Order Code RL32457

Manufacturing and Information Technology Trends in the United States and Other Industrial Countries: A Review of Major Studies

July 7, 2004

Stephen Cooney
Industry Specialist
Resources, Science, and Industry Division

Manufacturing and Information Technology Trends in the United States and Other Industrial Countries: A Review of Major Studies

Summary

The performance of the U.S. manufacturing sector, including the loss of manufacturing jobs, has been long and widely discussed, but the issue has intensified since the recession of 2001. Less widely noted is that other industrial economies have also seen a loss of employment in manufacturing. With increased labor productivity, employment in manufacturing has declined in most industrial countries, as well as the more industrially advanced developing economies. This point was discussed in CRS Report RL32179, *Manufacturing Output, Productivity and Employment*.

Two reports in 2004 by international bodies have analyzed the comparative performance of U.S. manufacturing in ways that provide a report card on relative U.S. performance. Both reports rate the U.S. economy as more effective than other industrial countries, in using information and communications technologies (ICT) to enhance competitiveness and growth.

The Commission of the European Union (EU) in its study, *Fostering Structural Change: An Industrial Policy for an Enlarged Europe*, found that while European industry overall has not suffered a decline in output since 1979, it has failed to match the United States in two key respects. First, U.S. manufacturing has had superior growth to the EU in labor productivity since 1995. Secondly, the EU report found that this is because of better productivity and output growth in ICT products, and in applying ICT in delivery of services.

The Organization for Economic Cooperation and Development (OECD) in 2004 produced a study, entitled *The Economic Impact of ICT*, which was the latest in a series of comparative analyses. It ranked the United States as the highest among industrial countries in its investment in ICT, used to measure "diffusion" of technology within the economy. This propensity to invest in ICT may have contributed to the higher rates of growth seen in the United States, compared to other industrial countries. The OECD research indicated that relatively lower levels of product and labor market regulation in the United States, by comparison with other industrial countries, are important governmental variables in encouraging private sector ICT investment, and its contribution to growth.

This CRS report will not be updated.

Contents

Introduction 1

European Commission Study of Industrial Trends 2
Sectoral Comparison of EU and U.S. Industry 4
EU Policy Conclusions 6

OECD Analysis of the Economic Impact of Information and Communications Technologies 7
U.S. Leadership in Information Technology Investment 8
Information Technology Investment and Regulation 8

Conclusion 10

List of Tables

Table 1. Trends in EU and U.S. Manufacturing Sectors 3
Table 2. Comparison of EU and U.S. Labor Productivity Trends 5

Manufacturing and Information Technology Trends in the United States and Other Industrial Countries: A Review of Major Studies

Introduction

The decline in U.S. manufacturing employment and perceptions of an erosion in the U.S. industrial base have been a concern for U.S. policymakers. After the onset of a recession at the end of 2000, the United States lost nearly 3 million manufacturing jobs over three years, notwithstanding an economic recovery that began in late 2001. Only in early 2004 did manufacturing employment start to recover, adding a total of about 100,000 new jobs on a seasonally adjusted basis from February through May, according to the Department of Labor's Bureau of Labor Statistics. There is widespread concern that the decline in manufacturing employment is mostly permanent, and not just a cyclical decline. Detailed CRS analysis found, however, that accelerated improvement in U.S. labor productivity accounted for a reduction across many industries in hourly labor input required to produce increased manufactured output. That analysis also looked at other countries, finding that "the recent U.S. experience is not unique: manufacturing employment is declining almost everywhere as productivity improves."[1]

Recently, the Commission of the European Union[2] (EU) and the Organization for Economic Cooperation and Development (OECD) published reports including analyses of comparative performance of the U.S. and other economies, especially with reference to the impact of information and communication technologies (ICT) on manufacturing and overall growth. The EU report included a direct comparison of U.S. and European industry. The OECD report studied investment and diffusion of ICT on a comparative basis in industrial economies in Europe, North America and Asia. The two reports are similar, in that they credit the United States, in comparison with other industrial countries, as having more success in utilizing information and communications technologies (ICT) to enhance the transition of its economy, including manufacturing, in the face of rapid global change.

---

[1] CRS Report RL32179. *Manufacturing Output, Productivity and Employment: Implications for U.S. Policy*, p. 39.

[2] Throughout this report, the European Union is considered as the 15 countries that were members before its expansion to 25 countries on May 1, 2004, except as noted. The European Commission acts as its executive body.

European Commission Study of Industrial Trends

The question of European deindustrialization was the focus of the recently released report of the European Commission (hereafter the "Commission"), *Fostering Industrial Change: An Industrial Policy for an Enlarged Europe*.[3] The conclusion was that Europe is *not* deindustrializing, but there were also serious reservations about some current trends in European manufacturing, especially by comparison with the United States.

The concern about "deindustrialization" in Europe arises from the decline in manufacturing's share of value added in the combined EU gross domestic product (GDP).[4] This is shown in the EU report as falling from 27.4% in 1979 to 19.0% in 2001, on a current value basis.[5] The EU report found that "most industrial sectors have recorded job losses," and that the decline in manufacturing employment is considered as a key factor in concerns over "deindustrialization."[6] As shown in **Table 1**, employment has declined in almost all industrial sectors in Europe. Out of 26 manufactured product groups, as selected by the Commission using the International Labor Organization's International Standard Industrial Classification (ISIC), only one, rubber and plastics, had greater employment in 2001 than in 1979.

However, the Commission differentiates between "industrial change" and "absolute deindustrialization." It states that the shift in employment from manufacturing to services reflects in part substantial improvements in labor productivity in manufacturing, a development that makes EU industry more competitive, not less so, in domestic and export markets. Among the 26 manufactured product groups listed by the Commission, only five showed declines in output in 1979-2001. These were textile mill products, clothing, shipbuilding, leather and footwear, and mineral and nuclear fuels. As shown below in **Table 1**, these five product groups are also among the less successful performers in the United States, with respect to both output growth and employment.

---

[3] Released as European Commission document COM(2004)274 final (April 20, 2004). The data in this report are drawn from a detailed statistical analysis published earlier by the Commission, *EU Productivity and Competitiveness: An Industry Perspective*, Mary O'Mahony and Bart van Ark, eds. (Luxembourg: Office of Official Publications of the European Communities, 2003).

[4] The U.S. Commerce Department Bureau of Economic Analysis defines "value added" as the market value of the output produced by an industry, less its intermediate inputs.

[5] EU Commission, *Fostering Structural Change*, Fig. 1.

[6] *Ibid.*, p. 4.

Table 1. Trends in EU and U.S. Manufacturing Sectors

(See notes and sources on next page)	Compound Annual Growth 1979-2001 (%)			
Industry	**Output**		**Employmt.†**	
	EU	**US**	**EU**	**US**
Electronic components (including semiconductors)	8.5	19.3	-0.1	1.8
Computers and office machinery	7.4	22.6	-0.6	0.2
Telecommunications equipment	7.3	5.0	-1.2	-2.8
Radio and TV receivers, consumer audio & video eq.	3.9	2.6	-2.3	-0.8
Chemicals	3.4	1.6	-1.3	-0.3
Electrical machinery	2.5	0.9	-0.7	-1.2
Photographic suppl. & eq., optical lenses, watches & clocks	2.5	0.4	-1.8	-2.6
Electricity measuring-controlling, sci. & medical instruments	2.4	7.1	-0.2	2.8
Rubber and plastics	2.4	4.2	0.6	2.6
Aircraft and spacecraft	2.1	1.3	-0.6	-0.8
Pulp, paper and paper products	2.0	1.2	-1.0	-0.3
Motor vehicles	1.6	2.0	-0.7	0.6
Printing and publishing	1.6	1.4	-0.1	1.2
Non-metallic mineral products. (stone, clay, glass, etc.)	1.1	0.5	-1.3	-0.8
Wood products	1.1	1.3	-1.0	0.2
Insulated wire and cable	1.1	2.6	-1.0	0.7
Food, beverages and tobacco products	1.1	1.5	-0.6	-0.1
Fabricated metal products	0.8	1.0	-0.8	-0.5
Basic metals	0.7	-3.5	-3.1	-3.0
Industrial machinery	0.6	2.1	-1.1	-0.7
Furniture and miscellaneous manufacturing*	0.4	1.8	-0.7	0.4
Clothing	-0.2	0.6	-3.4	-3.4
Shipbuilding	-0.2	0.6	-3.4	-1.3
Textile mill products	-0.8	0.2	-3.2	-2.3
Leather and footwear**	-1.1	-2.9	-3.3	-5.6
Petroleum refining,, coal products and nuclear fuel***	-3.6	-0.1	-2.0	-2.8

Sources: European data from European Commission. *Fostering Structural Change*, Tables 3 and 4. U.S. industry output data from U.S. Dept. of Commerce, Bureau of Economic Affairs. "Gross Domestic Product by Industry data: Shipments of Manufacturing Industries," output and price data reported on SIC basis, 1977-2001. U.S. employment data from U.S. Dept. of Commerce, Bureau of the Census, *Annual Survey of Manufactures* (1979); and, Bureau of Economic Affairs, Office of Productivity and Technology, unpublished data on employment (SIC basis), 2000.

Notes: Industry descriptions altered from EU report for clarity, based on ISIC and U.S. SIC code descriptions. The present report has adjusted U.S. data based on the Standard Industrial Classification (SIC) system, no longer in use in the United States, to try to align categorizations with the EU report insofar as possible for 1979-2001. The following note specific categories where such adjustments were not readily possible:

*Includes recycling industries for EU only.
**Includes non-leather footwear for EU only.
***US does not include nuclear fuel.
†US employment data on SIC basis available through 2000 only.

As found in the earlier CRS report, U.S. manufacturing's share of current-dollar GDP declined in a similar way as it did in Europe during the same period. The CRS report also highlighted the significance of improved labor productivity in the U.S. manufacturing sector.[7] Consequently, as shown in **Table 1**, most U.S. industries increased absolute output levels between 1979 and 2001, even though many also displayed declining employment.

Sectoral Comparison of EU and U.S. Industry

Despite common U.S.-European trends and overall European growth in output, the European Commission in its report nevertheless viewed the data on relative competitiveness with some concern. It noted a significant slowdown in the rate of EU labor productivity after the mid-1990s, as shown in **Table 2**. According to this analysis, the trend in overall EU labor productivity improvement was stronger than in the United States in 1979-1995. The annual EU rate of improvement of labor productivity in manufacturing alone during this period was approximately the same as the U.S. rate, about 3.5%. However, in 1995-2001 the rate of annual U.S. labor productivity improvement in manufacturing increased to 3.8% , according to the EU report, while the rate of improvement in Europe was only 2.3%. The Commission noted that better performance by some EU national economies (Finland, Ireland, Sweden), as well as in the United States, is evidence that a decline in productivity was not an inevitable result of other broad economic trends.[8]

---

[7] See CRS Report RL32179, Figs. 2 and 4, and pp. 7-10.

[8] European Commission, *Fostering Structural Change*, p. 6.

Table 2. Comparison of EU and U.S. Labor Productivity Trends

Annual % Increase:	European Union			United States		
	1979-90	1990-95	1995-2001	1979-90	1990-95	1995-2001
Total Economy	2.2	2.3	1.7	1.4	1.1	2.3
Manufacturing	3.4	3.5	2.3	3.4	3.6	3.8

Source: European Commission. *Fostering Structural Change*, Table 2.

Secondly, the European Commission also commented that, by comparison to the United States, the EU's performance was especially disappointing in "high-tech sectors." A review of **Table 1** shows that the EU beat the United States in 11 of 26 categories, when one compares output growth data in manufacturing on a sector-by-sector basis over the 1979-2001 period. However, the point made by the Commission is that while, "Growth in Europe's labor productivity in sectors with a strong technological content has been robust in comparison with the overall economy ... it has, on the whole, been significantly lower than in the United States in these sectors."[9] Looking at **Table 1**, one can see that this has led to higher rates of U.S. output increases especially in computers and office machines, electronic components (including semiconductors), scientific instruments (a category that includes medical equipment, and measuring and controlling instruments, such as those used in electronics manufacturing), and insulated wire and cable (which includes fiber optics).[10] The Commission found that the gaps between U.S. and EU productivity improvement rates were growing notably in those industries that manufacture ICT equipment. The gap in these trends was also growing in those services that are intensive ICT services users.[11] This will be discussed in more detail when reviewing the OECD analysis below.

---

[9] *Ibid.*

[10] Generally, the EU and OECD reports use the designations "high technology" and "information and communications technologies" (ICT) interchangeably. In the United States, "high technology" may also be used interchangeably with "advanced technology," a concept developed by the U.S. Commerce Department. This includes information technology products, but also a variety of other manufactures, such as biotechnology, pharmaceutical and aerospace products. See for an analysis, Ernest H. Preeg, *The Threatened U.S. Competitive Lead in Advanced Technology Products* (Arlington, VA: Manufacturers Alliance, 2004), p. 2 and **Table 1**. For purposes of comparison, the present report considers only ICT products, as designated by the EU and the OECD, as "high technology."

[11] European Commission, *Fostering Structural Change*, p. 6 and Table 7, with data taken from the more detailed study, *EU Productivity and Competitiveness: An Industry Perspective*. As noted in CRS Report RL32179, pp. 18-19, esp. fn. 35, real (constant-currency) comparisons over time in "ICT" industries are extremely problematic, and the U.S. Commerce Department discourages reliance on such data. To minimize distortions between U.S. and EU output data, the EU researchers adopted the U.S. deflators for these products.

Conversely, the EU report finds that U.S. output growth is slower than in the EU in some traditional industrial sectors. According to Barry Bosworth of the Brookings Institution, in reference to the performance of U.S. industry, "Everybody's talking about high rates of growth in productivity. But it's in two areas: high technology and services. The rest of the goods-producing industries have not shared in this."[12] A number of important U.S. manufacturing sectors have not experienced high rates of productivity growth: cement (included in the ISIC category of non-metallic minerals), fabricated metal products, furniture, printing, food manufacturing, electrical equipment, paper and primary (basic) metals. With the exception of furniture, which the Commission and the ISIC combine statistically with "miscellaneous" manufacturing, U.S. overall output has grown slower, or not appreciably faster than, the EU performance in these product groups, as shown in **Table 1**.[13]

EU Policy Conclusions

Nevertheless, a continued ability to match labor productivity trends and output growth of U.S. industries in certain sectors of traditional European strength, such as chemicals and electrical machinery, is of relatively little comfort to the European Commission. It believes that these product groups are more vulnerable to competition from developing economies, both the more advanced competition from East Asia, and the newer competitors looming in China and India. The Commission believes that there will naturally be shifts of production, as well as research and development activities, to such countries as they become increasingly important to industrial producers' global competitive position. Moreover, competition from these countries will intensify, not only in traditional industries, where cost and market location considerations are paramount, but also increasingly in high technology fields, where ICT technical proficiency is important.[14] While facing such challenges, the Commission believes that the EU is not well positioned, compared to the United States or Japan, in specializing more in industries requiring higher levels of private sector research and development activities and industrial innovation. The report cites data to show that the EU trails the United States in many dimensions on such factors.[15]

The Commission report proposes a multidimensional approach to resolving the problems of lagging EU competitiveness, measured in terms of labor productivity gains and output increases in "high-tech" sectors, with regard to the United States and other industrial regions. It emphasizes the 2004 enlargement of the EU as a unique answer to the competitiveness problem. The Commission views the new member states, particularly the larger economies of eastern Europe, as vital sources of well educated and trained, or highly trainable, labor at competitive wage rates. The Commission believes that this productive potential can be readily integrated into

---

[12] *Business Week*, "U.S. Factories: Falling Behind" (May 24, 2004), pp. 94-96.

[13] These are categories cited as examples in *ibid*., and are based on latest U.S. data, which may not exactly correspond to either the categories listed in the Commission report, or earlier U.S. SIC-based data categories.

[14] European Commission, *Fostering Structural Change*, pp. 10-13.

[15] *Ibid.*, pp. 6-10.

the EU through expansion of the common body of EU law and treaty obligations, and provide a competitive production source across many industries, in both European and export markets.[16]

Beyond EU expansion, the Commission reviewed a range of other policy areas. It argued for increased sensitivity to the need for a "regulatory environment favorable to industry" in competition policy, environmental policy and tax policy. The Commission in particular emphasized the need to encourage research and development (R&D) more systematically.[17] Specifically, the EU has proposed "creation of a 'European Research Area' designed to create an internal market for research and technology and counter the fragmentation currently affecting European research ... [as well as] an action plan to increase investment in research and meet the objective ... of increasing total R&D spending in Europe to 3% of GDP by 2010."[18] The Commission report summarizes this action plan, a similar plan on "innovation policy," and a plan to be proposed for a "strategic agenda on the future of research in the manufacturing industry." The Commission complements the focus on R&D with proposed policies to improve "human capital and worker training," and to "create a coordinated approach of Community policies in the field of ICT."[19]

OECD Analysis of the Economic Impact of Information and Communications Technologies

The OECD Directorate for Science, Technology and Industry in recent years has produced a series of reports and analyses on the "new economy:" generally, the impact of "ICT" on overall economic growth and development. In early 2004, it produced a further report in this series, *The Economic Impact of ICT: Measurement, Evidence and Implications*.[20] As in the EU's analysis, the OECD study makes specific comparisons between the performance of U.S., European, and in this case, some other industrial economies.

The focus of the most recent OECD study is on the key question that the European Commission policymakers have been grappling with, namely what encourages a greater "diffusion" of ICT into the general economy? The bulk of the

---

[16] *Ibid.*, pp. 14-17.

[17] For a concise discussion of the present state of European government-industry cooperation especially in ICT and the semiconductor industry, see the section on "European Partnerships" in Charles W. Wessner, ed., *Securing the Future: Regional and National Programs to Support the Semiconductor Industry*, (National Research Council: Washington, 2003), pp.137-148.

[18] As of 2000, total EU R&D spending was less than 2% of GDP; *OECD Science, Technology and Industry Scoreboard*, 2003 ed., Fig. A3. By comparison, the U.S. total was 2.8% of GDP in 2001 (National Science Foundation, *Science and Engineering Indicators, 2004*, vol. 2, Table 4-43).

[19] European Commission, *Fostering Structural Change*, pp. 17-27.

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

study examines a number of firm and industry comparative studies in specific OECD countries. The authors admit that many of their conclusions are tentative, in part because the data series are not definitive. ICT diffusion, the subject of the study, is itself a relatively new phenomenon, and reliable data series do not have a long history. The present CRS report focuses on the second chapter in the OECD study. This develops cross-national conclusions and comparisons, based on "recently developed official statistics," which the authors feel "provide a sound basis for international conclusions."[21]

U.S. Leadership in Information Technology Investment

The OECD report finds that the United States leads the other economies, in terms of how much of its capital investment has gone into ICT.[22] ICT investment is measured as a share of gross fixed non-residential capital formation in each of 18 countries. In 2001, the U.S. percentage was about 28%; it was the only country whose percentage of such investment was greater than 25%.[23] Also, when measured against the levels of 1980 and 1991, the U.S. percentage of capital investment in ICT had increased progressively and steadily. Among other countries, the United Kingdom, Sweden, the Netherlands, Canada and Australia each placed more than 20% of capital investment in ICT, Finland was above 17%, Germany, Japan and Italy were above 15%, Ireland was just at 15% (but growing rapidly), and France was about 12% (just above Portugal, at the bottom of the group). Considering also the absolute size of the U.S. economy by comparison with the other countries, this statistic alone indicates how large is the U.S. lead in terms of its installed ICT base, and, presumably, the competitive advantage thereby derived.

Information Technology Investment and Regulation

The OECD report sought to find indicators of what encouraged or discouraged firms' investment in ICT. Much of the report examines specific case studies and microeconomic indicators, such as the size of firms that utilize ICT and specific reasons why firms do not make ICT investments (such as concerns with data security and lack of trained personnel). But of particular interest with regard to the policy perspective were the findings of the OECD study with respect to the "business environment" that governments create for the operation of companies. The OECD report found that higher levels of investment in ICT is generally linked to lower levels of detailed government regulatory control in an economy, defined as "product market regulation" and "employment protection legislation." These two measures

---

[21] *Ibid.*, ch. 2, "The Diffusion of ICT in OECD Economies," by Dirk Pilat and Andrew Devlin.

[22] "ICT" for the purpose of this project consists of the "high tech" manufacturing categories identified by the European Commission in the comments above on Table 1, plus consumer electronics, and the following ISIC services categories: wholesale of machinery, equipment and supplies; renting of office machinery and equipment; telecommunications; and, computer and related activity, including consulting, maintenance and data processing services; *ibid*., p. 21.

[23] The latest available data may be from an earlier year for some countries in the list.

were based on "summary indicators" developed in an earlier OECD working paper.[24]

Product market regulation was based on a series of measures of government intervention in the economy. These measures included relative size of the public enterprise sector, its scope, role of legislation in controlling public, privatized and private enterprises, administrative burdens on enterprises, legal barriers (including barriers to entry for new enterprises), licensing requirements and price controls. The OECD report used an index scale from 0 to 6 to measure levels of product market regulation among 18 member countries, including the United States, Japan and most EU member states. All countries scored within a range of <1.0 to 3.0. The authors of the chapter related this index to the level of investment in ICT as a share of non-residential gross fixed capital formation. According to the authors:

> ... Product market regulation can limit competition ... Since ICT offers firms new capabilities, *e.g.*, in selling or purchasing on-line, firms may be able to enter markets and introduce products and services that were not feasible before ... ICT might thus enable the introduction of competition in markets that were previously characterized by low competition, for example a national or regional monopoly. Product market regulations may also reduce the incentives for firms to innovate and develop new ICT applications.

The study found that "Countries that had a high level of [product market] regulation in 1998 had lower shares of investment in ICT than countries with low degrees of product market regulation." The United Kingdom, the United States, Australia and Ireland were the only countries among the 18 studied with a score of 1.0 or less on the product market regulation scale, and as noted above, the first three also ranked above 20% in the ratio of ICT investment to gross capital formation. The three countries with the highest levels of product market regulation (index scores >2.0) were Italy, Greece and France, which also ranked among the lowest countries in ICT investment intensity, at 15% or less. Germany and Japan ranked about the middle on both dimensions.[25]

The OECD report also measured the extent of ICT investment against the strictness of employment protection legislation. Again, the OECD constructed a six-point scale based on legislated restrictions on working hours, notice and severance pay requirements for "no-fault" dismissal of permanent, full-time workers, and constraints on temporary employment.[26] The authors hypothesized that, "If firms cannot adjust their workforce or organization and make ICT effective within the firm, they may decide to limit investment or relocate activities."

---

[24] OECD. Economics Dept. Working Paper no. 226, "Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation," by G. Nicoletti, S. Scarpetta and O. Boyland (ECO/WKP (99) 18, April 2000).

[25] In statistical terms, the correlation between the two indices was -0.54. *Ibid*., p. 30 and Fig. 2.10. The OECD authors noted that the market regulation rankings were based on 1998 data, and that some countries had passed new liberalizing legislation since then.

[26] OECD. Nicoletti *et al.*, "Summary Indicators," pp. 40-43.

The authors found a fairly strong negative correlation between scores on this six-point index of employment protection legislation and the ratio of ICT investment intensity. The United States was by far the lowest-scoring country on employment protection legislation and the highest on ICT investment intensity. The United Kingdom was second-lowest in employment protection, and second-highest in ICT investment. Following what some in Europe call the "Anglo-Saxon model," Australia and Canada both scored 1.0 or less on the employment protection index and were among the leaders in ICT investment. Among the continental European countries, Denmark scored lowest on employment protection and third-highest on ICT investment. Netherlands and Sweden both scored high (more than 20%) on ICT investment, but both were over 2.0 on employment protection. However, Japan and Germany scored between 2.5 and 3.0 on employment protection, compared to their mid-range scores on ICT investment. France, Spain, Italy, Greece and Portugal were all above 3.0 on the employment protection legislation index and were also among the lowest scores on ICT investment. The OECD report's authors also noted that two independent studies published in 2002 confirmed such links between levels of legislated employment protection, ICT investment and productivity performance.[27]

Conclusion

As noted in the European Commission study, many factors influence manufacturing performance, not all of which are covered here. The EU authors state, for example, that they did not consider the impact of exchange rates or trade issues on industrial performance. But within the limits of the EU and OECD reports, the main features of a comparison between U.S. and European manufacturing performance are reasonably clear.

- Manufacturing in both Europe and the United States experienced declines in its shares of the overall economy, in terms of both employment and current-value GDP. However, manufacturing output has increased over this period, so that it may be misleading to talk about "deindustrialization."

- The European Commission is concerned, however, that the U.S. manufacturing sector has clearly been outperforming Europe since the mid-1990s in information and communication technologies (ICT), the fastest-growing "high tech" sectors of modern economies.

- OECD economists, comparing performance across many industrial economies, find that the United States has had by far the highest rate of growth in ICT investment. They also find that such investment in the United States appears to be positively influenced by the relatively low degree of product market regulation and legislated employment protection compared to other industrial countries.

---

[27] Correlation between the indices was -0.65. *Ibid.*, p. 30 and Fig. 2.11. The employment protection index was based on legislation in place in 1998.

Both the EU and the United States are examples of mature industrial economies (as is Japan, also included in the OECD study), which are struggling with the effects of multiple transitions. The ratio of jobs in manufacturing to those in services is declining, high labor productivity in manufacturing means fewer well-compensated manufacturing production jobs per unit of output, and ready availability of trainable labor in developing countries in an increasingly globalized world economy has encouraged offshore outsourcing of industrial products and processes. Both the EU and the OECD studies appear to conclude that the U.S. manufacturing economy has outcompeted its EU counterpart, not in all product groups, but certainly in promoting the manufacture of ICT products and the application of ICT throughout the economy.

With different purposes, the EU and OECD studies appear to arrive at differing policy conclusions. Emphasizing the policy areas under its purview, the European Commission foresees that Europe can address the problem of lagging labor productivity and investment in ICT through full integration of new member countries in the internal EU market, greater and more systematically coordinated support of R&D within the EU, and attention to other policy areas, such as competition policy.

Though focused on the microeconomic factors that appear to promote or hinder firms' adoption of ICT, the OECD study comes to an unambiguous conclusion with respect to the "business environment" provided by government: higher levels of product market regulation and legislated job protection effectively discourage wider use of ICT in industrial economies. Among eighteen OECD member industrial nations, the United States clearly had the highest percentage of investment in information and communication technologies as a share of gross non-residential fixed capital investment. The United States also scored the lowest on an index of strictness of employment protection legislation, and was in the lowest-scoring group on strictness of product market regulation. From this comparative review of the policy evidence contained in these international studies, it would appear that increased governmental efforts to regulate product and labor markets in the business environment reduces the investment in information technology and, possibly, its contribution to overall growth.