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Working Party on the Information Economy

RECENT DEVELOPMENTS IN THE ICT SECTOR

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FOREWORD

In June 2003, this report was presented to the Working Party on the Information Economy (IE). It was recommended to be made public by the Committee for Information, Computer and Communications Policy in October 2003.

The report was prepared by Mr. Vladimir Lopez-Bassols of the OECD's Directorate for Science, Technology and Industry. It benefited from inputs from Mr. Pierre Montagnier and Mr. Graham Vickery. It is published on the responsibility of the Secretary-General of the OECD.

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RECENT DEVELOPMENTS IN THE ICT SECTOR

Introduction

It is widely accepted that ICTs played an important role during the recent period of strong economic expansion in a wide range of OECD countries through their impact on productivity growth via three main channels:

- Production (faster productivity growth in a sector which itself is growing).
- Investment (capital deepening).
- Usage/diffusion (efficiencies from reorganising activities with the help of ICTs).

Although a detailed analysis of the current economic downturn is beyond the scope of this paper, it is useful to begin by mentioning some background elements which help to place the recent trends in the ICT sector and ICT demand in context. It has been observed that the current downturn is different from previous ones in that it has been mostly driven by the collapse of business investment and recent OECD work (Dalsgaard *et al.*, 2002) suggests that the business cycle itself is changing and that some of these changes can be attributed to the growing role of ICT. For example, its diffusion may improve inventory management, which in turn allows firms to adjust production (and employment) levels more rapidly. Concerns have been voiced from many sides about the situation of the IT industry, and whether the current decline in IT investment could impact future growth and productivity (OECD 2003a). This could potentially be due to continuing slow growth in the ICT sector itself, a slow-down in capital deepening as ICT investment remains flat, and a slow-down in the impacts of usage/diffusion across the economy as the productivity pay-offs of earlier investments are reaped. Therefore an analysis of the recent trends in the supply-side and the overall health of the sector can provide insights into how the demand for IT products and services is evolving, which in turn reflects the increasing role that these technologies are playing throughout the economy.

It is difficult to predict when a recovery will take place and how strong it will be, both in the overall economy, and in IT markets (see Figures 1 and 2). However, we can expect IT-related developments to play a greater role in OECD economies than in the past, as the sector itself accounts for a larger share of economic activity (including output, employment, trade, and R&D) while maintaining high rates of productivity growth and as the use of IT expands across other sectors (OECD 2002a, 2003b).

This note provides an update on recent trends in the ICT sector drawing on a wide range of sources, using official data where possible. Although it attempts to cover developments in all regions, data limitations oblige us to draw extensively on the United States, which is still the largest ICT producer and user. The note begins by presenting recent data on the severity of the slowdown in the ICT industry as well as some initial evidence of a forthcoming upturn in the industry. It then proceeds to examine firm-level developments including changes in IT budgets and financial data for some large ICT firms. Finally it lists some positive and negative factors which could potentially drive the demand for IT investment, thus affecting the timing and nature of the upturn in the industry, without attempting to engage in forecasts for specific markets. This note provides a basis for further work on this topic to be undertaken in the context of

the 2004 *Information Technology Outlook* and complements the analysis of recent developments in the telecommunications sector contained in the 2003 *Communications Outlook* (OECD, 2003b).

A significant obstacle for this type of analysis is the lack of consistent short-term indicators covering the ICT sector and ICT investment for many OECD countries, which creates a challenge in attempting to obtain a global picture of the most recent trends and to adequately grasp cyclical developments in supply and demand.¹ An initial country-by-country compilation of available short-term indicators from official national sources covering ICT² shows that sectoral coverage is usually much better for ICT manufacturing sectors than for ICT services and, in both, it is often limited to a few key variables such as production and employment.

Examining the downturn - Is the trend reversing?

The ICT sector

The underlying questions that this note addresses are: (i) whether the late 1990s boom in the ICT sector was unique; and (ii) to what extent can we expect ICT markets and investment to return to the earlier high growth rates after the current downturn. Looking back at the second half of the 90s we see that the ICT sector was probably growing at unsustainable rates, bolstered by the fact that it was enjoying higher rates of return on investment and higher earnings than other sectors (IMF, 2001). ICT firms relied heavily on the stock market, external financing and short-term debt making the sector more vulnerable to economic downturns and shifts in investor confidence.³ There is reason to believe that many of the growth factors in play during this period (mostly on the demand side) are unlikely to be repeated, at least in the short-term (Gordon, 2002):

- The growth of the commercial Internet brought about important one-off investments which will not be repeated in the next few years.
- Y2K concerns moved forward hardware and software replacement cycles.
- Stock market excesses financed the high-tech investment boom, but now that the bubble has burst, investors are likely to be more cautious in the future.
- Unrealistic expectations of future demand compounded by a glut in supply, for example the over-building of installed fiber-optic capacity.

Evidence of the downturn in the United States from the supply-side includes sharp declines in shipments, new orders, sales, and exports. Shipments of communication equipment and components were growing at annual rates in excess of 15-20% during 1999-2000; but by late 2001 they were declining by more than 30% (Figure 3). Shipments began to decline in mid-late 2000 while inventories continued growing, particularly telecommunication equipment and components (Figures 4-5).

¹ OECD work on short-term indicators is carried out by the OECD Statistics Directorate (STD) through the newly established Short-Term Economic Statistics Expert Group (STESEG). See <http://www.oecd.org/EN/document/0,,EN-document-0-nodirectorate-no-20-29933-0,00.html>

² The Appendix to this document contains a list of additional short-term data sources on ICT.

³ For a detailed analysis of the crash in the telecom sector, see OECD (2003b) and *OECD Economic Outlook* 73, Chapter 4, "After the Telecommunications Bubble".

US ICT exports continue to decline due to weak demand from all regions (Figure 6). Likewise in Canada, ICT exports are still sluggish, in particular due to the sharp drop of communication equipment exports which tumbled by more than 60% from their peak in Q2 2000 (Industry Canada, 2003). ICT manufacturing trade in OECD countries (average of imports and exports) declined in 2001 by around 13%.⁴ Although complete data are not yet available for 2002, it can be expected that the impact of this sharp drop in worldwide demand for ICT goods has been strongest in countries which have specialised in ICT exports (e.g. Ireland, East Asia) (IMF, 2001). In Ireland, the share of ICT goods in total exports has recently been declining after a peak of 35% in December 2000, to less than 25% since 2002 (Figure 7).

Labour market data from the United States also confirm a serious downturn despite the growing trend demand for skilled IT workers. Employment in computer and communications equipment manufacturing continues to decline, while growth in IT services has stagnated since 2001. On the other hand, although layoffs in the IT manufacturing sector (computer and electronic products) are still high (as measured by total initial claimants), at more than 15 700 during the first quarter of 2003, this figure is more than 20% lower than during the same period in 2001 and 40% lower than in Q1 2002 (Figure 8).

In Japan, production of computer equipment has slowed down considerably since early 2001 (Figure 9) and after a period of strong growth during 2000-2001, sales by IT services firms have also slowed down and recently started declining (Figure 10). In France, sales in the ICT services sector have been relatively more resilient to the downturn while those in ICT manufacturing have suffered a substantive decline since the second half of 2001, particularly electronic components (Figure 11).

Firm-level evidence confirms that sales declines have been the strongest in the US and European markets and that the hardest hit segments were IT hardware and communications equipment (Figures 12 to 15).

In the United States, the decline in ICT shipments has slowed since Q1 2002 (Q4 01 for computer equipment). August 2002 shows the first positive growth in shipments (on a year-to-year basis) since December 2000. Another positive sign is that the inventory realignment in the ICT sector continues (particularly for communications equipment) and inventories have now reached their lowest levels in a decade (when the US Census M3 survey started using NAICS) (Figure 16).

In the case of semiconductors, a decline in shipments in all main regions started in late 2000, and was particularly sharp in Japan and the United States (Figures 17-18). The decline in the Asia-Pacific region was much softer and by mid-2001 this region had surpassed the United States as the number one producing area. By early 2002, the Asia-Pacific was once more enjoying positive (albeit fragile) growth while other regions tend to lag by 2-3 quarters (with shipments declining once more in the United States into early 2003). Wafer fabrication capacity has remained relatively stable since late 2000, while utilisation rates have rebounded from their lows of around 65% in late 2001, to more than 85% in Q2 and Q3 2002, then slightly declining in the last quarter (Figures 19-20).

Evidence from other regions supports this: in Canada, ICT sector output is growing, in particular for electronic components and ICT services (Industry Canada, 2003) and employment is also beginning to rebound, particularly in computer services and software (Figures 21-22). Likewise in Finland and Ireland, two important ICT equipment producing countries, the most recent data suggest that an upturn in the industry (albeit tentative and uneven) is already taking place (Figures 23-24).

⁴ Source: OECD STAN and ITCS databases, 2003.

ICT spending and investment

ICT budgets and spending

Demand remains subdued as firms continue to scale back and defer ICT investments. When earnings begin to pick up, capital expenditure growth can be expected to resume (“accelerator effect”). But most firms do not expect IT spending to recover before 2004. A survey of 500 large US firms (*Infoweeek*, 2002) shows that average IT budgets declined sharply in 2002 (-34%) (Figure 25). IT budgets also declined as a percentage of revenue, from 4.3% in 2000 to 3.3% in 2002, and most of this decline relates to salaries and employee benefits which are the largest component of IT budgets (Figure 26). Anecdotal evidence also suggests that equipment replacement cycles could be lengthening, that new products that are essential for business are not coming on-stream as rapidly as in the past, and that outsourcing, e-business integration and other business strategies are increasing the efficiency of the installed ICT base.

ICT investment

Given the short life cycle of most ICT investments, firms cannot postpone replacement cycles too long. In the United States, ICT investment – unlike other private fixed investment categories – has already picked up since Q1 2002 (Figures 27-28). ICT as a percentage of private fixed investment (in nominal terms) increased between late 1994 and end-2000 by four percentage points (22.5% to 26.6%). This share dropped during 2001 (below 24%) but has since recovered (to almost 26% in Q1 2003) (Figure 29). The drop in hardware investment was sharper, while software was less affected (Citigroup, 2001) and its share of total investment continues to grow (Figures 30-31).

The Netherlands displays similar trends regarding IT investment with computer equipment declining as a share of GFCF, while the share of software continues to grow reaching in 2002 almost twice the share as in the mid-90s (Figure 32). Although data limitations restrict the analysis to software investment, other OECD countries display similar – if less pronounced – trends (Figure 33). Software investment (as a share of GFCF) in Australia grew steadily reaching a peak in early 2001 (over 10%) but has since declined (due to both a slowdown in software expenditure and to a pickup in other types of investment). Software investment in Canada grew steadily in the late 90s reaching around 8% of GFCF since early 2001. New Zealand has followed a similar trend with the share of software in total investment growing by 150% between 1995 and early 2001, but remaining steady around 4% since. On the other hand software investment in the United Kingdom displays a different evolution: its share has remained relatively low and stable since the mid-90s (between 2.8 and 3.7% of GFCF). Although these figures provide some indication on time trends within countries, they should not be compared directly across countries given significant differences existing in the measurement of software investment (Ahmad, 2003).

Assuming that rates of technological innovation do not slow down (in particular for semiconductors), we can expect ICT to continue to be a key investment category due to falling ICT prices, which leads to a substitution effect with regard to other types of investment (Figure 34). However, it remains to be seen whether economy-wide productivity growth will hold up after a period of broad ICT spending decline.⁵

⁵. The OECD Secretariat examined recent productivity trends at the December 2002 meeting of the Statistical Working Party of CIBE. See also OECD (2003a).

Looking ahead

Obstacles

Industry projections suggest that IT budgets will remain tight during 2003-2004 and that only a moderate recovery can be expected in the short-term⁶. Companies are trying to extend computer hardware replacement cycles and price competition puts increasingly strong pressure on margins for producers. In addition, dot-com failures provided the market with a large pool of pre-owned software and ICT equipment. Product cycles for semiconductors shortened during the second half of the 1990's with new chips being released more frequently (in response to increased competitive pressures), but this trend has since returned to a slower pace (McKinsey Quarterly, 2002).

As was mentioned earlier, excessive reliance on certain modes of financing make the ICT sector more vulnerable to economic downturns and shifts in investor confidence. Stock market valuations of ICT firms have dropped dramatically (when it hit its bottom in early October 2002, the NASDAQ index had lost more than 75% of its value since its peak in March 2000) and venture capital investment into the sector has slowed down significantly (Figures 35 and 36). On the positive side, software firms have been less affected by this slowdown, and in early 2003 ICT firms still retain their relative priority for new investment and accounted for almost two-thirds of all venture capital investment in the United States, albeit at much lower levels.

Factors driving future demand

There is increasing evidence that ICTs can contribute positively to business performance and be an important factor in productivity growth (OECD, 2003a). Within firms, benefits are still to be reaped from reorganisation around ICTs (OECD, 2003c). In particular, the following developments are likely to have a positive effect on future demand:

- Demand for software is strong, particularly for optimising systems and infrastructure, as well as for integrating different applications (*e.g.* e-business). Industry projections suggest that outsourcing and IT services will also benefit from this growth trend (UBS, 2002), despite the fact that the IT services market suffered its first year of decline during 2002 (Gartner, 2003).
- Security concerns are an increasing priority for firms of all sizes.
- Open source / Linux are becoming viable business alternatives.
- Demand for storage (hardware and software) is likely to increase.
- Broadband demand from both households and businesses continues to grow and new application such as WiFi will spur new demand (OECD, 2003b).

There is also evidence suggesting that in some OECD countries, the tightness in labour markets which prevailed during the late 90s is now softening and compensation growth is slowing down. If productivity continues to hold up, this will result in lower unit labour costs and increasing margins for firms. Another positive trend is that most ICT firms are holding up R&D budgets despite declines in sales/earnings (Figures 37 to 40) as well as continuing to recruit R&D personnel (Figure 41). In the United States, as demand from businesses begins to resume, demand from consumers has been resilient (Figures 42 and 43),

⁶. A survey of IT managers revealed in July 2002 that only 26% expected their 2002 IT budgets to grow by more than 5% compared to the previous year (Goldman Sachs, 2002). In March 2002, this figure was 33%.

despite recent falls in equity prices which could still hurt future sales by forcing households to postpone equipment upgrades. In the EU, consumer demand has been less affected given lower penetration rates in most countries and the lower share of equities in household wealth.

Conclusions

It is important to differentiate between short- and long-term factors when considering how supply and demand will contribute to an upcoming upturn. The industry is still in a difficult position, and its recovery will depend on the overall business climate and consumer confidence. On the one hand, demand for IT investment will recover gradually, but may not quickly return to 1995-2000 rates, while on the other, technological innovation can be expected to continue to drive the industry and price declines will further contribute to high demand. An important distinction which future work should consider is that not all countries are being affected by the downturn in the ICT sector in the same way. Although growing, this sector accounts for a relatively small share of economic activity (around 10% of business sector value added, on average) and countries have specialised in different sub-segments within the industry (OECD 2002b). Trade and investment linkages will also result in differential impacts across regions as demand continues to recover.

Finally, a challenging question is how will economy-wide productivity growth evolve after a period of lower ICT investment, and possibly, slower innovation? Many observers believe that recent productivity gains are indeed sustainable (Jorgenson *et al.*, 2002; DeLong and Summers, 2001), and that further organisational and technological innovations will continue to contribute to improving the overall efficiency of the economy, as they take time to be adopted and their full potential exploited.

This paper has provided an overview of recent developments in the ICT sector which can be summarised as follows:

- The sector has suffered a serious downturn which has been particularly sharp in equipment (telecom and to a lesser degree computer) as well as in electronic components; software and services have been much less affected.
- Although there are already indications that a recovery in the sector is underway, it will be uneven across regions given differences in the overall economic environment.
- Even though comparable data are scarce, it appears that investment in ICT continues to grow steadily (despite a short-term drop), particularly in software.
- Technological and economic factors should ensure that the demand for ICT goods and services resumes, although probably at lower rates than in the late 1990s.

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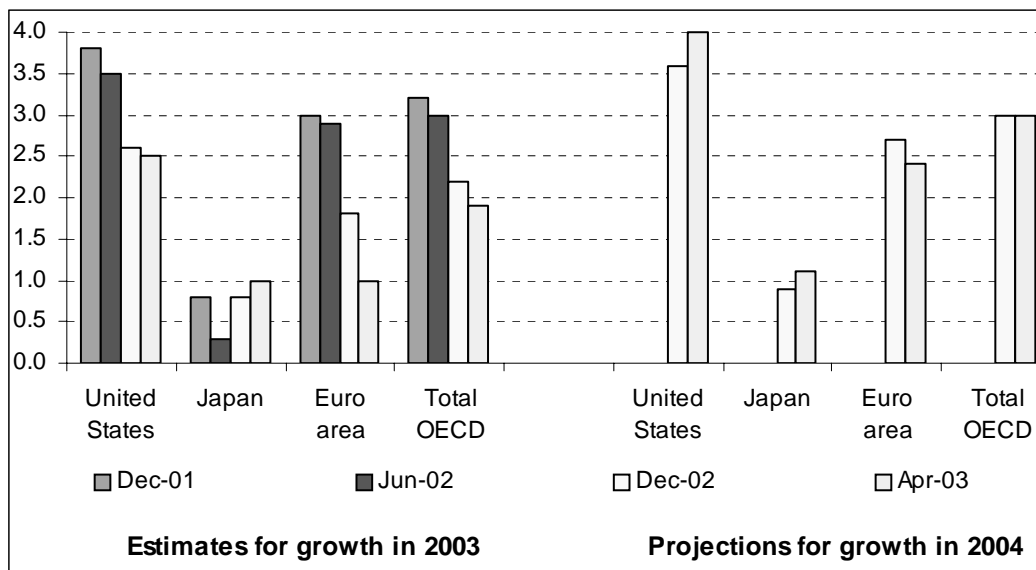
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ANNEX: FIGURES

Figure 1. Revising estimates of GDP growth

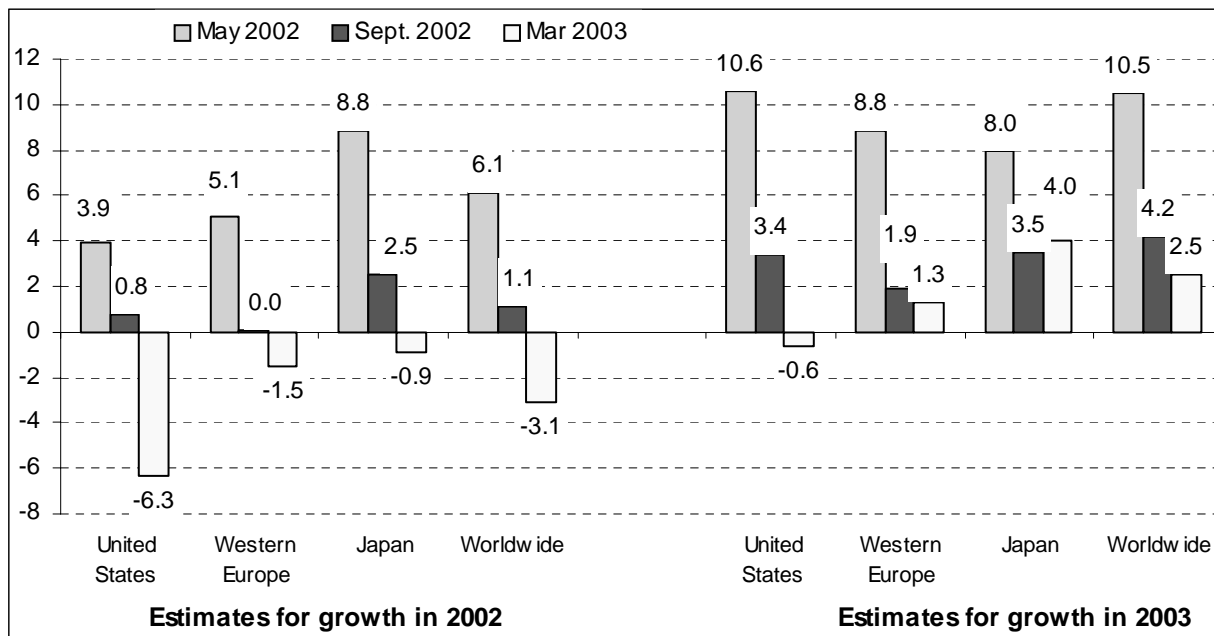
Annual (real) growth rates in %



Source: OECD Economic Outlook, Nos. 70 (Dec. 2001), 71 (June 2002), 72 (Dec. 2002), 73 – Preliminary edition (May 2003).

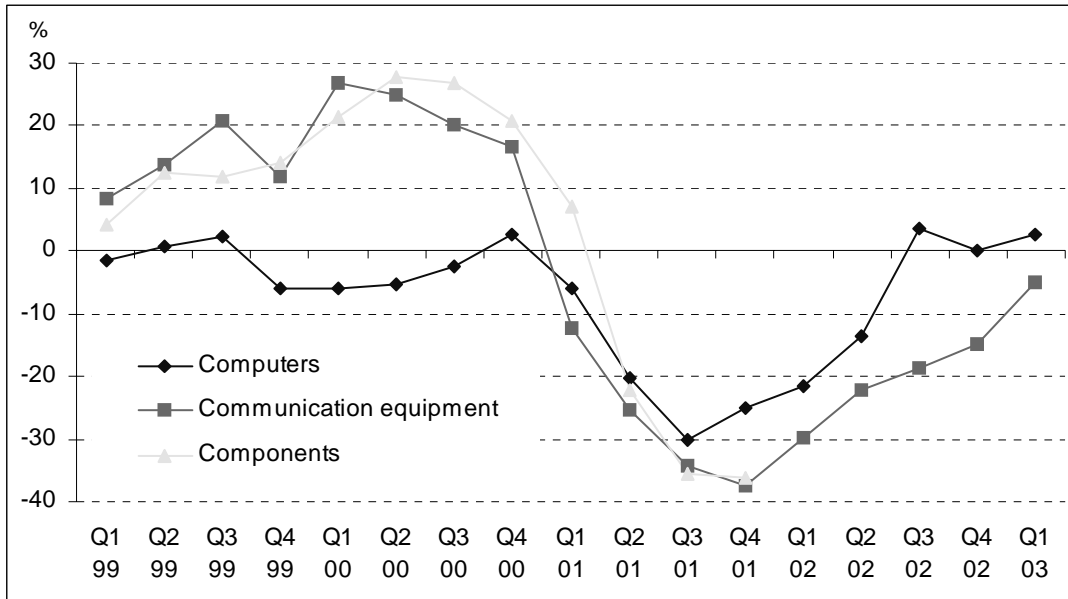
Figure 2. Revising estimates of IT regional market growth

Annual growth rates in %



Source: IDC (2002), various press releases and EITO (2003).

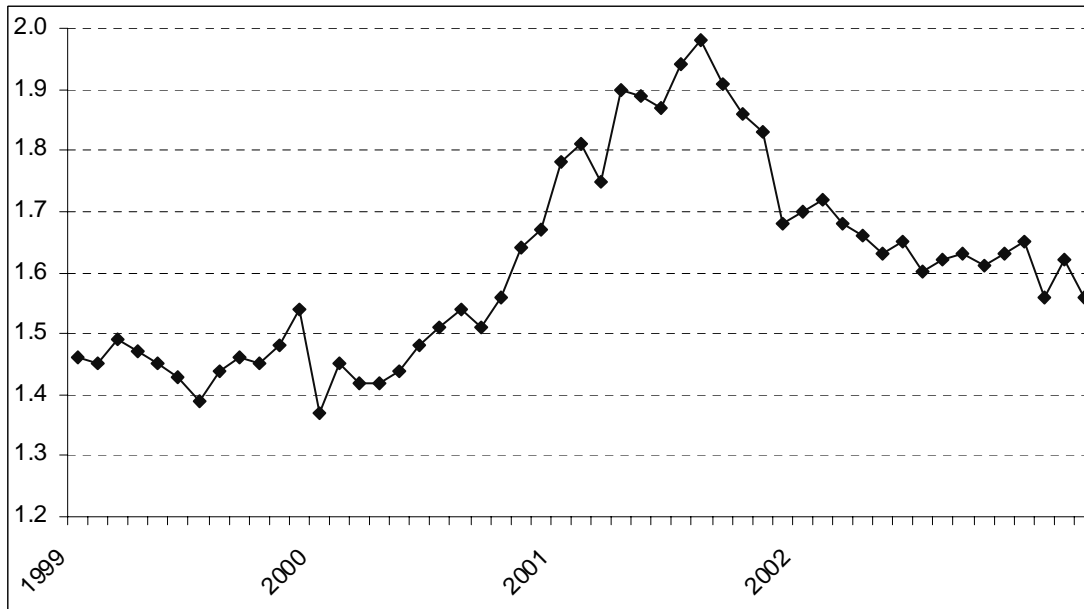
Figure 3. Quarterly US shipments of ICT goods by segment, Q1 99 – Q1 03
Year-to-year change in %



Note: Due to the number of large semiconductor manufacturers choosing not to participate in this voluntary monthly survey, the Census Bureau does not currently produce monthly estimates of semiconductor shipments, orders, or inventories. Data on semiconductors (and total ICT) are only available until December 2001.

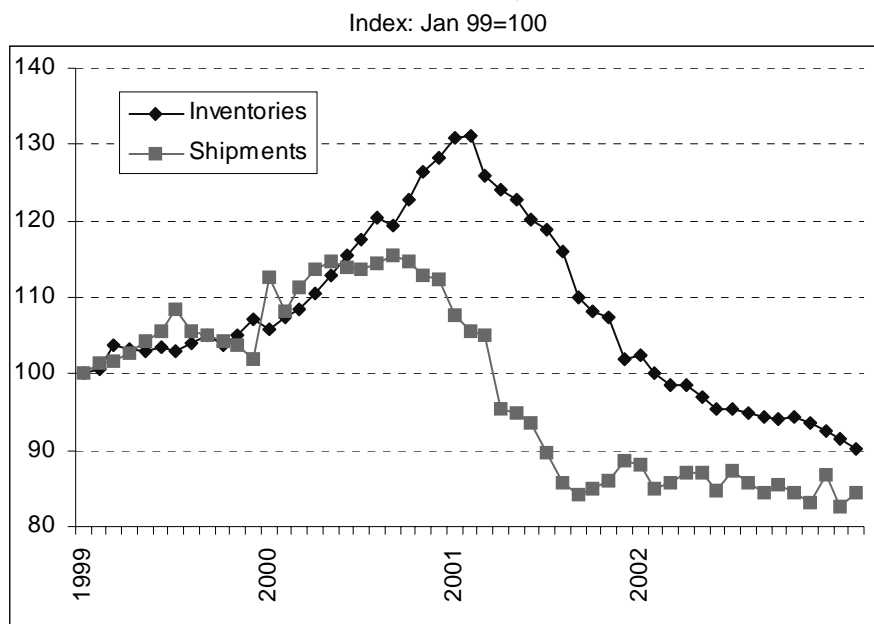
Source: US Bureau of the Census, Manufacturers' Shipments, Inventories and Orders (M3) survey, May 2003. <http://www.census.gov/indicator/www/m3/>

Figure 4. Computer and electronic products, monthly inventories-to-shipments ratio (United States), Jan 99 – Mar 03



Source: US Bureau of the Census, M3 survey, April 2003.

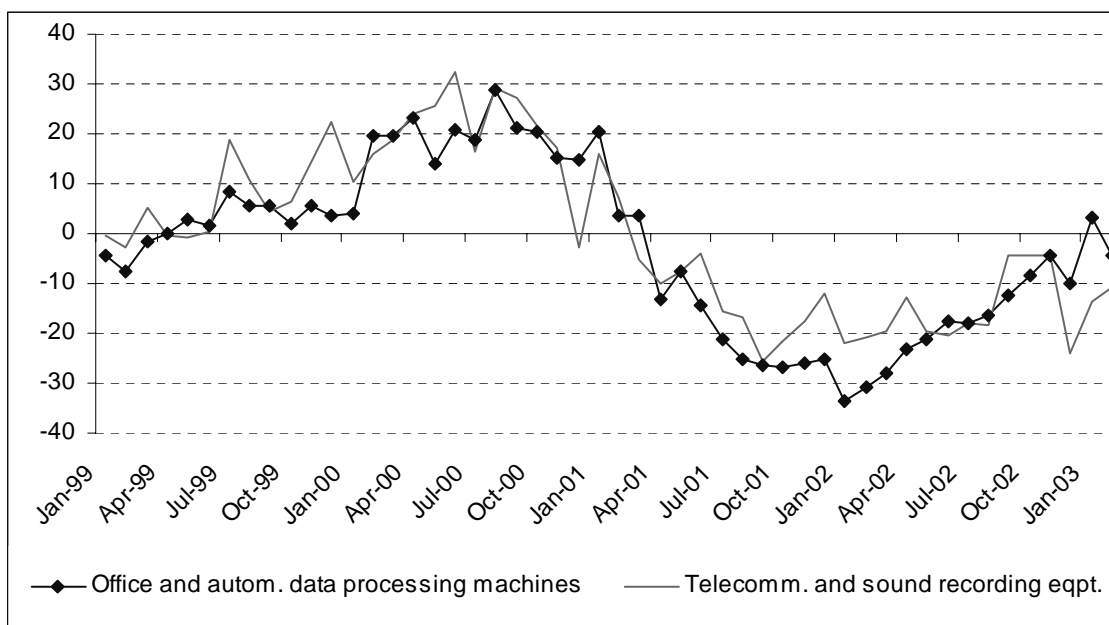
Figure 5. Computer and electronic products (US), monthly inventories and shipments, Jan 99 – Mar 03



Source: US Bureau of the Census, M3 survey, April 2003.

Figure 6. US monthly ICT exports, Jan 99 – Feb 03

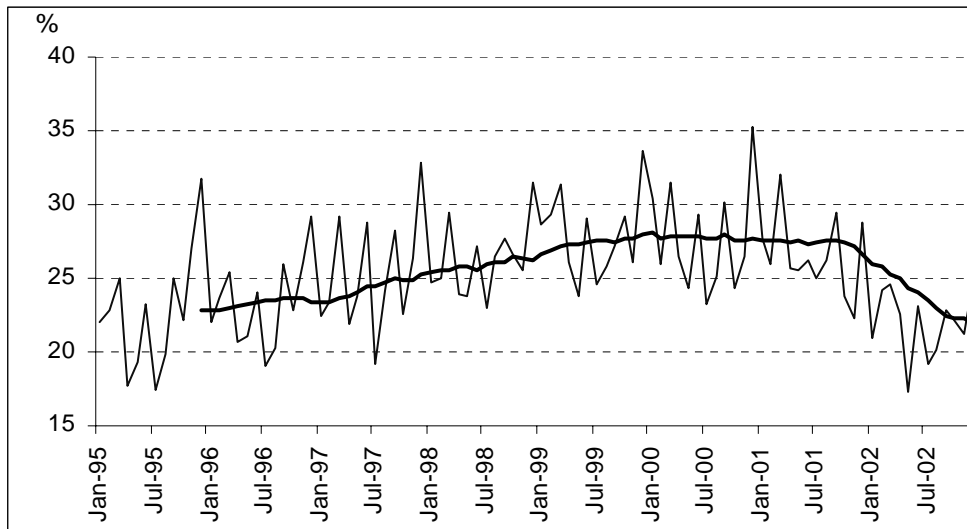
Year-to-year growth in %



Source: US Department of Commerce, International Trade Administration (ITA), May 2003.

Figure 7. Monthly exports of ICT goods (NACE 30+32) in Ireland, Jan 95- Jan 03

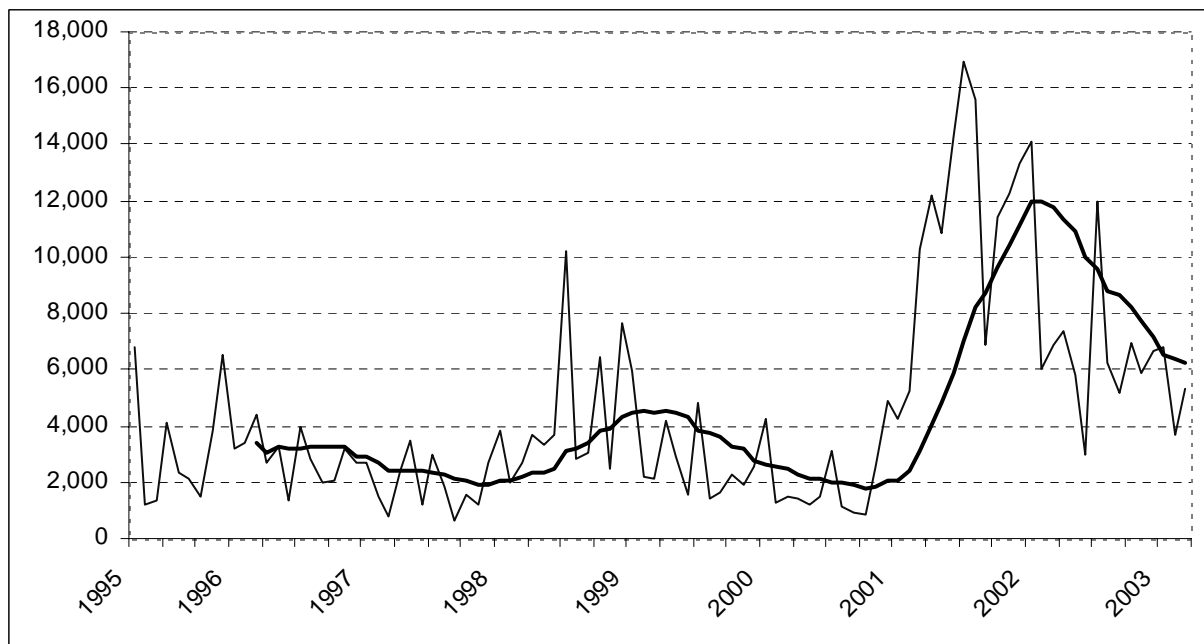
As a % of total exports and 12-month moving average



Source: Central Statistics Office (CSO) Ireland, TSAM-Trade: Imports & Exports by Section/Division (Monthly), May 2003. <http://www.eirestat.cso.ie/TSAMvarlist.html>

Figure 8. Monthly layoffs in the US computer and electronic products industry, Apr 95 – Mar 03

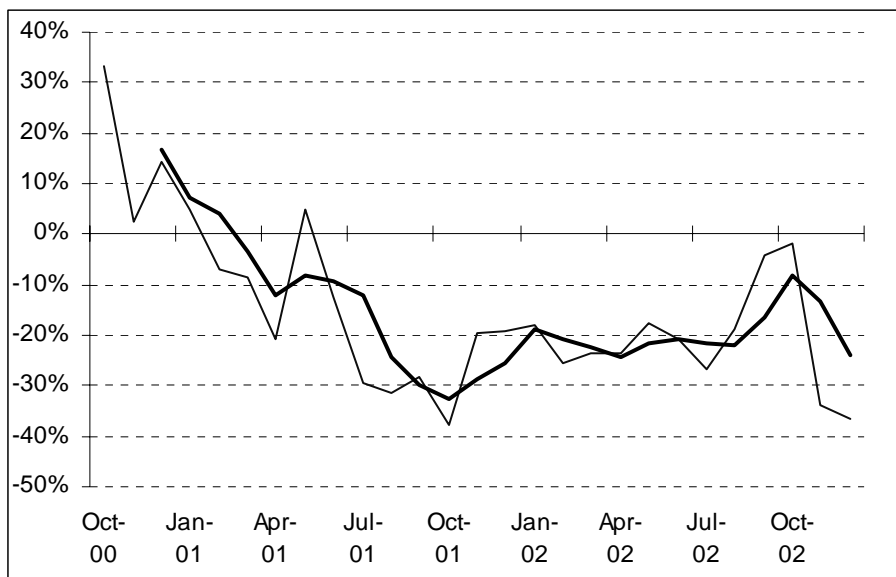
Total initial claimants and 12-month moving average



Source: US Department of Labor, Bureau of Labor Statistics (BLS), Mass Layoff Statistics, May 2003. <http://www.bls.gov/mls/home.htm>

Figure 9. Growth of monthly production of computer processors in Japan, October 2000-Dec 2002

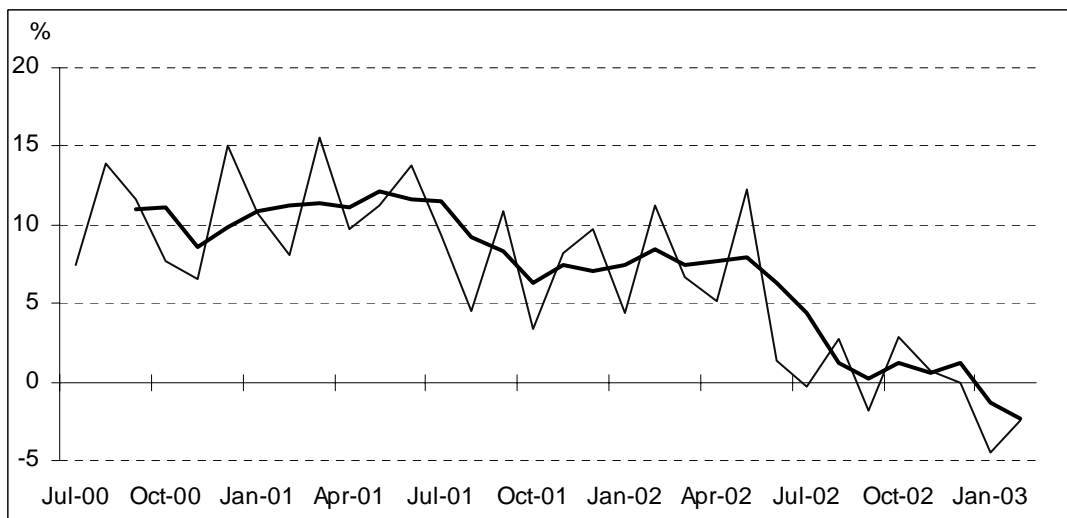
Year-to-year growth and 3-month moving average in %



Source: METI, Monthly Statistics of Japan, May 2003.

Figure 10. Growth of monthly sales by IT services industries in Japan, July 2000-Feb 2003

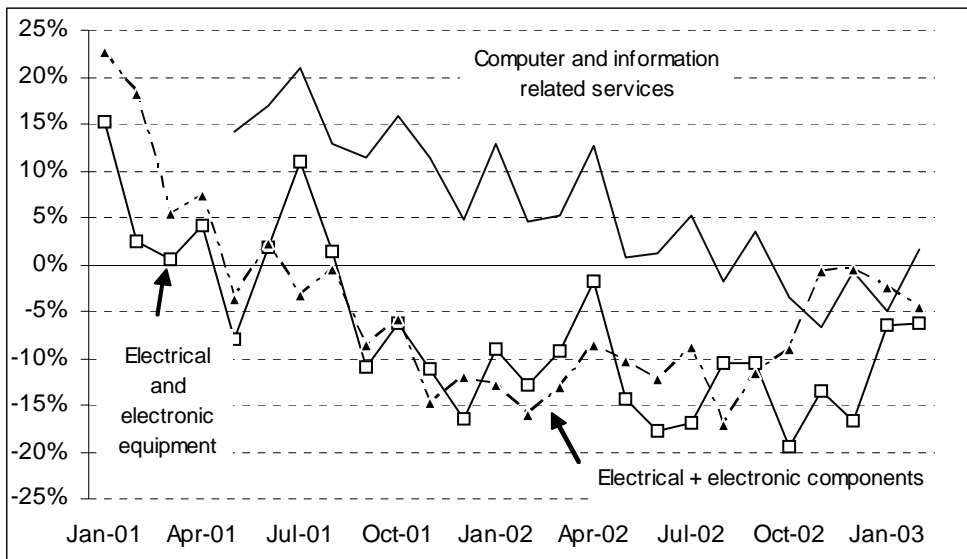
Year-to-year variation and 3-month moving average in %



Source: Japan Information Technology Services Industry Association (JISA), METI Monthly Survey on IT Services Market, May 2003. <http://www.jisa.or.jp>

Figure 11. Growth of monthly sales in selected ICT sectors in France, Jan-01 to Feb-03

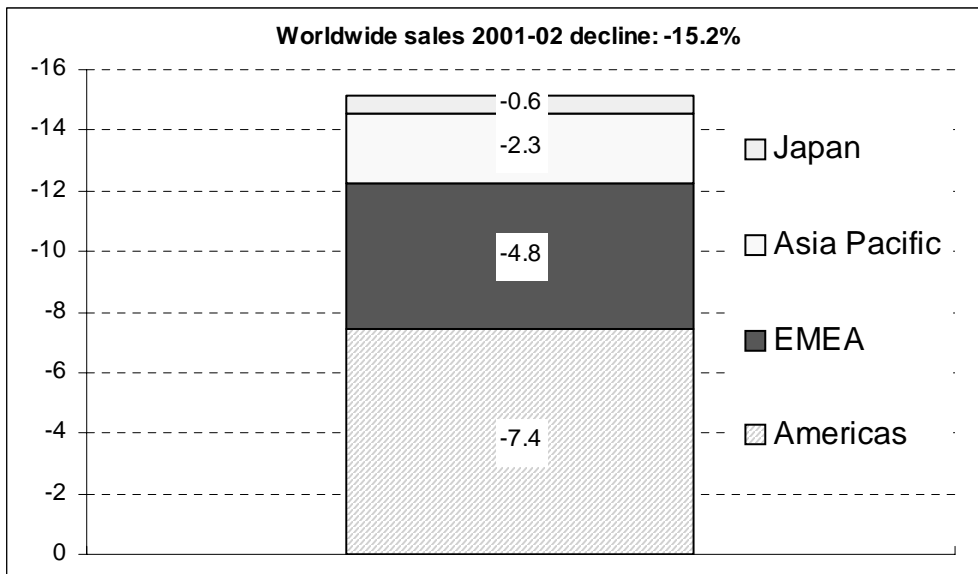
Year-to-year change in %



Source: INSEE, Bulletin Mensuel de Statistiques, May 2003.

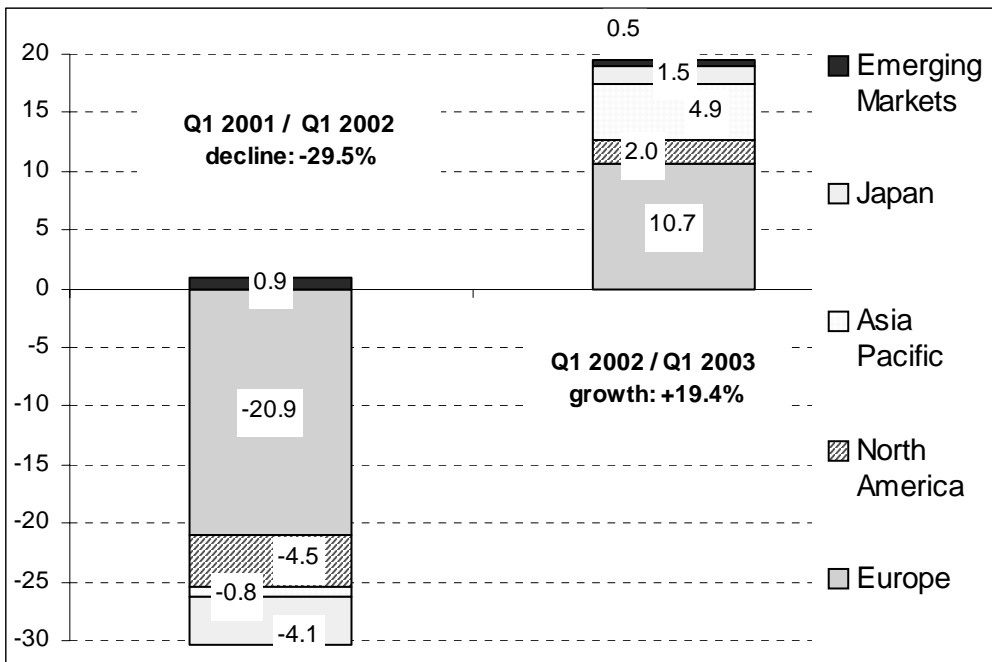
Figure 12. Geographic breakdown of Cisco's 2001 – 2002 annual sales change

(contributions by region in percentage points)



Source: Company annual report (10-K), September 2002.

Figure 13. Geographic breakdown of STMicroelectronics' 2001/02 and 2002/03 sales change
(contributions by region in percentage points)



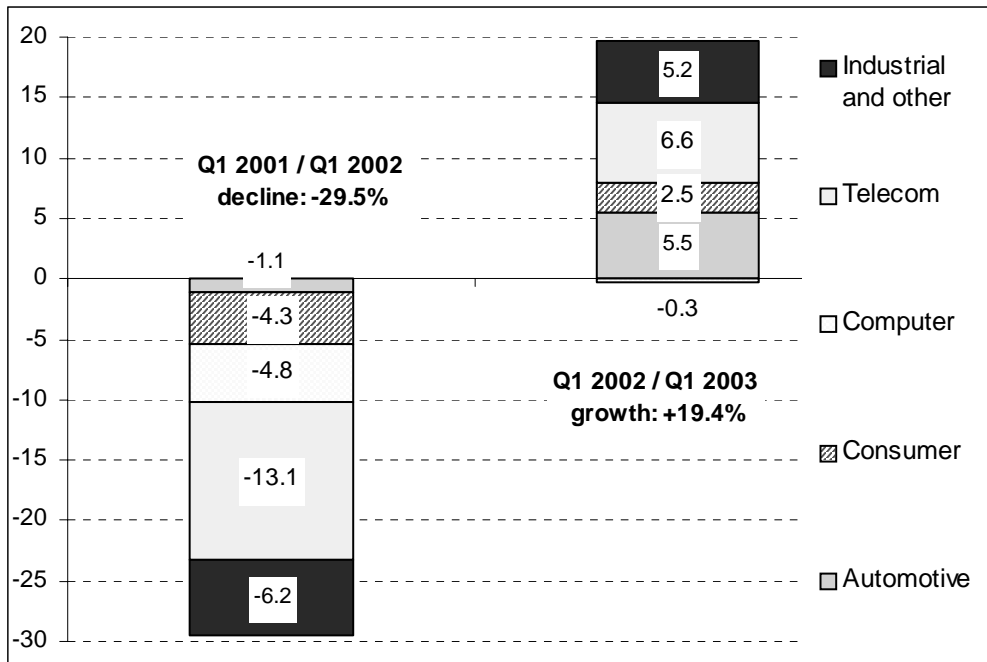
Note: Data refer to 1st quarter of each year.
Source: Various Company 6-K Forms, May 2003.

Figure 14. Breakdown of IBM's 2001 – 2002 sales change by segment
(contributions by main segment in percentage points)



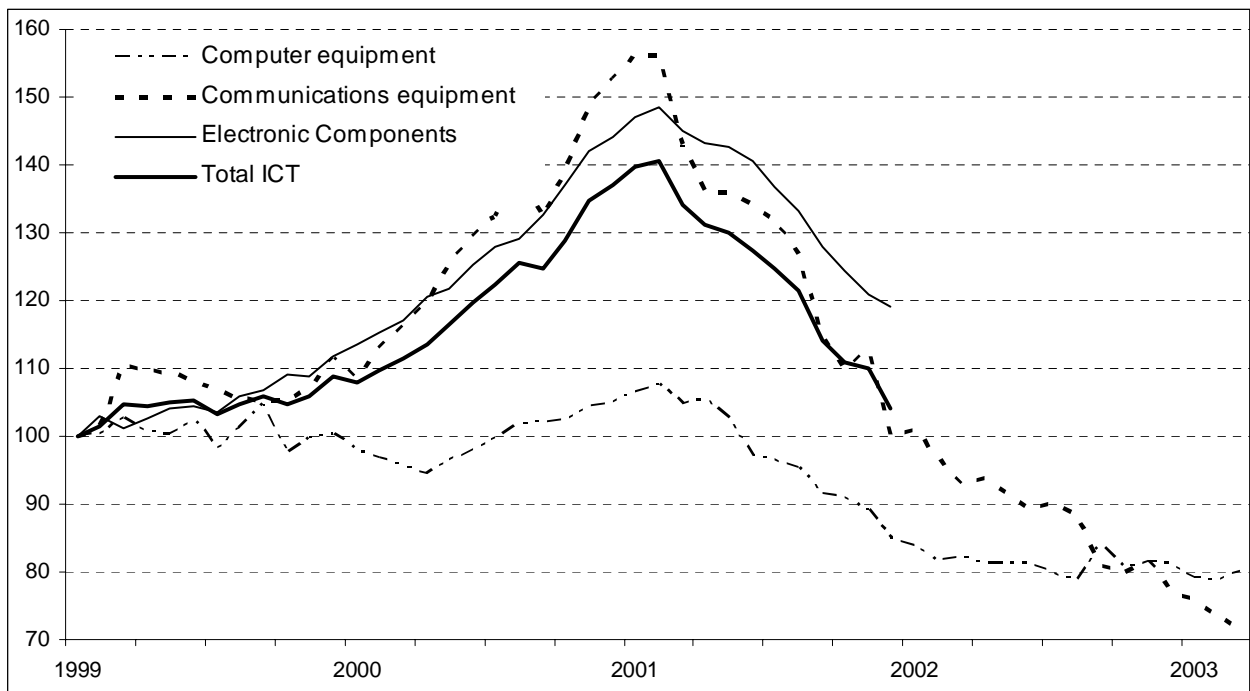
Source: Company 10-Q Form, November 2002.

Figure 15. Breakdown of STMicroelectronics' 2001/02 and 2002/03 sales change by market segment
(contributions by main application in percentage points)



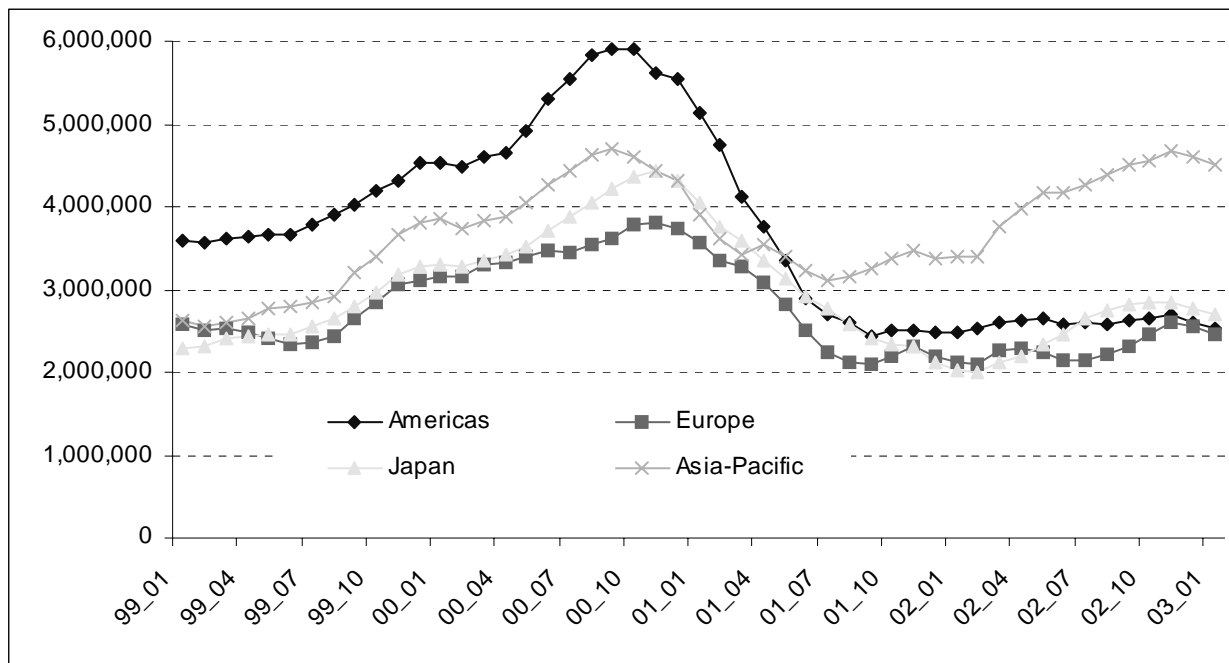
Note: Data refer to 1st quarter of each year.
Source: Various company 6-K Forms, May 2003.

Figure 16. Monthly inventories of US ICT sector firms, by main segments, Jan 99 – Mar 03
Index: Jan 99 = 100



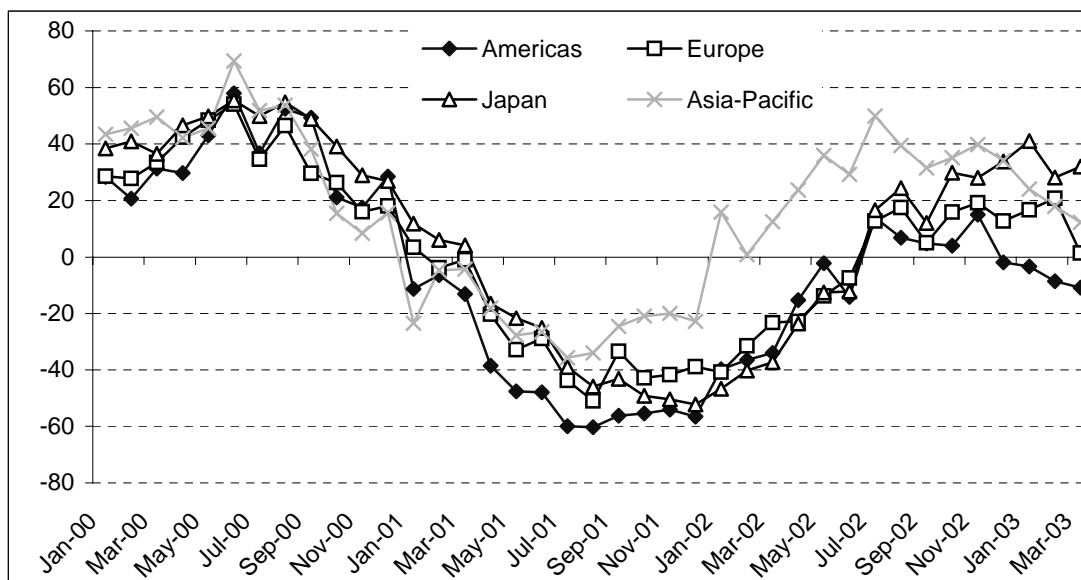
Source: US Bureau of the Census, M3 survey, May 2003.

Figure 17. Worldwide monthly semiconductor billings by main region, Jan 99 – Mar 03
Value in USD '000s, 3-month moving average



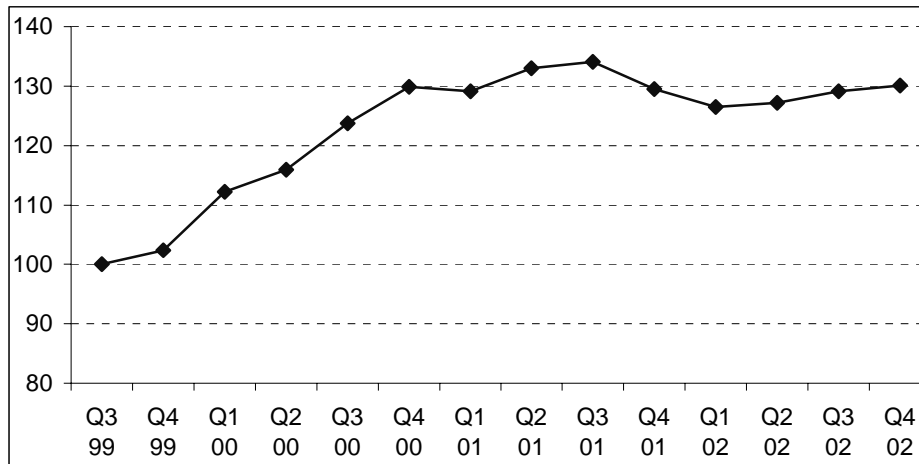
Source: Semiconductor Industry Association (SIA), April 2003. <http://www.semichips.org/home.cfm>

Figure 18. Worldwide monthly semiconductor shipments by main region, Jan 00 – Mar 03
Year-to-year change in %



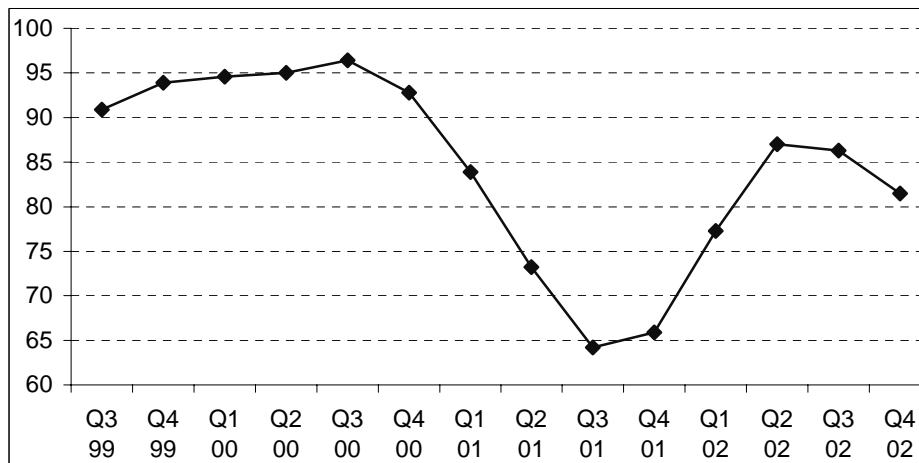
Source: Semiconductor Industry Association (SIA), April 2003. <http://www.semichips.org/home.cfm>

Figure 19. Quarterly Worldwide Integrated Circuit Wafer – Fab Capacity, Q3 99 – Q4 02
 Index: Q3 99=100



Note: Statistics are based on data supplied by manufacturers accounting for the majority of the world's integrated circuit production.
Source: Semiconductor International Capacity Statistics (SICAS), April 2003.
<http://www.semichips.org/home.cfm>

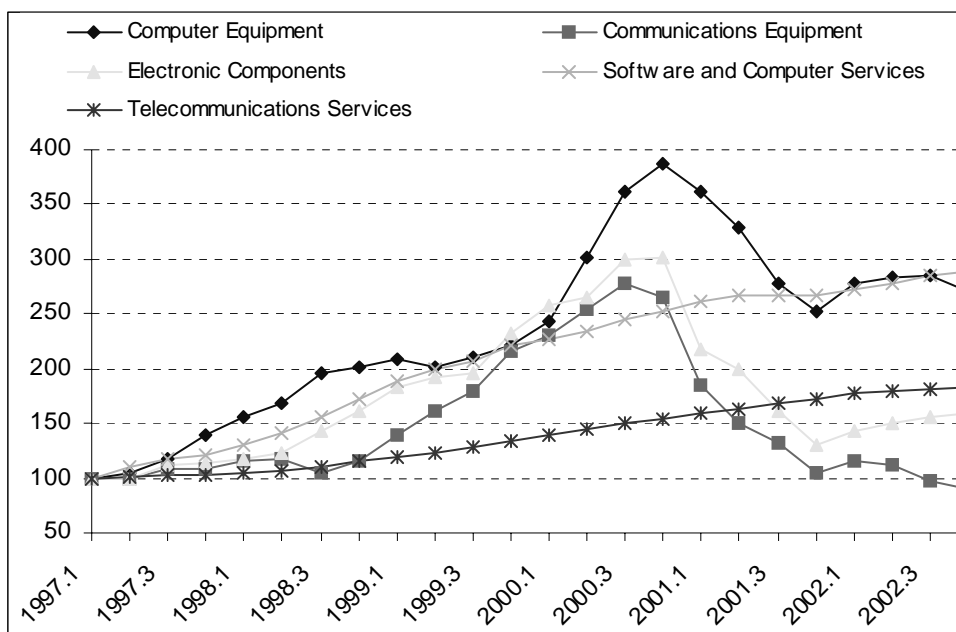
Figure 20. Quarterly Worldwide Integrated Circuit Wafer – Fab Utilisation Rate (in %), Q3 99 – Q4 02



Note: Statistics are based on data supplied by manufacturers accounting for the majority of the world's integrated circuit production.
Source: SICAS, April 2003. <http://www.semichips.org/home.cfm>

Figure 21. Recent trends in output in the Canadian ICT sector

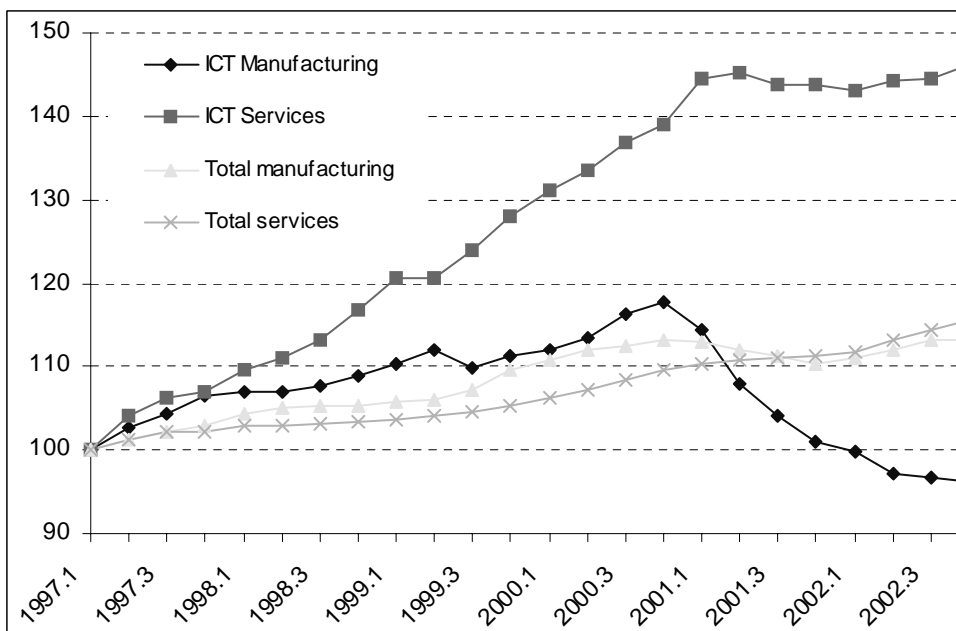
Index: 1997Q1=100



Source: Industry Canada, Quarterly Monitor of the Canadian ICT Sector – Fourth Quarter 2002, March 2003.

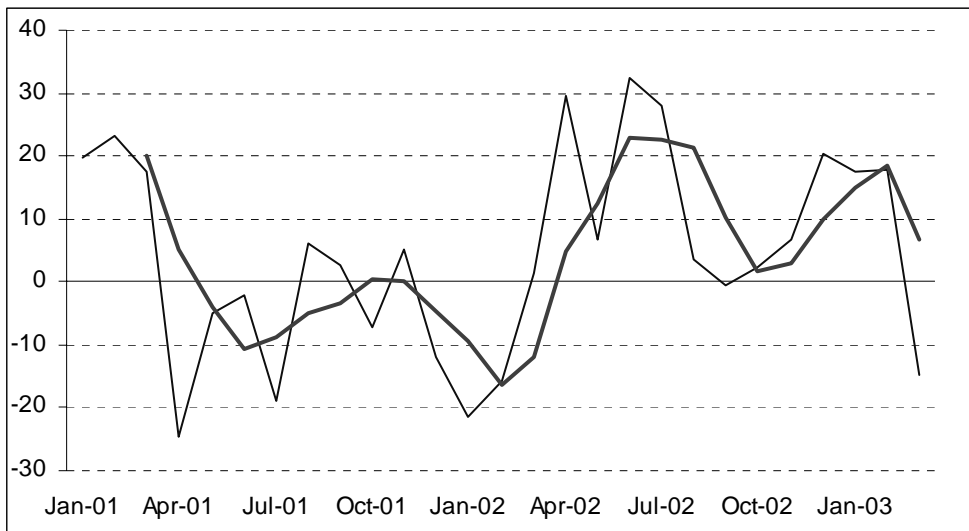
Figure 22. Recent trends in employment in the Canadian ICT sector

Index: 1997Q1=100



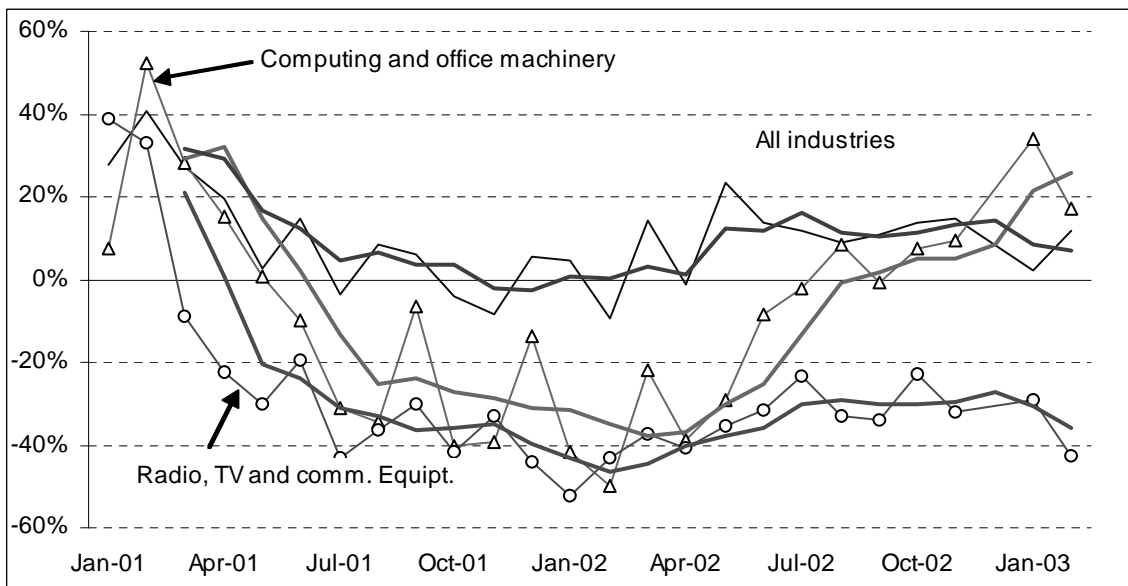
Source: Industry Canada, Quarterly Monitor of the Canadian ICT Sector – Fourth Quarter 2002, March 2003.

Figure 23. Monthly output in the electrical equipment manufacturing sector in Finland, Jan-01 – Mar-03
 Year-to-year variation in % and 3-month moving average



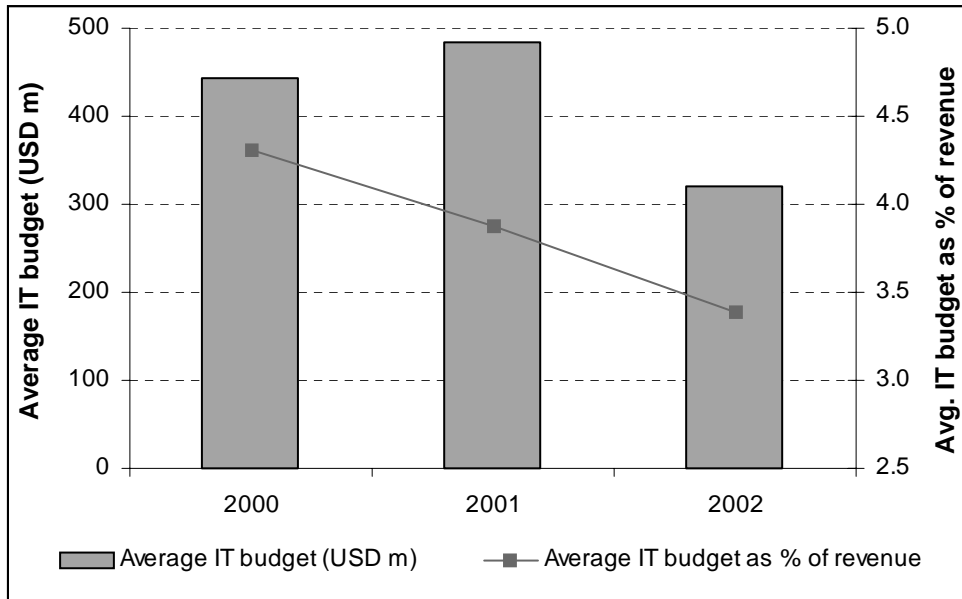
Source: Statistics Finland, Volume Index of Industrial Output, various press releases.

Figure 24. Monthly production in selected ICT sectors in Ireland, Jan-01 – Feb-02
 Year-to-year variation in % and 3-month moving averages



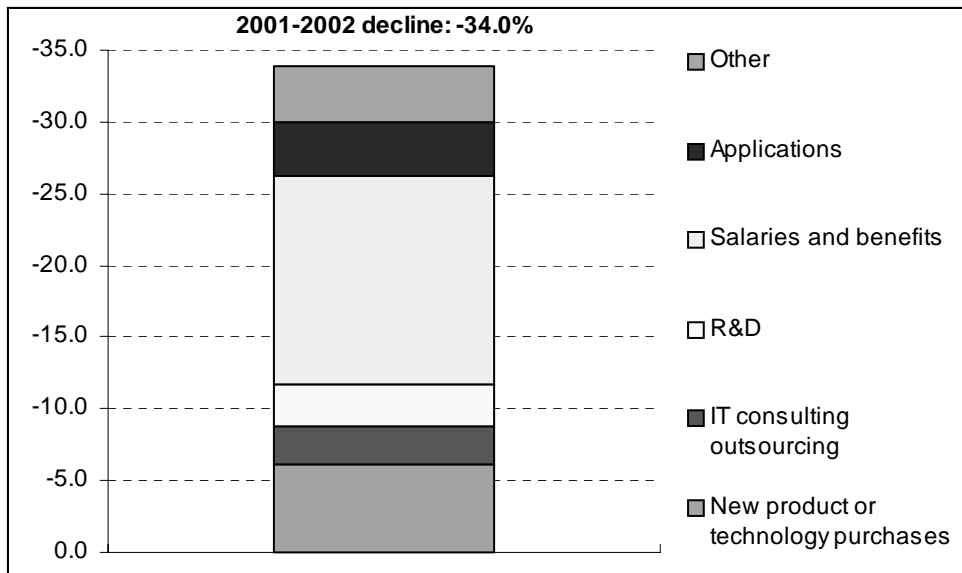
Source: CSO, Industrial Production and Turnover, April 2003.

Figure 25. Average IT budget trends in a sample of large US firms, 2000 – 2002
 Budgets in USD m and share of revenue in %



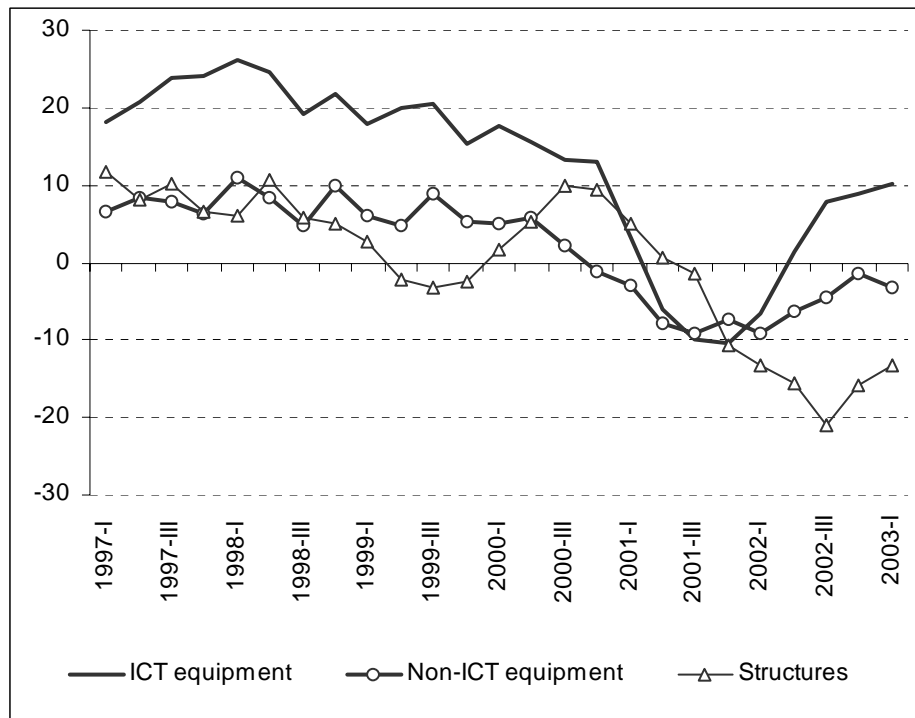
Note: Data from survey of IT executives in 500 top IT-using US firms (*InformationWeek 500*) from all sectors. Firms must have revenues in excess of USD 1 billion and are ranked according to their “innovative use of IT”, not the size of their IT budgets.
 Source: *InformationWeek 500*, September 2002. <http://www.informationweek.com>

Figure 26. Contribution by segment to average IT budget decline (2001-2002) in a sample of large US firms
 Percentage points



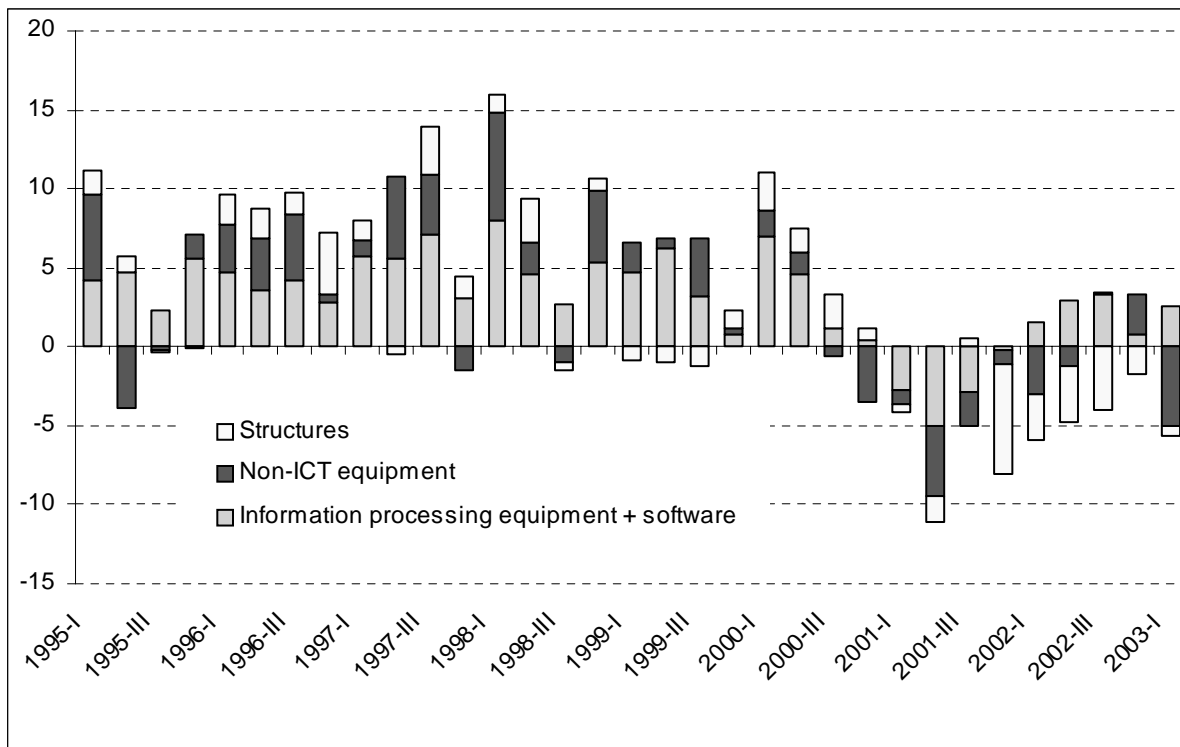
Source: *InformationWeek 500*, September 2002. <http://www.informationweek.com>

Figure 27. Quarterly non-residential fixed (real) investment by type in the United States, Q1 1997 – Q1 2003
Year-to-year growth (%)



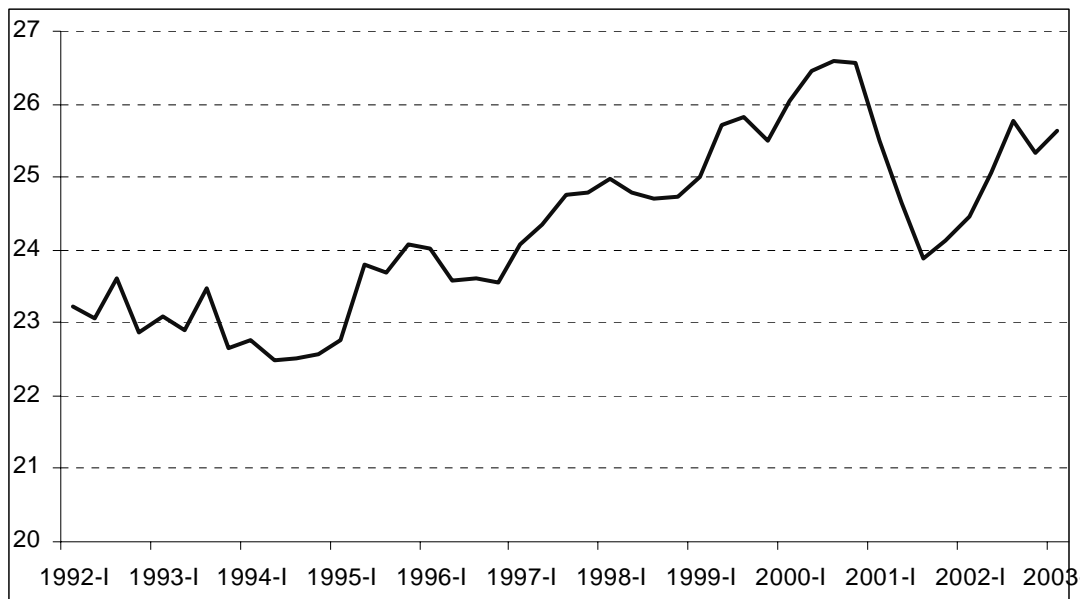
Source: Bureau of Economic Analysis (BEA), National Income and Product Accounts (NIPA) tables, May 2003. <http://www.bea.doc.gov/bea/dn/nipaweb/index.asp>

Figure 28. Contributions to percent change in quarterly real private fixed investment by type in the US, Q1 95 – Q1 03



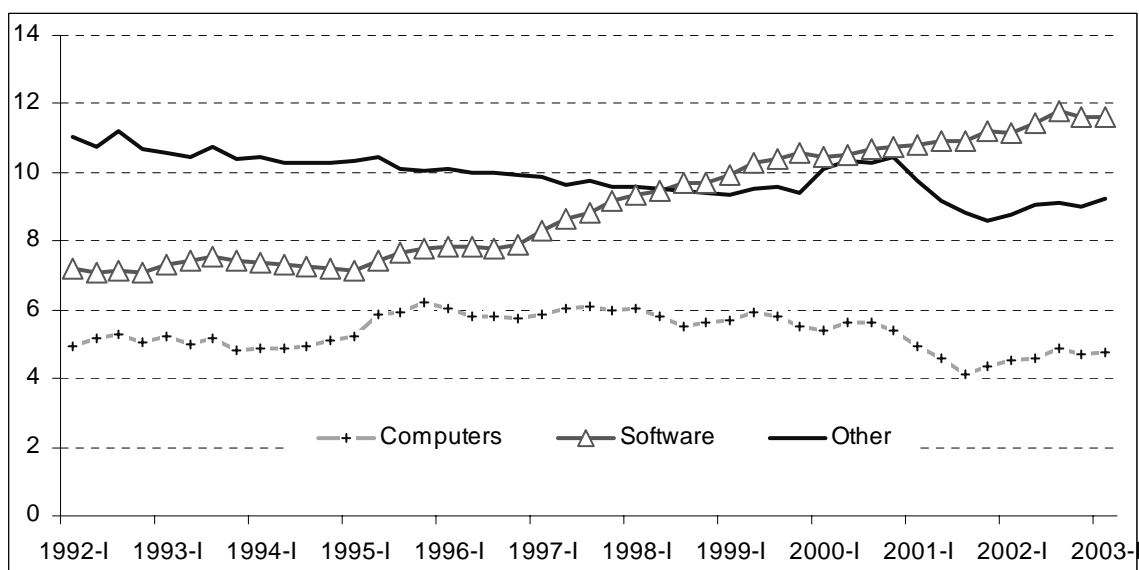
Source: BEA, NIPA tables, May 2003.

Figure 29. Share of information processing equipment and software as % of nominal quarterly private fixed investment in the US, Q1 92 – Q1 03



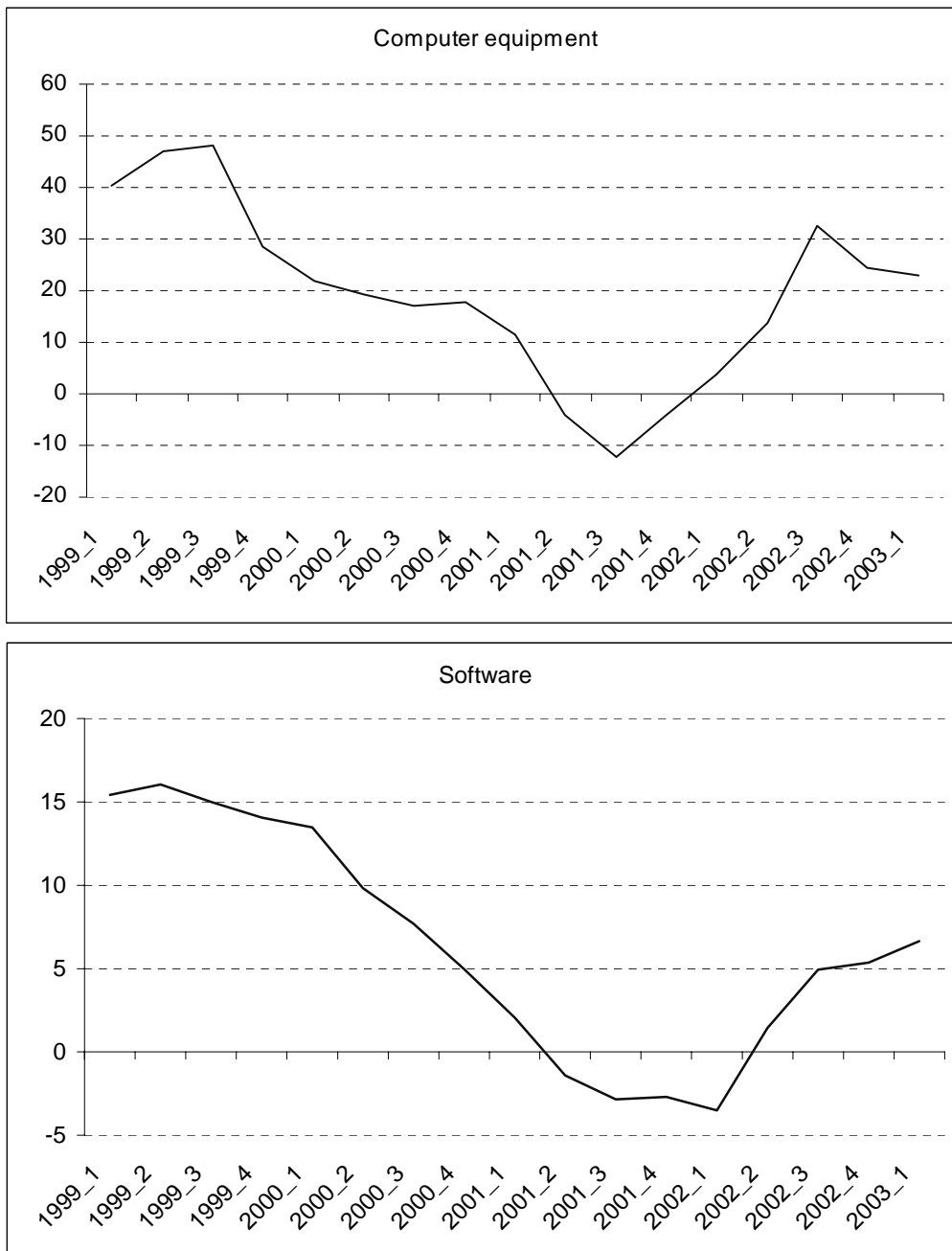
Source: BEA, NIPA tables, May 2003.

Figure 30. Quarterly investment in information processing equipment and software in the US, Q1 92 – Q1 03
As a percentage of total private fixed investment



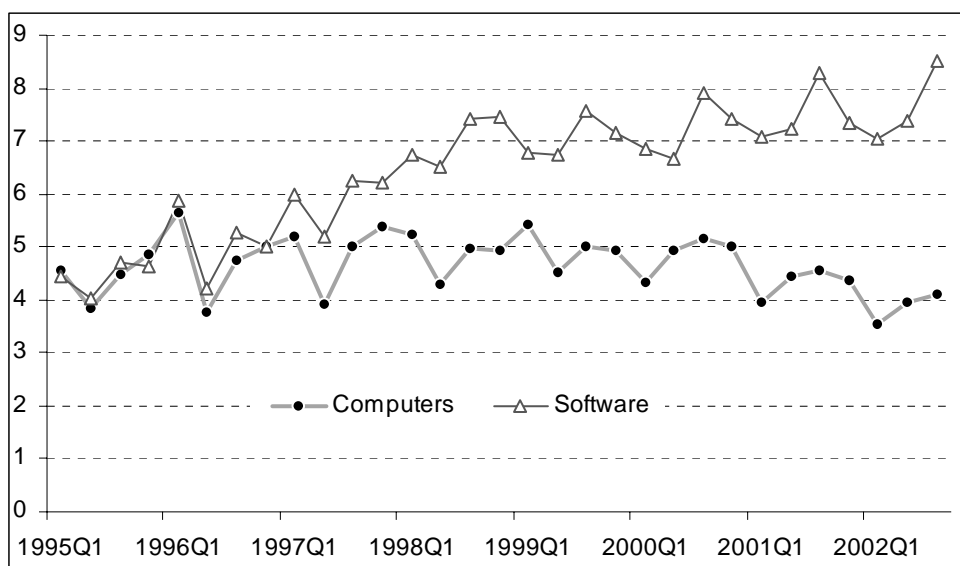
Source: BEA, NIPA tables, May 2003.

Figure 31. Private fixed (real) investment in IT, United States, Q1 99 – Q1 03
 Year-to-year change in percentage



Source: BEA, NIPA tables, May 2003.

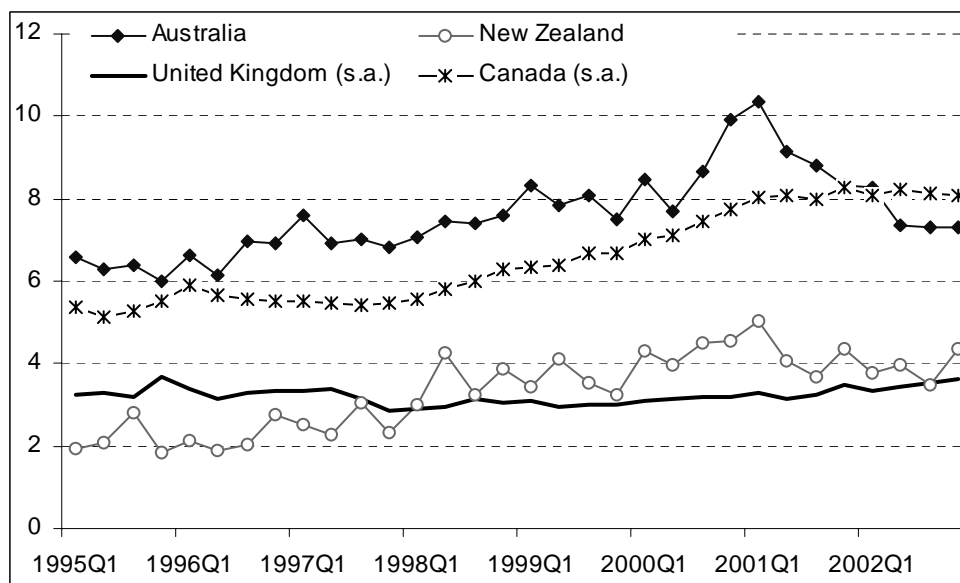
Figure 32. Quarterly investment in computers and software in the Netherlands, Q1 95 – Q4 2002
As a percentage of GFCF



Note: Software refers to intangible fixed assets.

Source: OECD, Quarterly National Accounts (QNA) database, May 2003.

Figure 33. Quarterly investment in software¹ in selected OECD countries², Q1 95 – Q4 2002
As a percentage of GFCF

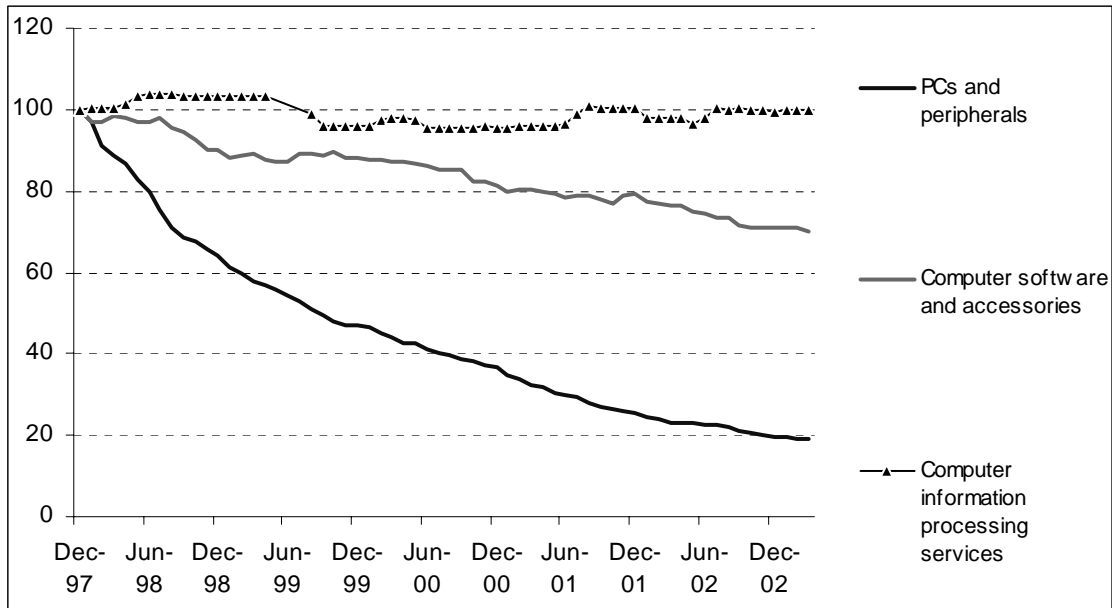


1. For all countries except Canada, investment refers to intangible fixed assets, which comprise mainly software. For Canada, investment data refer to software (including business and government investment) and are seasonally adjusted. For Australia, data refer to business sector.

2. Due to methodological differences, data are not directly comparable across countries; see Ahmad (2003) for a detailed discussion.

Source: OECD Quarterly National Accounts database, May 2003.

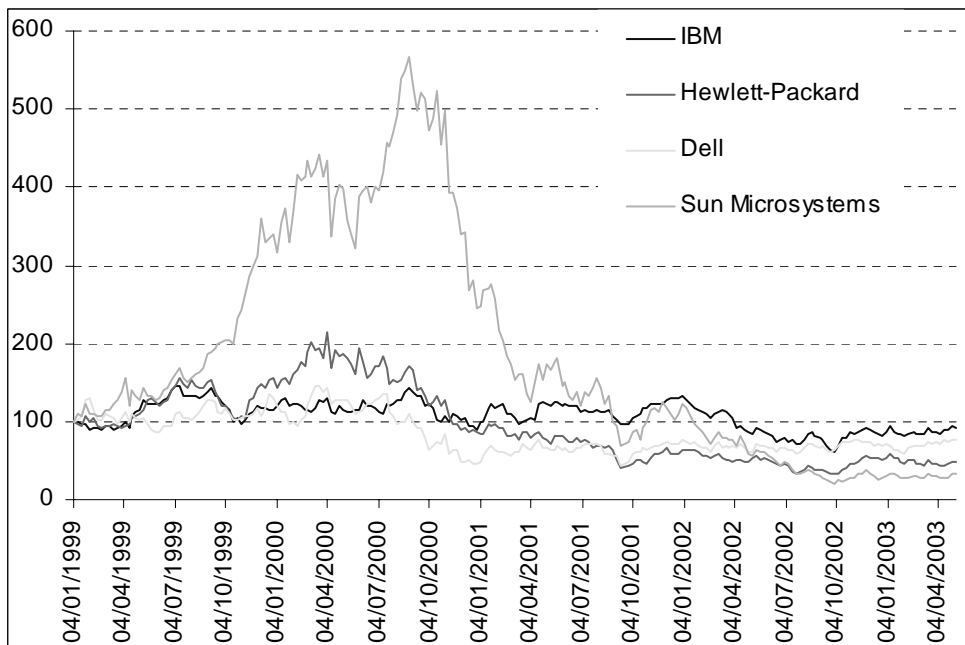
Figure 34. Price declines of ICT goods and services in the US, Dec 97 – Mar 2003
 Consumer price index; Dec 97 = 100



Source: US Department of Labor, BLS, May 2003. <http://www.bls.gov/cpi/home.htm>

Figure 35a. Stock prices of leading US IT equipment firms, 1999, 2003

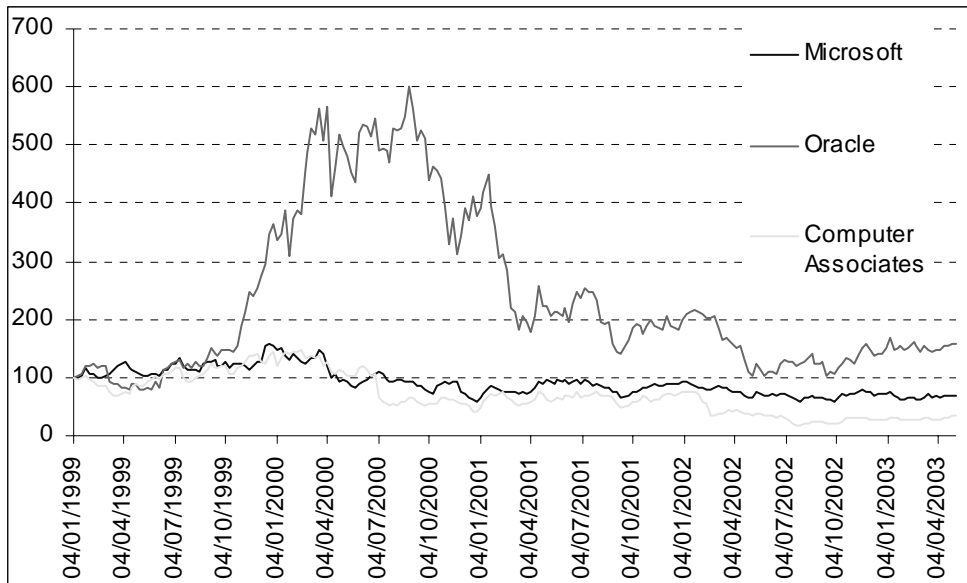
Index: Jan 99 =100



Source: Yahoo! Finance, May 2003. <http://finance.yahoo.com>

Figure 35b. Stock prices of leading US software firms, 1999-2003

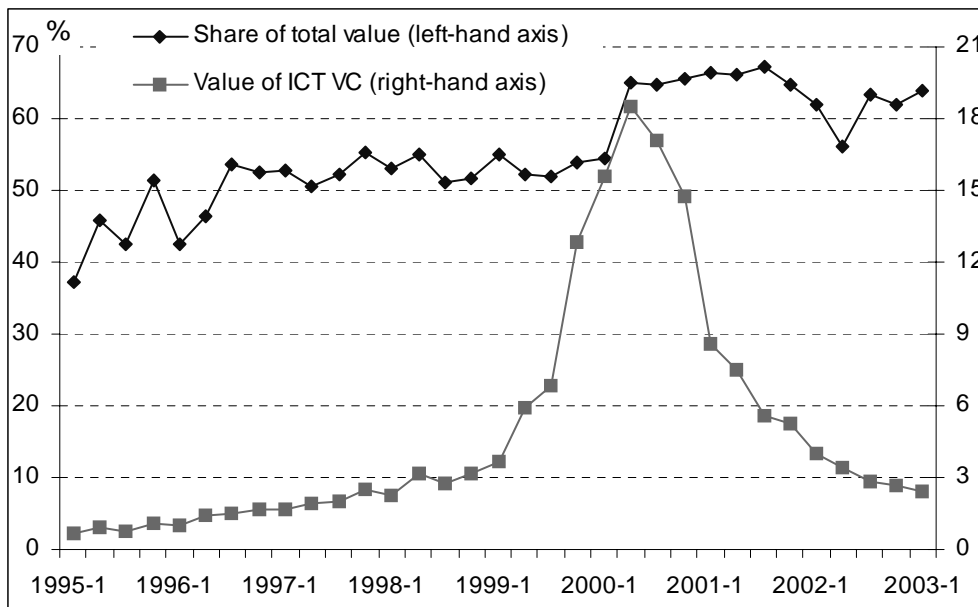
Index: Jan 99 =100



Source: Yahoo! Finance, May 2003. <http://finance.yahoo.com>

Figure 36. Quarterly venture capital investment in the ICT sector in the US, Q1 95 – Q1 03

As a share of total venture capital investment, and in value (in USD billions)



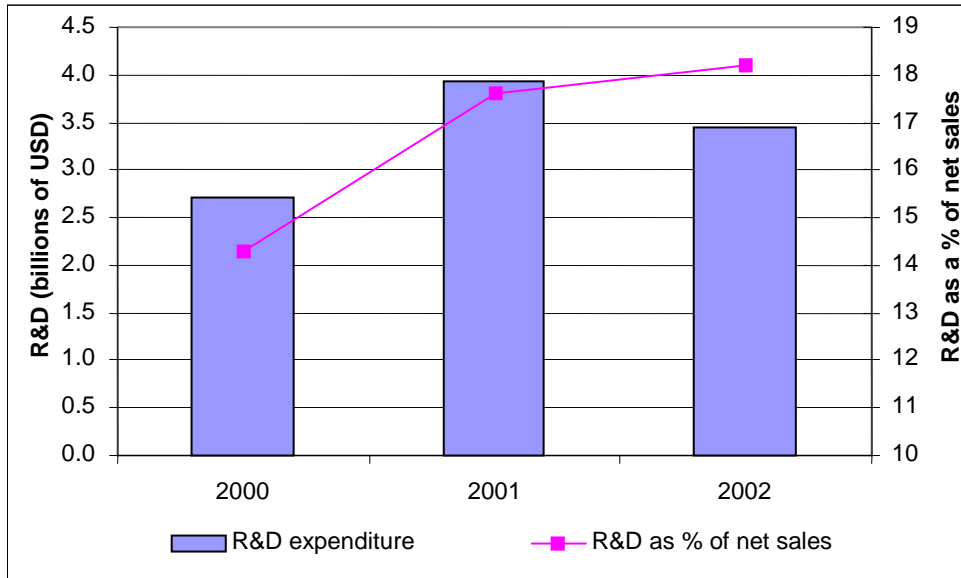
Note: The ICT sector includes the following industries: software, telecommunications, networking and equipment, semiconductors, IT services, computers and peripherals, and electronics/instrumentation.

Source: PricewaterhouseCoopers *et al.* MoneyTree Survey, Q1 2003 Report, May 2003.

<http://www.pwcmoneytree.com/>

Figure 37. Cisco's annual R&D expenditure, 2000 – 2002

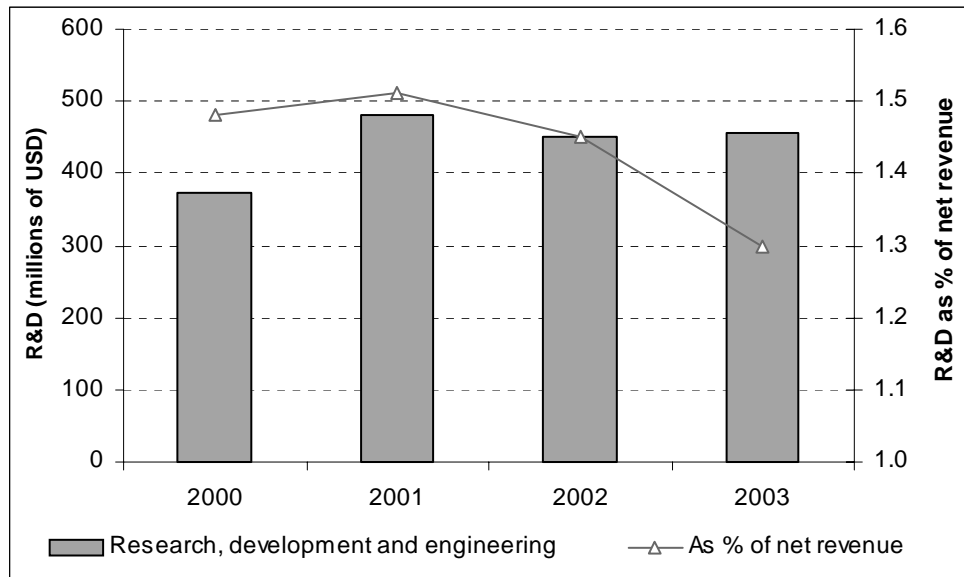
In billions of USD and as percentage of net sales



Source: Company annual report (10-K), September 2002.

Figure 38. Dell's annual R&D expenditure, 2000 – 2003

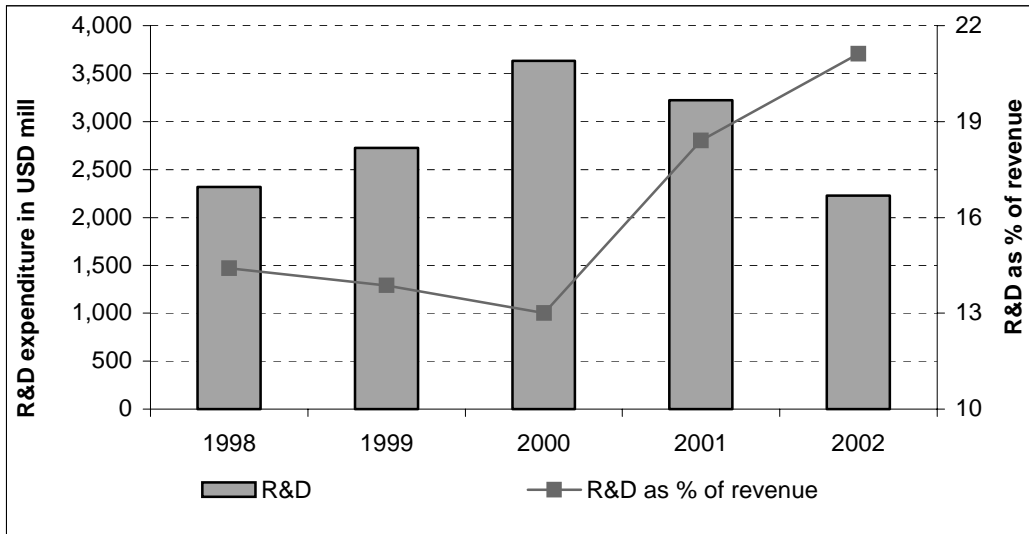
In millions of USD and as percentage of net revenue



Source: Company annual report (10-K), May 2003.

Figure 39. Nortel Networks' R&D expenditures in 1998-2002

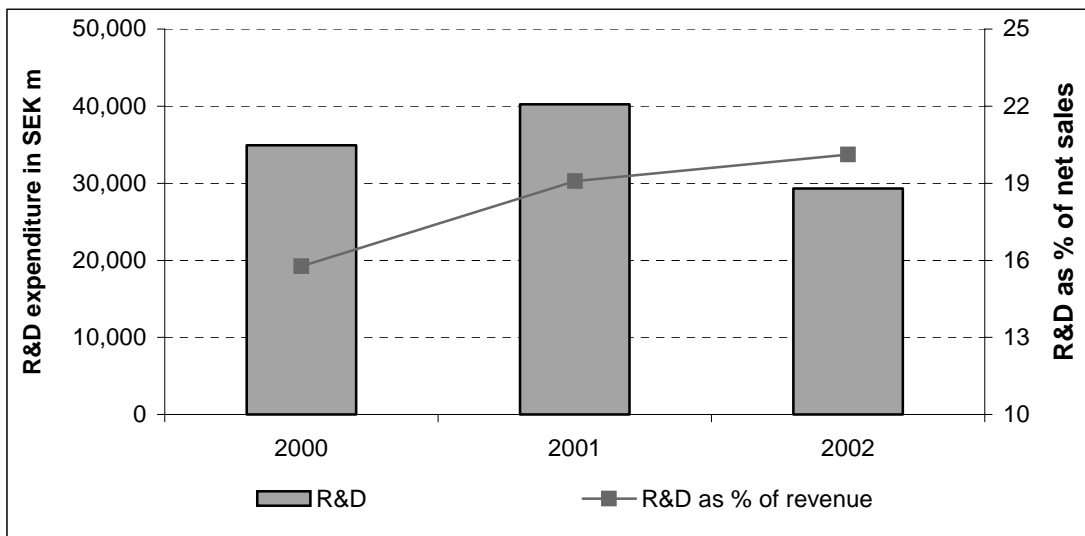
In millions of USD and as a percentage of revenue



Source: Company annual report (10-K), March 2003.

Figure 40. Ericsson's R&D expenditures in 2000 – 2002

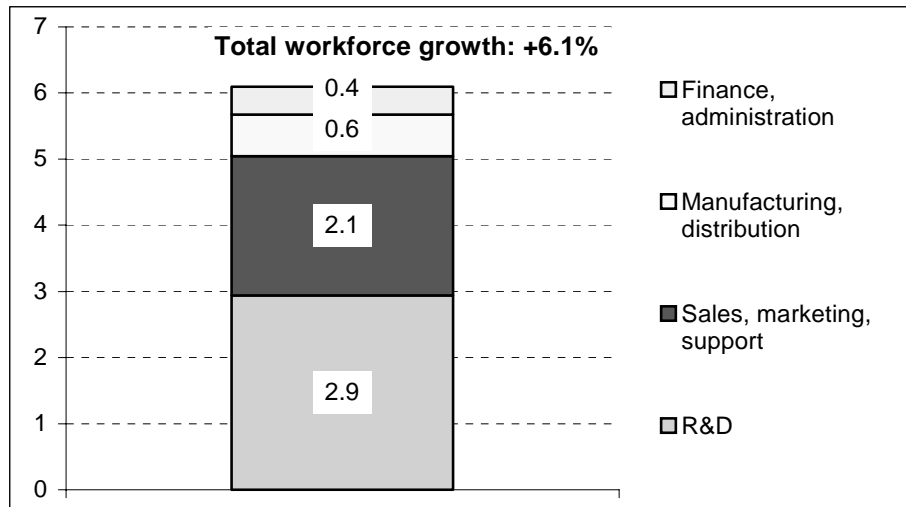
In millions of SEK and as a percentage of net sales



Source: Company annual report 2002, April 2003. <http://www.ericsson.com/investors/>

Figure 41. Breakdown of Microsoft's worldwide employment 2001-2002 change

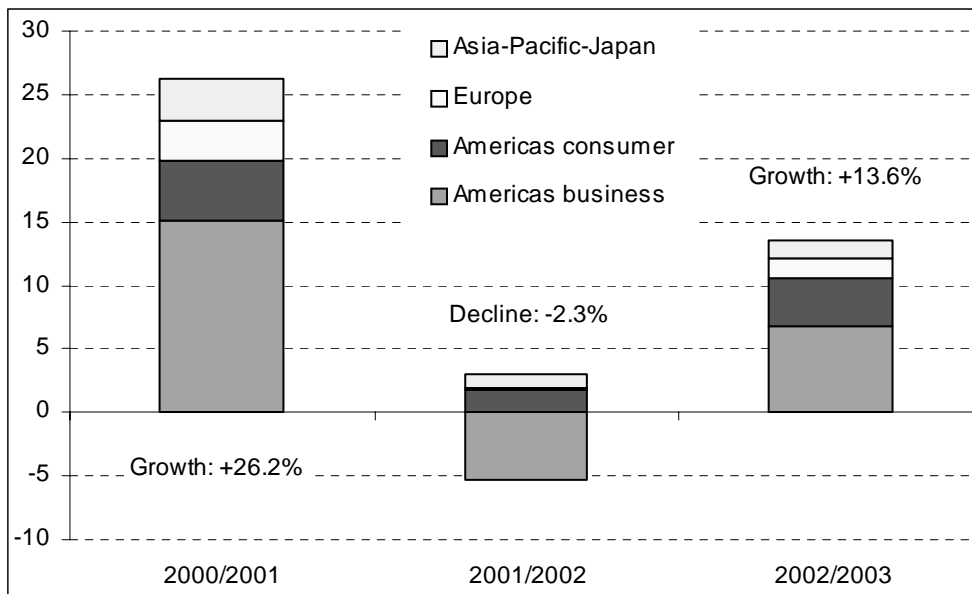
Contribution by type of employment in percentage points



Source: Company annual report (10-K), September 2002.

Figure 42. Breakdown of Dell's annual revenue change, 2000-2003

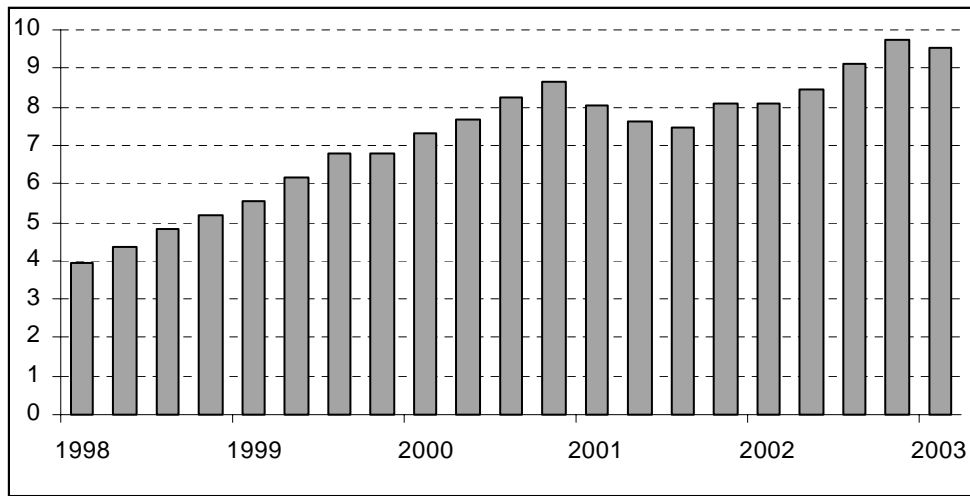
Contribution by main region/segment in percentage points



Source: Company annual report (10-K), April 2003.

Figure 43. Dell's quarterly revenue, Q1 98-Q1 03

Billions of USD



Source: Various company reports (10-Q/10-K).

APPENDIX: OTHER SOURCES FOR SHORT-TERM INDICATORS RELATING TO ICT

OECD sources

Quarterly National Accounts (QNA) Database

Contains quarterly data on ICT investment for selected OECD countries. In particular:

- Australia: GFCF, private sector, intangible fixed assets.
- Canada: GFCF, business and Government, software.
- Netherlands: GFCF, computers and intangible fixed assets.
- New Zealand: GFCF, intangible fixed assets.
- United Kingdom: GFCF, intangible fixed assets.

Other public sources

Eurostat

The Eurostat New Cronos database provides data on short-term economic indicators, such as indices on turnover, production, new orders, labour input and producer prices, which are usually available at the 2- and sometimes 3-digit level of the NACE Rev.1 classification. NACE 30, 32 and 72 are available for five to ten EU countries, depending on the indicator selected.

Some EU countries provide quarterly Labour Force Statistics (LFS) to Eurostat which can be broken down to identify the employment of computer professionals (based on occupational classifications).

Private/industry sources

World Semiconductor Trade Statistics (WSTS)

The WSTS is an industry group which produces monthly shipment data by product category and region as well as market forecasts. Its members account for around 90% of worldwide shipments value.

Source: <http://www.wsts.org/>

PricewaterhouseCoopers MoneyTree Survey

The MoneyTree Survey is a quarterly study of venture capital investment activity in the United States. It is the fruit of collaboration between PricewaterhouseCoopers, Venture Economics and the National Venture Capital Association. The survey includes the investment activity of professional venture capital firms with or without a US office, SBICs, venture arms of corporations, institutions, investment banks and similar entities whose primary activity is financial investing. Where there are other participants such as angels, corporations, and governments in a qualified and verified financing round, the entire amount of the round is included.

Qualifying transactions include cash investments by these entities either directly or by participation in various forms of private placement. All recipient companies are private, and may have been newly-created or spun-out of existing companies.

The survey excludes debt, buyouts, recapitalisations, secondary purchases, IPOs, investments in public companies such as PIPES (private investments in public entities), investments for which the proceeds are primarily intended for acquisition such as roll-ups, change of ownership, and other forms of private equity that do not involve cash such as services-in-kind and venture leasing.

Investee companies must be domiciled in one of the 50 US states or DC even if substantial portions of their activities are outside the United States.

Source: <http://www.pwcmoneytree.com/moneytree/index.jsp>