European countries (EU and EEA members[4]). The survey found that more than half of the companies (115) continue to encounter mandatory, national export-market requirements, necessitating product changes, almost half (92) meet extra national export-market testing and certification requirements, while 15 percent (34) meet other supplementary national requirements, such as compulsory extra documentation (UNICE 2004). While there may be some bias in the answers to the survey, its results do indicate the substantial scope of the problem.

Recognizing problems like these, which are particularly widespread in the service sector, the European Commission states in its latest report on the implementation of the Internal Market from 2004 that "there is no genuine Internal Market for services yet; 53.6 percent of the European Economy is still not integrated" (European Commission 2004e,10). Progress has been made in financial services with the Financial Services Action Plan, although it is too early to gauge its effect, as it is still largely unimplemented. More discouragingly, harmonized legislation in areas such as regulation of sales promotion, clearing and settlement of securities, and particularly the recognition of professional qualifications remain nonexistent. Until such legislation is in place, implemented, and enforced, the single Internal Market does not exist.

As an indicator of the extent to which national governments have implemented their directives, the European Commission publishes a regular "scoreboard" of member state performance. In the most recent form (2004f), only a third of member states (Britain, Spain, Finland, Sweden, and Denmark) fulfill the target of a nonimplementation ratio of only 1.5 percent, and it is noticeable that the three big continental European economies—Germany, France, and Italy, all have more than twice that percentage of outstanding directives (European Commission 2004f). In response to a failure to implement directives, the European Commission will typically ask member states to bring an infringement to an end, and may subsequently refer the case to the European Court of Justice for punitive sentencing. According to the latest "scoreboard," France and Italy have the largest num-

(box continues next page)

Box 3.2 *(continued)*

ber of infringement cases against them—two to three times as many as does Britain, an economy of roughly the same size (European Commission 2004f, figure 8).

The European Commission's procedure to force member state compliance is frequently very time consuming. Should the case involve the ECJ, litigation time is invariably measured in years. This may in itself be sufficient to deter especially smaller companies from entering markets in other member states. Aware of this issue, in July 2002 the European Commission started its SOLVIT system, which allows EU citizens and businesses to bring cases of misapplication of Internal Market rules directly to the attention of an offending member state's administrators and thus bypass the requirement for Commission involvement. The target process time is ten weeks—very fast in cases involving the administrative bureaucracy of a foreign country. While these are early days, preliminary data indicate that this system solves almost three quarters of complaints to the satisfaction of the plaintiff in an average of only 64 days (European Commission 2003a, 2004f, 15), and thus could become a powerful tool to promote market integration in the future.

1. European Commission Press Release IP/03/581, April 28, 2003.
2. European Commission Press Release IP/03/581, April 28, 2003.
3. European Commission Press Release IP/03/1755, December 17, 2003.
4. European Economic Area countries, which participate in the Internal Market without being members of the EU. These are Iceland, Norway, and Liechtenstein.

Lessons for Europe about Procompetitive, Productivity-Enhancing Regulation

All industries are subject to laws and regulations and depend upon them to function. Property rights are enforced and even new and freewheeling industries like high tech make use of patent protection. Companies sue each other regularly under the antitrust statutes. And zoning laws are essential—how would you like a noisy factory next door to your house? The debate should be about how much regulation is optimal, how to regulate in ways that achieve social goals most efficiently, and how to use regulations or laws to make markets work better.

The conclusions of the case studies of industries in France, Germany, and the United States give clear evidence that regulation matters for productivity and employment. When regulations are used to restrict competition or to prevent industries from consolidating and evolving toward more productive formats, there is a significant productivity price to pay. And the good news is that when sound regulatory reform is carried out, it shows up in higher productivity growth. Based upon the case study evidence, France and Germany could raise their productivity growth rates and hence levels.

The bad news is that restructuring often involves the loss of existing jobs. Job losses are usually costly to the workers that suffer them, but this does not mean those losses should be repressed. Instead there should be assistance given to those who lose jobs to help them financially in the short term while they find new jobs, an issue taken up in chapter 5. Attempts to slow or stop industry restructuring do not work in the end and may even lead to larger not smaller employment declines. Long-run job security is not provided when a company is forced to maintain excess employment. A failure to restructure weakens companies and makes them less able to compete in the long run. The ultimate adjustment of employment may be greater and more costly.

The main industry among the case studies where restructuring need not involve a net loss of jobs in the industry is retailing, where jobs could probably be gained in France or kept in Germany if more flexible land use allowed the growth of specialty retailing and if wage levels were market determined. The United States uses shopping malls to do this, and these are very popular with consumers. But there are other alternatives, more consistent with Europe's desire to preserve the existing downtown areas, that could be chosen instead, such as the development of urban shopping districts.

The lessons for product-market regulation and deregulation from the case studies can be summarized as follows.

- *Procompetitive product-market reform has been tried in Europe and it is working.* As examples, the auto industry in France and utilities in Germany have responded to deregulation and competitive pressure and raised productivity.
- *There are still many sectors where reform is needed*. Many industries remain productivity laggards and the direction of movement is not always positive. Examples include the utilities in France and the banks in Germany, both of which maintain overemployment and do not achieve best-practice operational performance.
- *It is essential to identify the ways in which regulation provides a barrier to competition and productivity improvement in each industry*. The barriers are often quite specific to a particular industry. It is important to identify the barriers to change and performance improvement and then do something about them. Barriers are often justified by a variety of more or less plausible rationalizations: "In our country people do not want to shop in the evenings," for example, or "our consumers do not want to buy trashy products from discount stores." Instead of coming up with rationalizations, it is better to give consumers the opportunity to shop in the evening and give low-income families the opportunity to buy low-price clothing for their children. They can choose for themselves rather than having choices made for them by regulators or politicians.
- *Implicit as well as explicit barriers can be important*. Many barriers to the entry of new competitors are hidden quietly in the way laws and reg-

ulations are administered in practice. Providing low-cost financing to an incumbent auto producer can slow down the process of restructuring, for example. Another example is that regulation of the water used in beer manufacture discourages the consolidation of the German beer industry.

- *Land-use policies create a large barrier to the creation of new businesses and new jobs*. Zoning laws are of course essential, but they should be eased to allow more development. Policies to encourage more flexibility of land use can encourage development without reducing green space.
- One way of shifting land use policies is to *make sure that the entity that is controlling land use is closely connected or the same as the entity that receives the property tax and a portion of the other tax revenue that results from economic development*. If local authorities receive most of their revenue from a central government, they will have only a modest incentive to favor new land use and job creation. If economic development requires expensive new infrastructure, this can create a strong incentive for local authorities to refuse permission for economic development.
- *Capital-market pressure can be a valuable addition to product-market competition in forcing productivity increases*. This was a conclusion from the France-Germany study. It was not the most important factor in any one industry, and the results are hard to document because it was not generally possible to talk about specific company performance in the results. But looking across the results, the productivity laggards were often companies that were not facing strong shareholder pressure. To improve performance takeovers should be facilitated, not forbidden. And companies that have lost competitive advantage should be allowed to cease operations and not be propped up by bailout loans.
- *Labor-market reform must accompany product-market reform.* Product-market reform leads to the restructuring of firms and industries and likely will result in layoffs. Without labor-market reform and greater wage flexibility these will lead to lower employment and higher unemployment. The benefits from restructuring an industry to raise productivity will accrue to the whole economy only if either output expands in that industry enough to maintain employment levels or labor is redeployed into other activities.

The Role of IT in Productivity in Europe: Is an IT Policy Needed?

In setting their goals in 2000, the EU Council clearly believed that IT was a key element in improving economic growth and even employment. Part of the statement of goals says that Europe should become "the most competitive and dynamic knowledge-based economy in the world. . . ." To achieve this, it argues, requires "preparing the transition to a knowledge-based economy and society by better policies for the information society and R&D. . . ."[25] In the discussion in previous sections, based on the OECD study of the sources of economic growth or in the McKinsey case studies, there was little emphasis given to technology or technology policy. It is time now to consider the role of IT and whether there are technology policies that could add significantly to European growth.

In 2000, it appeared there was a clear story to tell about productivity growth in Europe compared to the United States. The United States in the 1990s had learned to make use of advances in IT and increased its own productivity growth. Europe had not invested as heavily in IT and had not increased its productivity growth. In order to improve their economic performance, European countries had to learn to take advantage of the new technologies.

The discussion of the productivity revival in the United States has shown that the first link in that chain, while not broken, shows more complexity and uncertainty than had been thought. The United States did benefit from new technologies, certainly in the industries producing the hardware and in industries using IT hardware and software. But the United States may have overinvested in the IT-using industries or not invested wisely. We saw that there was not a clear relation between the industries whose productivity accelerated after 1995 and the industries whose IT investments increased.

The idea that the root cause of Europe's slow productivity growth in recent years is the result of a failure to use enough IT or to use IT effectively is one that has been developed in several studies. It is worth reviewing the nature of the evidence that emerged from these studies. Even though we disagree with their final assessment, they were serious and careful studies and it is important to see what they had to say. In deciding what Europe should do to improve its economic performance it is important to determine whether increasing the usage of IT and improving the way IT is used will substantially help performance.

25. In Lisbon in 2000 EU leaders also launched the *e*Europe Action Plan, aimed at "bringing Europe online." Benchmark targets were set up in areas such as access to the Internet, price of Internet usage, e-commerce, and online public services. This Action Plan was subsequently renewed in 2002 with the *e*Europe 2005 Action Plan. See the European Commission *e*Europe Web site at www.europa.eu.int/information_society/eeurope/2002/action_plan/mid-term_review/index_en.htm for an overview of the plan's current content. The Action Plans are predominantly a passive monitoring exercise of numerous IT-related benchmarks and, while these do have linkages to other EU initiatives, do not entail significant independent expenditures or legislative action. The *e*Europe Action Plans hence cannot be said to constitute an *EU IT policy*. Other broader goals of the Lisbon agenda, such as the goal to raise R&D expenditure to 3 percent of GDP, are also not specific *EU IT policies*.

The Role of IT in European Economic Growth

The OECD economic growth project described earlier took place over an extended period. Prior to the main report (OECD 2003f) that was reviewed earlier in this chapter, there was an earlier study entitled *The New Economy: Beyond the Hype* (OECD 2001c), which makes a careful assessment of the role of IT in growth (the OECD terminology is to refer to information and communications technology, or ICT). The report acknowledges that there was a great deal of hype around the new economy, which resulted in an overstatement of what the technology had done or could do. But in the end, it says: "Nevertheless, the evidence suggests that something new is taking place in the structure of OECD economies. Furthermore, it is this transformation that might account for the high growth recorded in several OECD countries. A surge in hardware and software investment is one consideration, while ICT appears to have brought 'soft' economic benefits too, like valuable networks between suppliers and more choice for consumers, notably thanks to the Internet. Crucially, ICT seems to have facilitated productivity-enhancing changes in the firm, in both new and traditional industries, but only when accompanied with greater skills and changes in the organization of work" (OECD 2001c, 10).[26]

This conclusion is measured and actually not that different from the conclusion we reached earlier in this chapter in assessing the evidence on the United States. The report argues that productivity growth differences among the OECD countries are accounted for by a variety of factors, of which IT is only one, and that IT raises productivity only when it is accompanied by business system innovation.

Bart van Ark, Robert Inklaar, and Robert McGuckin (2002) make a forceful argument that Europe's failure to achieve stronger productivity growth in the 1990s was, to a substantial degree, the result of its failure to take advantage of IT in key service industries, such as retail and wholesale trade. Table 3.4 is taken from their paper and shows the pattern of productivity growth for the United States and the European Union from 1990 to 1995 and from 1995 to 2000 broken down by the industries that produce IT and those that use IT. The big difference in performance lies in the IT-using service industries. In further analysis, the authors carry out the same calculations for each of the EU countries separately and the same basic pattern seen in table 3.1 applies individually to France, Germany, Italy, and Britain, the countries that have been the focus of this book.

As van Ark, Inklaar, and McGuckin (2002) point out themselves, however, these industry findings do not show that IT alone is the reason for the productivity growth differences. There could be other factors that

26. There was also a follow-up study by the OECD, *The Economic Impact of ICT* (OECD 2004f), which concluded that ICT continued to be an important source of productivity increase, despite the slump in ICT spending.

Table 3.4 Labor productivity growth (value added per person employed), 1990–2000 (by industry group, average annual percent change)

	European Union		United States	
	1990–95	**1995–2000**	**1990–95**	**1995–2000**
Total economy	1.9	1.4	1.1	2.5
ICT-producing industries	6.7	8.7	8.1	10.1
Manufacturing	11.1	13.8	15.1	23.7
Services	4.4	6.5	3.1	1.8
ICT-using industries[a]	1.7	1.6	1.5	4.7
Manufacturing	3.1	2.1	–0.3	1.2
Services	1.1	1.4	1.9	5.4
Non-ICT industries	1.6	0.7	0.2	0.5
Manufacturing	3.8	1.5	3.0	1.4
Services	0.6	0.2	–0.4	0.4
Other	2.7	1.9	0.7	0.6

ICT = information and communication technology

a. Excluding ICT-producing industries.

Source: van Ark, Inklaar, and McGuckin (2002, table 6).

were at work and one way to see this is to look more broadly at the pattern of speedups and slowdowns. The focus of attention has been on the relatively rapid growth in the United States in the post-1995 period, but one could also ask why the United States grew so much more slowly than the European Union in the first half of the 1990s. The industries that do not use IT intensively, based on the van Ark, Inklaar, and McGuckin assessment, achieved fairly rapid productivity growth in the European Union (much faster than in the United States) before 1995, and then much slower growth after 1995. In part, the explanation of the puzzle of slow growth in Europe in the late 1990s depends on changes that took place in the industries that were not intensive users of IT.[27] The bottom-line conclusion the authors draw from their study is similar to that of this book,

27. There are also some measurement questions. The data on IT investment and use by industry are not very good in Europe. In the van Ark et al. study, industries are assigned to the different categories based on the IT intensity of the same industry in the United States, not on how much IT is used in Europe. And when deciding whether a particular US industry is IT intensive or not IT intensive, the basis for the decision is the share of IT capital in total capital. Alternative assignments could be considered, such as IT capital per worker, or IT capital per unit of output. The answers might be different. For example, retail trade is a large industry that had a large acceleration of productivity in the United States after 1995. Based on IT capital per worker hour, it is not that intensive in IT use. Based on share of IT capital in total capital it is classified as IT intensive and that helps drive the results of this study. The procedures used in this study are very sensible, but other approaches might give somewhat different perspectives.

that IT is important but not by any means the only driver of productivity or productivity differences across economies.

Two IMF economists, Markus Haacker and James Morsink (2002), go a bit further and make a spirited case for IT as the key source of productivity growth based on regression analysis. They use growth accounting to compute a residual estimate of multifactor productivity (MFP) growth for 20 OECD countries. This procedure, you may recall from the prior discussion, assumes a substantial contribution of IT capital to the growth of output. The authors then take this MFP residual and ask whether the acceleration or deceleration of MFP after 1995 in each country is related to IT expenditure or IT production in the country. They find that it is, using a variety of different specifications. Somewhat surprisingly, they conclude that *expenditure* on IT hardware has a more significant impact on productivity growth than does the *production* of IT hardware.[28]

These results are interesting and suggestive. The question mark about them is the extent to which investment in IT hardware was a cause or a consequence of rapid economic growth. The authors of the study acknowledge the potential problem of reverse causality and it is an easy criticism to level at many statistical studies of economic data—we questioned the exogeneity of the independent variables in the OECD study also. The problem is of particular concern in this case, though, because IT hardware has become part of the backbone of any modern economy and the faster the overall economic growth, the faster will be the pace of investment in IT hardware. There is a strong possibility that rapid GDP growth leads to rapid IT hardware investment, rather than vice versa. This is not just a business-cycle issue. It will arise for longer time periods also.

It is important to question the results of aggregate studies, but this does not mean their results should be discarded completely. These analyses are valuable and interesting and the results surely reflect the fact that indeed the use of IT does play a role in understanding Europe's productivity performance. The question of determining exactly how much remains open, however. Moreover, this approach to understanding the impact of IT leaves open the issue of how IT is affecting growth and what barriers may exist to its use in a country or sector or company that is making less use of IT than in best-practice industries or companies—a point we suspect the authors would agree with.

The additional way to add information to the debate about the importance of IT to growth in Europe is to reexamine the industry case studies and see how companies are actually using or failing to use IT effectively. The MGI studies did ask specifically how IT had affected productivity in the case industries so we will summarize their findings in this area.

28. Surprising because we know almost as a matter of arithmetic that since IT-producing sectors had very rapid MFP growth in the 1990s, the larger the share of these industries in GDP, the faster will be the growth of MFP.

The study found clear examples where IT played a critical role in generating productivity growth. For example, in mobile telecom the industry was essentially created by developments in technology, while in retail banking new technologies allowed back-office automation, created the opportunity for a shift to electronic payments and for online banking. The team concluded that technology developments were the source of about half of the gains in productivity in retail banking in France and Germany in the 1990s.

There were examples where industries in France and Germany had failed to take full advantage of the productivity-increasing advances in technology. In retail banking the improvements in back-office automation did not produce the reductions in employment in Germany that could have been achieved, because of the difficulty of laying off workers. In retail, the advanced supply chain management systems used in the United States had not been put in place in Europe to the same degree. These systems allow collaborative supplier relations when used with key IT applications such as point-of-sale data on individual products, data warehouses, forecasting tools, and development of a common IT platform for information sharing. In road freight, IT-based network optimization tools were not implemented in France and Germany to the same extent as in the United States.

There were also examples going in the other direction, however, where a US industry had not achieved the productivity gains from IT that had been reached in France or Germany. Mobile telecom, as we have seen, was an area where suboptimal scale in the United States reduced productivity. In retail banking, paper checks account for a very large fraction of the payment transactions in the United States, thereby reducing the use of electronic funds transfers and reducing productivity in payments, compared to its potential.

While its primary focus was on the case studies, the McKinsey team also evaluated the aggregate data on IT spending in France and Germany. They concluded that the gap in IT spending to the United States was not as great as had been suggested in some studies because in-house IT development is larger in France and Germany than in the United States. In 2000, they estimate that internal IT spending was 1.4 percent of GDP in the United States, compared with 1.8 percent in Germany and 1.7 percent in France. Overall IT spending by users in 2000 was 7 percent lower in Germany than in the United States and 18 percent lower in France (this discussion refers only to spending by users of IT, not producers of it).

On balance, the conclusion from the case studies is that IT is indeed used somewhat more intensively in the United States than in Europe.[29] So the findings do provide some support for the studies cited. That support

29. See also Inklaar, O'Mahony, and Timmer (2003) for industry-level detail of higher US usage of IT.

is limited because the overall study shows clearly that the driver of productivity growth in these industries in France and Germany is not just IT and often is not primarily IT. In many cases, in fact, IT is not a central reason for the productivity increase. Furthermore, much of the difference in IT use comes from the fact that some industries in Europe are less consolidated than in the United States and have more traditional operating formats. The team often found that when comparing similar operations across countries—auto plants or large financial institutions—then IT is used in very similar ways in the two regions.

The Lisbon Accord said that the radical transformation of the European economy that the EU leaders wished for would take the form of a shift to an information economy. And indeed the European economy, like that in the United States, is becoming an information economy to a greater and greater extent each year. But it is a mistake to think that the main focus of growth policy should be on finding ways to push IT onto companies or individuals. With the possible exception of the study by the IMF authors, none of the evidence discussed above leads to the conclusion that Europe should embark on a deliberate policy effort to increase the use of IT in companies. Given the collapse of IT spending in the United States, we doubt the European Council would have placed the same emphasis on the information economy if it were to rewrite the Lisbon Accord today.

To the extent that more IT is needed, the biggest impetus to this in Europe would come naturally from the overall reform of the economy. As industries consolidate and modern production facilities and retail formats replace more traditional formats, European companies seem capable of determining when IT investment will pay off.

Of the policy suggestions about IT use developed in the OECD's *New Economy* study (OECD 2001c, figure 11.1, 28), two stand out as being appropriate responses to a desire to enhance the benefits of IT.

- According to the OECD's price comparisons, the United States had by far the lowest price for IT equipment in the 1990s. The price of office and data-processing machinery (averaging 1993 and 1999 prices) exceeds the US level by nearly 30 percent in Britain, by over 30 percent in France, by close to 40 percent in Italy, and by about 45 percent in Germany. The purchase price of the equipment is only one element in total IT costs, so equalizing hardware prices will not change overall IT costs in proportion. Nevertheless, there is no reason for these price differences, since the same companies are selling hardware in both regions. And the high prices must discourage IT use to some degree. EU countries should take an easy step on the way to a more competitive economy by eliminating the barriers to competition that create these price differentials in the market for IT hardware. Removing restrictions on imports or Internet sales would likely be all that was needed.

- Education is not a focus of this book, but the evidence of rising wage inequality and the increase in the return to education suggests that there is a substantial payoff to education that may be linked to the shift to an information economy. Making sure students acquire the skills needed for IT use is a necessary condition for expanded use of the technology. It is encouraging to note that *e*-education to improve IT skills for students and teachers—and in fact all Europeans—features prominently in the *e*Europe Action Plans mentioned above.[30]

30. The opening statement for the *e*-education part of the Action Plans is "Every European citizen should be equipped with the skills needed to live and work in the information society. *e*Europe proposes to connect all schools to the Internet, to adapt school curricula and to train teachers to use digital technologies." See European Commission Web site at www.europa.eu.int/information_society/eeurope/2002/action_plan/eeducation/index_en.htm.