

The economic impacts of ICT on firms and economies

Dirk Pilat, Senior Analyst, Organisation for Economic Co-operation and Development

Information and communications technology (ICT) has turned into the key technology of the past decade. The rapid diffusion of the Internet, of mobile telephony and of broadband networks all demonstrate how pervasive this technology has become. But how precisely does ICT affect economic growth and the efficiency of firms?

Impacts of ICT at the aggregate level

Capital deepening through investment in ICT is important for economic growth. It establishes the infrastructure for the use of ICT (the ICT networks) and provides productive equipment and software to businesses. ICT investment in OECD countries rose from less than 15% of total non-residential investment in the early 1980s, to between 15% and 30% in 2001. Since investment mechanically adds to the capital available to workers, it contributes to labour productivity growth. Estimates show that it typically accounted for between 0.3 and 0.8 percentage points of growth in GDP and labour productivity over the 1995-2001 period (Figure 1, opposite page). The United States, Australia, the Netherlands and Canada received the largest boost; Japan and United Kingdom a more modest one; and Germany, France and Italy a much smaller one. Investment in software accounted for up to a third of the overall contribution of ICT investment.

The impacts of ICT investment on economic growth have not disappeared with the slowdown. Technological progress in the production of computers, e.g. the release of increasingly powerful computer chips, is projected to continue for the foreseeable future. The same is true for communications technologies. As long as firms producing these technologies are confronted with sufficient competitive pressure, the (quality-adjusted) prices of these technologies will continue to decline, encouraging ICT investment and stimulating further productivity growth. The level of ICT investment may well be lower than before 2000, however, as the 1995-2000 period was characterised by some one-off investment peaks, e.g. investments related to Y2K and the diffusion of the Internet. On the other hand, some countries may still have scope for catch-up; by 2000, Japan and the European Union area had a share of total investment in ICT similar to that of the United States in 1980.

The second important economic impact of ICT is linked to having a sector producing ICT goods and services. Having such a sector can be important for growth, since ICT-production has been characterised by rapid technological progress and very strong demand. The sector has therefore grown very fast, making a large contribution to economic growth, employment and exports. Moreover, having a strong ICT sector may help firms that wish to use the technology, since the close proximity of producing firms might have advantages when developing ICT applications for specific purposes. Having an ICT-producing sector can thus support growth, although previous OECD work has shown that it is not a prerequisite to benefit from the technology.

Empirical studies show that in Finland, Ireland and Korea, close to 1 percentage point of aggregate labour productivity growth over the 1995-2001 period was due to the strong productivity performance of the ICT manufacturing sector (Figure 2, overleaf). In the United States, Japan and Sweden, the ICT-producing sector also contributed significantly to productivity growth. The ICT-producing services sector (telecommunications and computer services) plays a smaller role in aggregate productivity growth, but has also been characterised by rapid progress. Partly, this is linked to the liberalisation of telecommunications markets and the high speed of technological change in this market. The contribution of this sector to overall productivity growth therefore increased in several countries over the 1990s. Some of the growth in ICT-producing services is also linked to the emergence of the computer services industry, which has accompanied the diffusion of ICT in OECD countries.

A third impact of ICT that shows up at the aggregate level is linked to the use of ICT. Several studies have examined the performance of those sectors of the economy that are intensive users of ICT. Most of these are located in the services sector, e.g. industries such as finance, business services and distribution. In some countries, notably the United States and Australia, there is evidence that sectors that have invested most in ICT, such as wholesale and retail trade, have experienced an increase in the overall efficiency of using labour and capital, or multi-factor productivity growth. This could be because these sectors have received productivity gains from ICT use over and above the labour productivity gains they received from investment in ICT, for instance because of network effects.

The three impacts of ICT noted above all feed through in aggregate productivity performance, though to different extents. For example, productivity growth in the United States, one of the key examples of ICT-driven growth and productivity improvements, has continued to be strong during the recent slowdown. Productivity growth in Australia and Canada (both countries characterised by ICT-intensive growth) was also strong over the recent past. However, such impacts are not visible in all countries, showing that countries have not benefited equally from ICT.

The largest economic benefits of ICT are typically observed in countries with high levels of ICT diffusion. OECD data shows that the United States, Canada, New Zealand, Australia, the Nordic countries and the Netherlands typically have the highest rates of diffusion of ICT. Many other OECD countries lag in the diffusion of ICT and have scope for greater uptake. But having the equipment or networks is not enough to derive economic benefits. Other factors, such as the regulatory environment, the availability of appropriate skills, the ability to change organisational set-ups, as well as the strength of accompanying innovations in ICT applications, affect the ability of firms to make ICT effective in the workplace and to seize the benefits of ICT. Consequently, countries with equal ICT diffusion will not always see similar impacts of ICT on economic performance.

Impacts of ICT at the firm level

The strongest evidence for the economic impacts of ICT emerges from firm-level studies. Firm-level data point to factors influencing the impacts of ICT that cannot be observed at the aggregate level. For example, the role of ICT in helping firms gain market share can only be examined with firm-level data, as can the role of organisational change. Over the past years, much progress has been made in developing statistics on the use of various ICT technologies in the economy. In addition, many countries have developed databases that provide detailed and comprehensive data on the performance of individual firms. Combining these two sources of information can help establish a link between firm performance and their use of ICT. Moreover, providing that these databases cover a large proportion of the economy, they can also link the performance of individual firms to that of the economy as a whole.

The empirical evidence from such studies, which have now been carried out in many countries, shows that ICT may have several impacts. For example, the effective use of ICT may help firms gain market share at the cost of less productive firms, which could raise overall productivity. In addition, the use of ICT may help firms innovate, e.g. by helping them to expand their product range, customise the services offered, or respond better to client demand. Moreover, ICT may help reduce inefficiency in the use of capital and labour, e.g. by reducing inventories. These effects would all lead to higher productivity growth.

Firm-level studies also show that the use of ICT is part of a much broader range of changes that help firms to enhance performance. The impacts of ICT are not guaranteed, but depend on complementary investments, e.g. in appropriate skills, and on organisational changes, such as new strategies, new business processes and new organisational structures. Firms adopting these practices tend to gain market share and enjoy higher productivity gains than other firms. ICT use by firms is also closely linked to the ability of a company to adjust to changing demand and to innovate. Users of ICT often help make their investments more valuable through their own experimentation and innovation, e.g. the introduction of new processes, products and applications. Without this process of “co-invention”, which often has a slower pace than technological innovation, the economic impact of ICT would be more limited. Firms that have introduced process innovations in the past are often particularly successful in using ICT. This is particularly important in services, as ICT helps firms in re-inventing business processes and developing new applications.

Firm-level evidence also shows that ICT is no panacea. Firms may well over-invest in ICT, either in an effort to compensate for lack of skills or competitive pressure, or because they lack a clear market strategy. It also takes time to adapt to ICT, e.g. in changing organisational set-ups and worker-specific skills. Firms that adopted network technologies several years ago, notably large firms, have often already been able to make the technology work, whereas more recent adopters are still adapting their organisation, management or skills. Evidence for the United Kingdom shows that among the firms that had already adopted ICT technologies in or before 1995, over 50 % purchased through electronic networks in 2000. For firms that only adopted ICT in 2000, fewer than 20% purchased through electronic networks in 2000.

The firm-level evidence also suggests that there are important cross-country differences in firms' use of ICT. For example, new firms in the United States seem to experiment more with ICT and relevant business models than those in other OECD countries; they start at a smaller scale than European firms, but grow much more quickly and get higher returns from their investments in ICT when successful. This may be linked to less aversion to risk in the United States, linked to its financial system, which provides greater opportunities for risky financing to innovative entrepreneurs. Moreover, low regulatory burdens may enable US firms to start at a small scale, experiment, test the market and their business model, and, if successful, expand rapidly. Moreover, if they do not succeed, the costs of failure are relatively limited. In contrast, firms in other OECD countries are often faced with high entry and exit costs. In a period of rapid technological change, greater scope for experimentation may enable new ideas and innovation to emerge more rapidly, leading to faster technology diffusion.

Policies to seize the benefits from ICT

What does the empirical evidence on the economic impacts of ICT imply for policy? The most important implication concerns the business environment. Governments should reduce unnecessary costs and regulatory burdens on firms to create a business environment that promotes productive investment. This involves policies that enable firms to undertake organisational changes, that strengthen education and training systems, that encourage good management practices, and that foster innovation, e.g. in new applications. Moreover, policy should foster market conditions that reward the successful adoption of ICT; competition is the key in selecting firms that are able to seize the benefits of ICT and in making them flourish and grow. Policies to foster growth in services are important too, as ICT offers a new potential for growth in the service sector, providing that regulations that stifle change are adjusted or removed. Moreover, competition needs to be strengthened. Competition not only helps lower the costs of ICT products and services, which fosters diffusion – it also strengthens pressures on firms to improve performance and change conservative attitudes.