ICT and Productivity: An Overview

Presentation made at the Telecommunications Policy Review Panel Policy Forum, October 24, 2005, Palais des Congres, Gatineau, Quebec by Andrew Sharpe, Executive Director, Centre for the Study of Living Standards

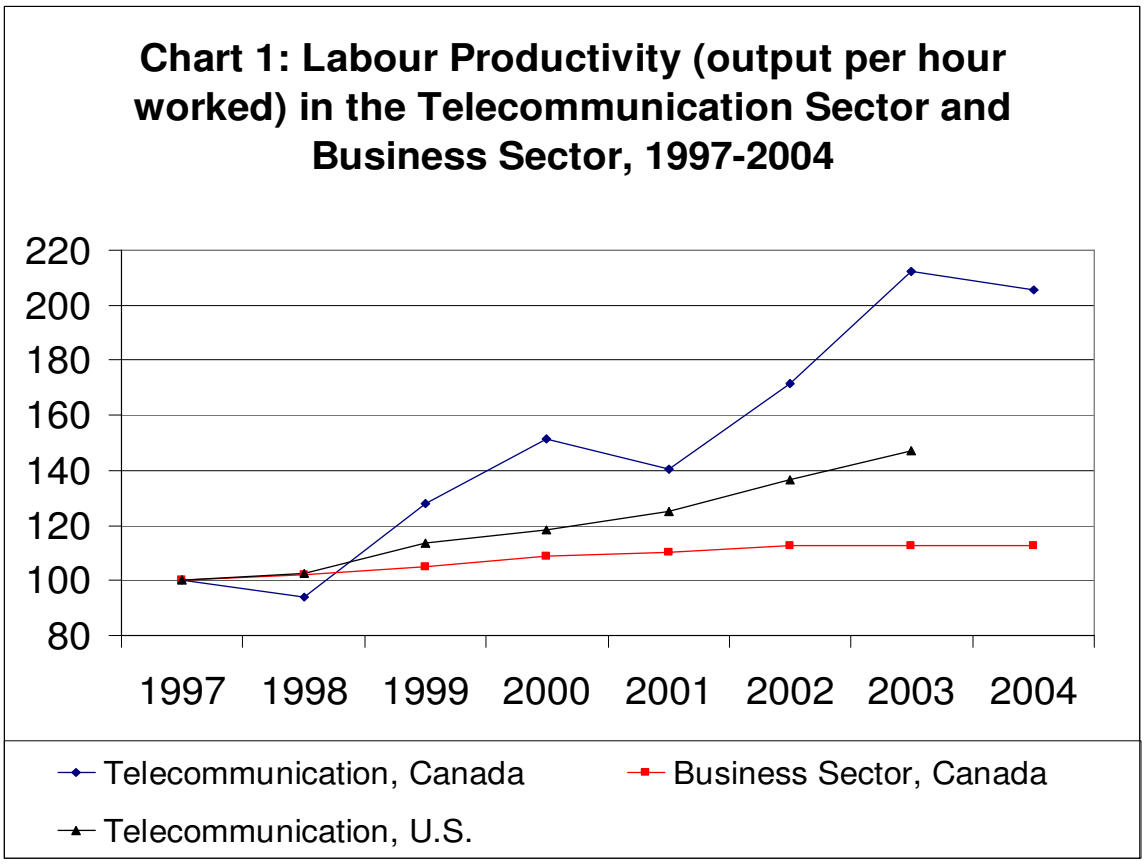
I would like to thank the panel for the invitation to address this Policy Forum. My presentation is divided into four parts. I first provide a brief overview of productivity developments, with particular attention to the telecommunications sector. Second, I discuss ICT investment trends in Canada and the United States. Third, I examine the issue of whether Canada has an ICT investment problem. And finally, I look at what the government could and should do to promote ICT investment in Canada.

Productivity Developments in Canada

The productivity issue has been at the forefront of the political agenda this fall in Ottawa. This attention to productivity has arisen from the deterioration of our productivity performance. In 2003 and 2004, output per hour growth in the business sector has essentially been zero in Canada. Since 2000, output per hour in Canada has increased at an average annual rate of 0.9 per cent per year, down from 2.8 per cent in the 1996-2000 period. In the United States, labour productivity growth has been a very robust 3.8 per cent per year since 2000. This much faster US growth has led to a significant increase in the Canada-US business sector labour productivity gap, from 18 points in 2000 to 25 points in 2004.

There is no definitive explanation for the post-2000 slowdown in productivity growth in Canada. Explanations include high commodity prices, which lead to the exploitation of poorer quality, higher cost resources, the downturn in the ICT sector, and weaker investment growth. The objective of policy makers is to reverse this worrisome trend.

In contrast to the mediocre productivity performance of the business sector in Canada in recent years, labour productivity growth in the telecommunications sector has been on a tear (Chart 1). Since 1997, output per hour in the sector has advanced at a 13.4 per cent average annual rate, over six times that of the business sector (2 per cent). Labour productivity growth in the Canadian telecommunications sector has also greatly exceeded that of its U.S. counterpart: 110 per cent versus 42 per cent over 1997-2003 period. The Canadian telecommunications sector has in no way been responsible for the post-2000 productivity slowdown in this country.



New technologies have been the driving force behind the stellar productivity performance of the telecommunications sector in Canada. The impact of regulation on productivity is complex. It should first be noted that only 30 per cent of telecom revenues are now generated from regulated telecom activity, so the role of regulation is now much less important than in the past. Current telecom regulation is a price cap regime where firms have a strong incentive to cut both labour and capital costs through productivity-enhancing investments. This type of regulation is certainly more conducive to capital and total factor productivity advance than the rate of return regulatory regime that preceded it, a regime that guaranteed an attractive rate of return and led to overcapitalization. But certain aspects of the current regulatory regime affect investment and the pace of introduction of new technologies and whereby influence productivity. For example, wholesale prices that are more favourable to resellers than incumbent telecoms can reduce investment in new facilities by incumbents.

It is very difficult to identify the characteristics of a regulatory system that would maximize productivity (whether one wants to maximize labour productivity of total factor productivity is another issue!). Indeed, I am not sure that productivity maximization is the most important objective of a regulatory regime. What is more important is that the regulatory regime, to the degree possible, foster competition, as competition spurs productivity advance. Of course, the definition of what constitutes a competitive market and the most appropriate way to ensure markets are competitive are hotly contested.

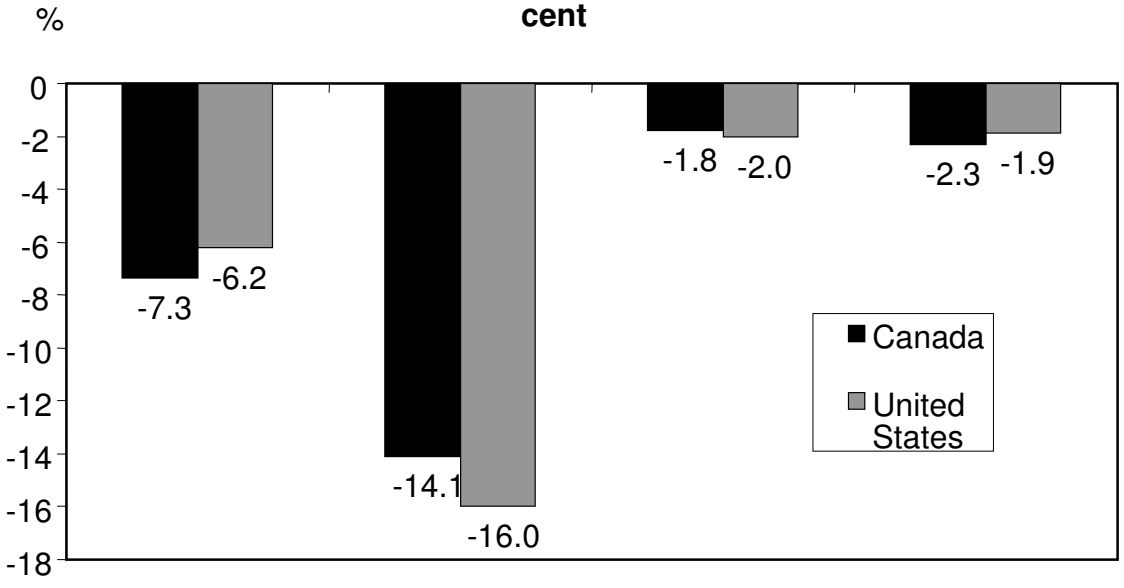
The current telecom regulatory regime has not been a drag on the productivity performance of Canada's telecom sector. It is also unlikely, but of course not impossible, that a new regulatory regime could made a significant contribution to better productivity growth in the sector. From this perspective, the telecom regulatory reform and the ICT investment-productivity growth mandates of the Telecommunication Policy Review Panel are conceptually distinct issues, although there are of course important linkages.

ICT Investment Trends

Information and communications technology (ICT) investment is defined as computer hardware, communications equipment, and software (which in turn is broken down into off-the-shelf, customized, and own-account components).

ICT investment has been very strong in Canada in recent years. For example, real business sector ICT capital stock, that is measured in inflation-adjusted or constant dollars, grew at a 7.7 per cent average annual rate between 2000 and 2004, although this was down from the 16.4 per cent average annual pace of the 1996-2000 period. These figures reflect falling ICT prices because of large quality improvements in ICT products, and current dollar ICT investment increases were much more modest. Indeed, the overall deflator for business sector ICT investment fell at a 7.3 per cent average annual rate from 1987 to 2003 (Chart 2). Computers experienced by far the largest price declines, an average 14.1 per cent per year. Communications equipment and software prices fell around 2 per cent per year.

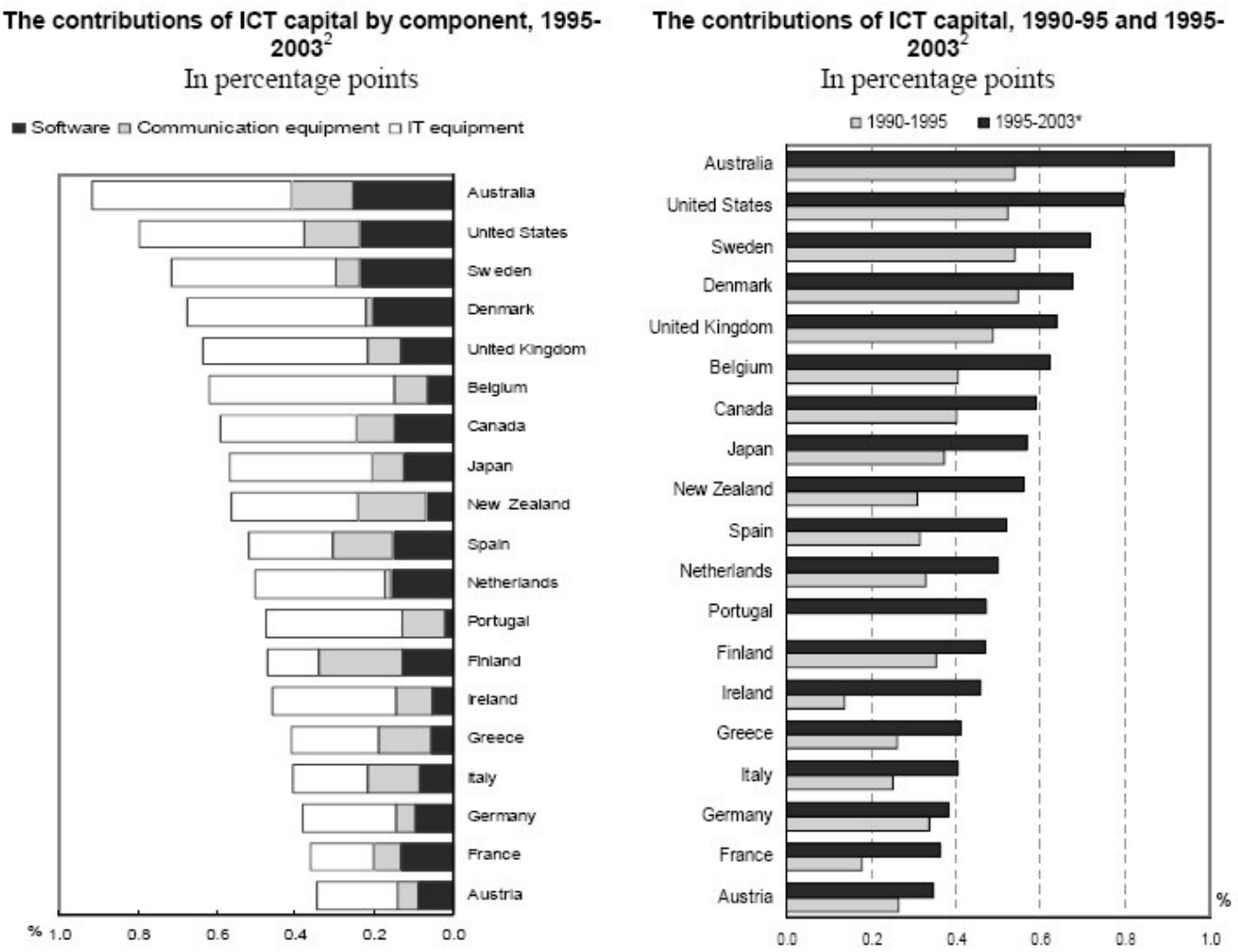
Chart 2: ICT and its Components Average Annual Deflator Growth in the Business Sector in Canada and the United States , 1987-2003, per cent



Source : CSLS ICT Database Table S29

The contribution of ICT capital to productivity growth in Canada in recent years has been fairly large from an international perspective. According to OECD estimates (Chart 3), during the 1995-2003 period ICT capital contributed 0.6 percentage points to productivity growth per year, below the 0.9 points in Australia and 0.8 points in the United States, but still seventh out of 19 countries. Of this 0.6 points, communications equipment was responsible for 0.4 points, software 0.2 points, and IT equipment 0.1 points.

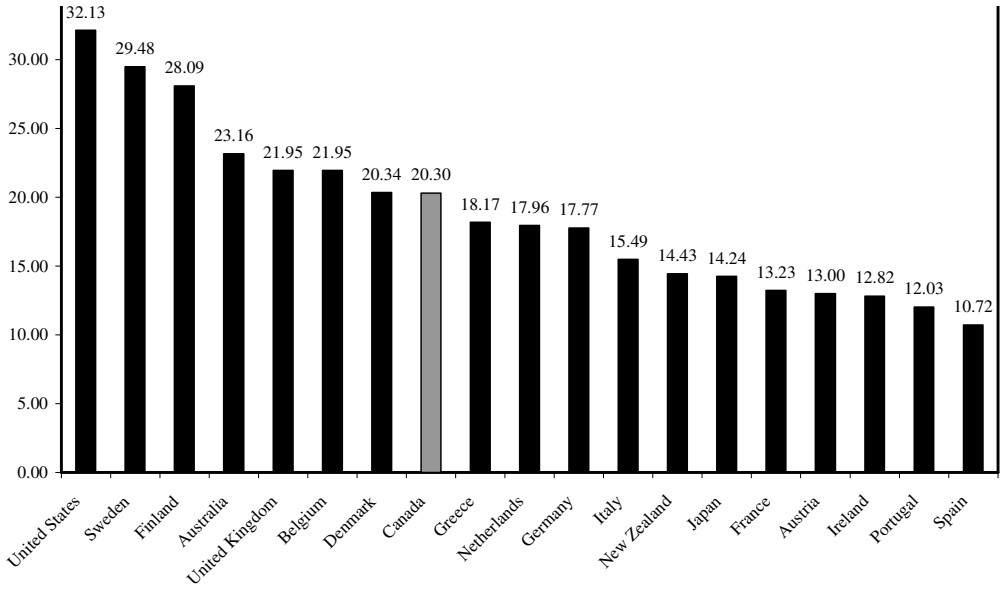
Chart 3: Contribution of ICT investment to total economy productivity growth, OECD countries, percentage points, 2003



1. 1991-1995 for Germany; 1995-2002 for Australia, France, Japan, New Zealand and Spain.
2. 1995-2002 for Australia, France, Japan, New Zealand and Spain.

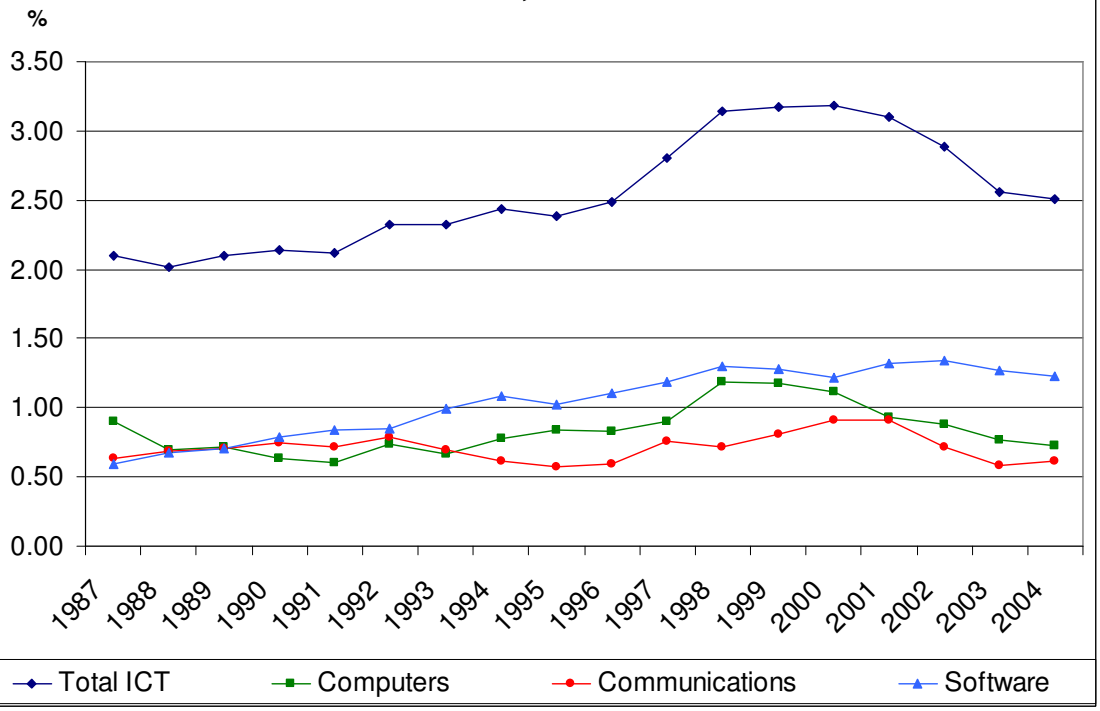
Source: OECD

Chart 4: Shares of ICT investment in non-residential fixed capital formation in selected OECD countries at the total economy level, 2001, per cent



Source : Table 1

Chart 5: Business sector non-residential ICT investment as a share of business sector GDP, current dollars, per cent, Canada, 1987-2004



The greater contribution of ICT capital to productivity growth in the United States reflected the greater importance of ICT investment in total economy non-residential fixed investment. Chart 4 shows that in 2001 ICT investment ranked first of 19 OECD countries in terms of the share of ICT investment in non-residential fixed capital formation (32.1 per cent). Canada ranked 8th at 20.3 per cent, less than two third of the US ICT investment share.

Chart 5 shows that there has been an upward trend in the share of ICT investment in business sector ICT, from 2.1 per cent in 1987 to 2.5 per cent in 2004. The share was over 3 per cent from 1998 to 2002. All the increase can be explained by software, which increased from 0.6 per cent of GDP in 1987 to 1.3 per cent in 2004. The share of computers actually fell from 0.9 per cent to 0.7 per cent while that of communications was stable.

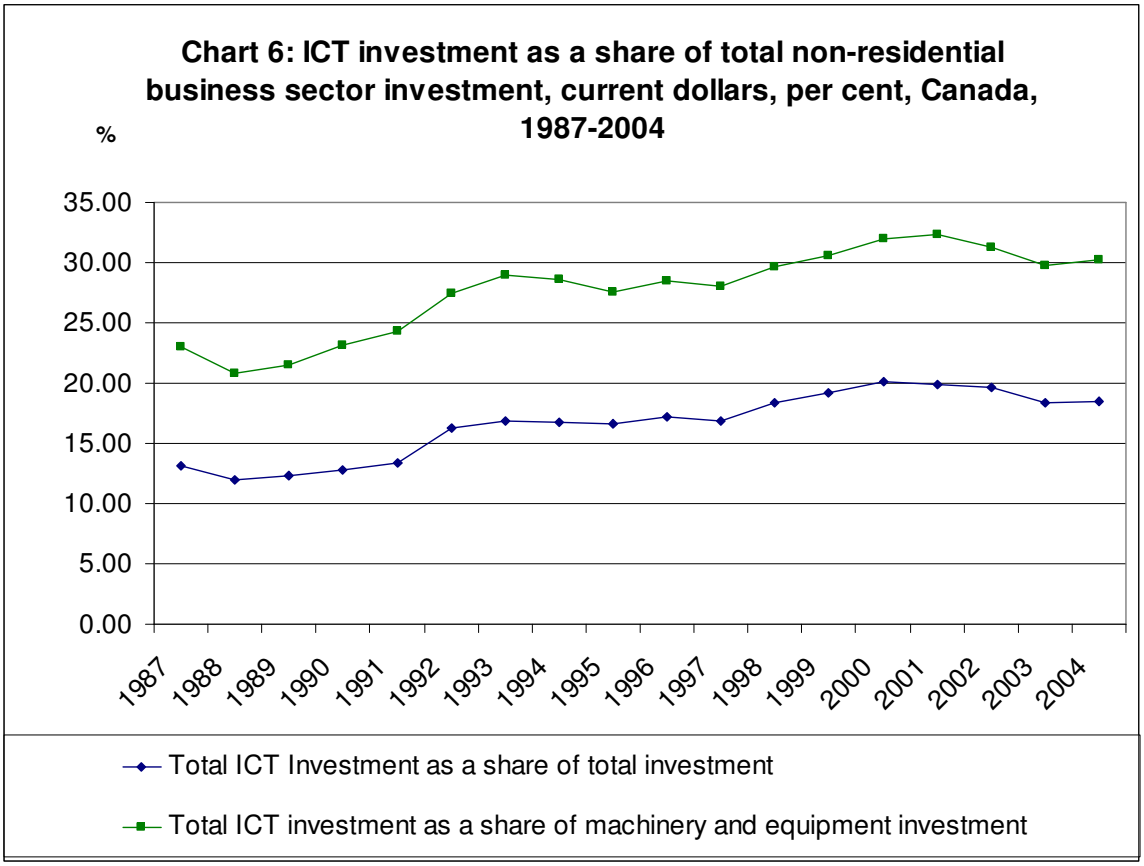
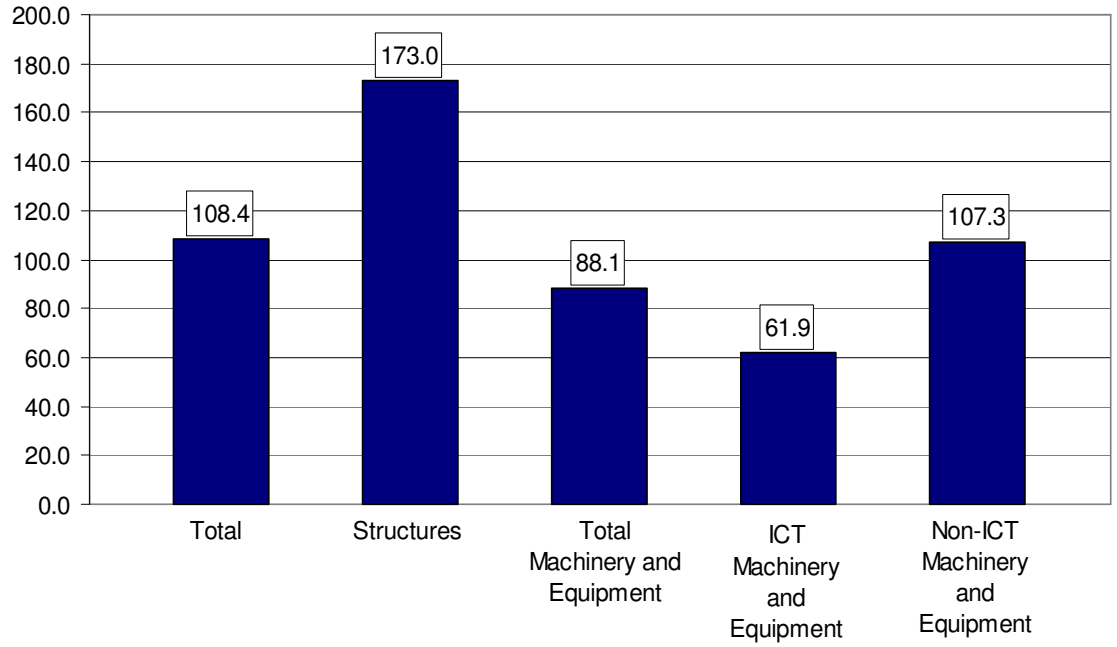


Chart 6 shows the share of ICT investment in total non-residential business investment and machinery and equipment (M&E) investment. Again, there is an upward trend for ICT from 13 per cent in 1987 to 18 per cent in 2004 for total non-residential investment and from 23 per cent to 30 per cent for M&E.

In 2003, the share of non-residential business investment in GDP in Canada was actually 108.4 per cent of that in the United States (Chart 7). This was explained by our very strong structures investment at 173.0 per cent of the US level. M&E investment was 88.1 of the US level. But the relative shortfall in ICT investment was entirely explained by weak IT investment, at 61.9 per cent of the US level. M&E investment excluding ICT as a share of GDP was actually larger in Canada than in the United States (107.3 per cent of the US level).

Chart 7: Non-residential investment as a share of business sector GDP, current dollars, Canada as a proprotion of United States, percent, 2003



Canada does not have an investment shortfall relative to the United States, but a M&E shortfall, and this shortfall in turn is entirely explained by an ICT investment shortfall.

Our relative ICT investment performance is even worse when measured on a per worker basis than as a share of GDP. In 2003, business sector ICT investment per worker in Canada was only 42.4 per cent of that of the United States (Chart 8). Moreover, this proportion has been on a strong downward trend from 67 per cent in 1987 (Chart 9). The lower level relative to the ICT/GDP share is explained by the lower overall productivity level in Canada relative to the United States and the lower purchasing power parity for ICT investment relative to GDP. The ICT per worker figure is less relevant than the ICT investment/GDP figure because of these two reasons.

Chart 8: Business sector non-residential investment per worker in current USD, Canada as a proprotion of United States, percent, 2003

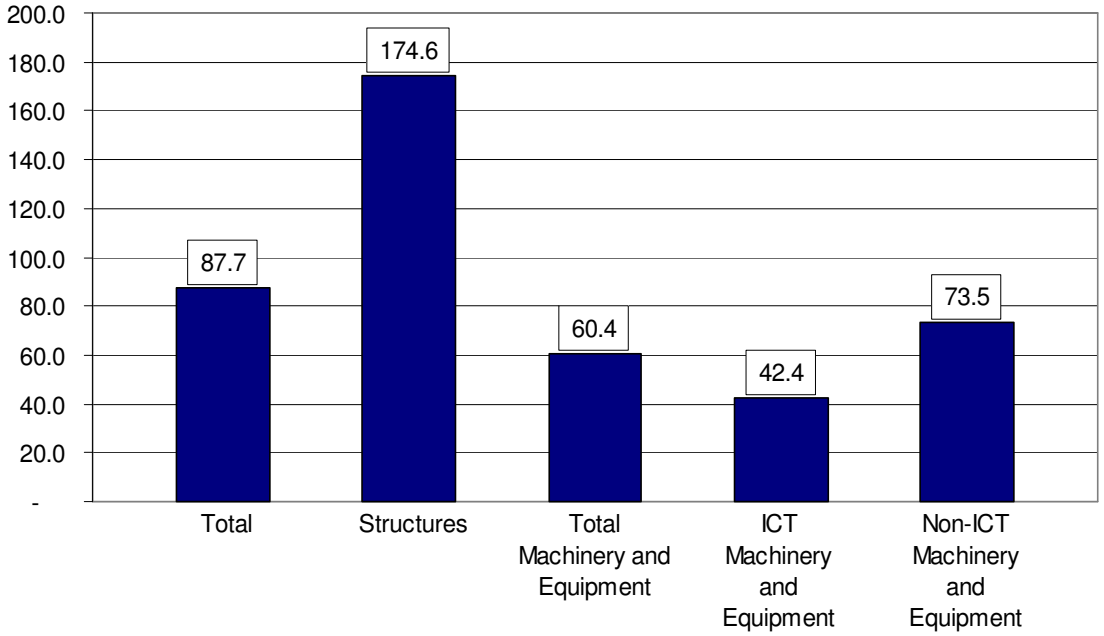
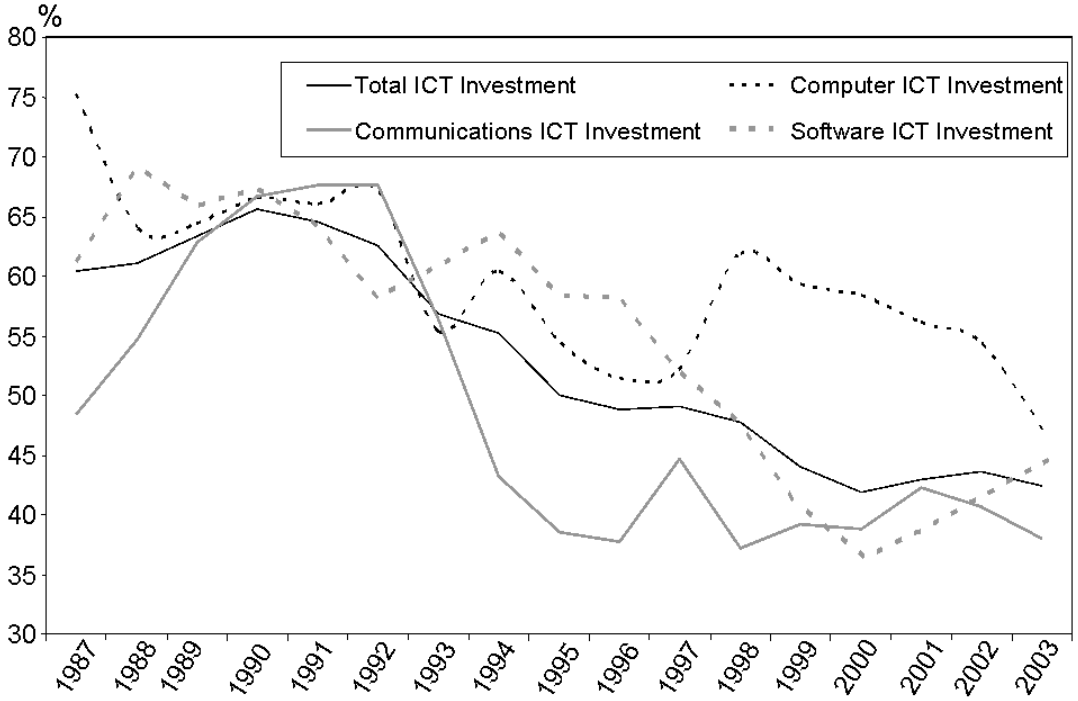


Chart ' 9: ICT Investment per Worker in the Business Sector in Canada, as a proportion of the United States, current US dollars, 1987-2003



Source : Table S1 to S4

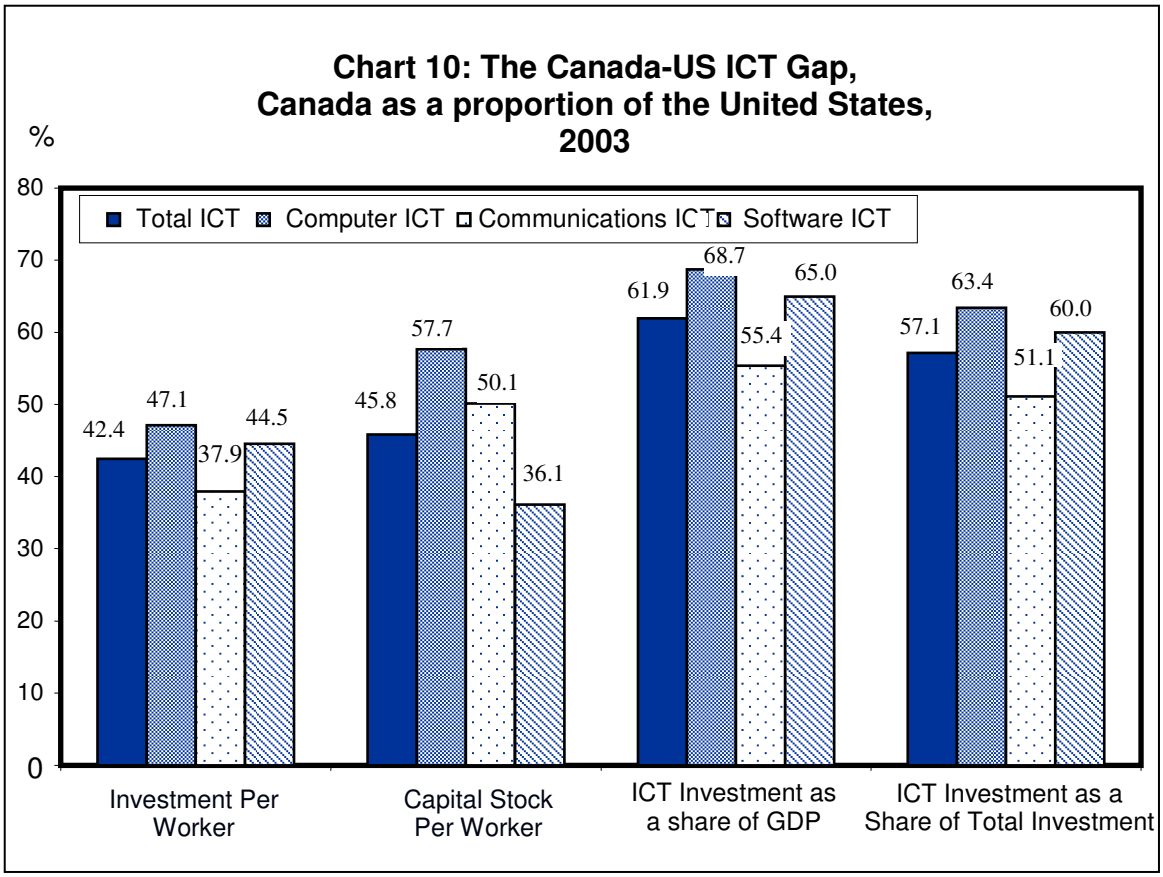
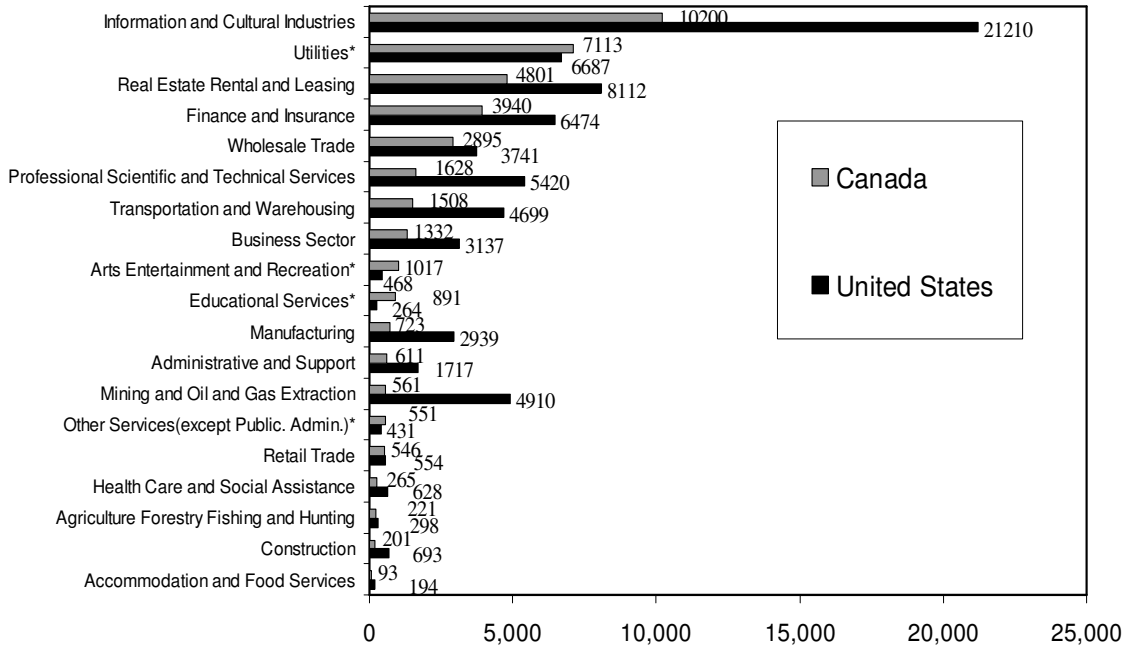


Chart 10 shows that the shortfall in ICT investment in Canada relative to the United States is found in all three ICT components. In 2004, computer ICT investment in this country was 68.7 per cent of its US counterpart, followed by 65 per cent for software and 55.4 per cent for communications.

Chart 11 shows ICT investment per worker in Canada and the United States by industry in 2003. A first observation is the very large variation in the ICT investment intensity of industries, ranging in Canada from a high of $10,200US in information and cultural industries to a low of $93US in accommodation and food services. The second observation is that ICT investment per worker exceeds that in Canada in 15 of 19 industries. The exceptions are utilities, arts, entertainment and recreation, educational services, and other services.

A key question is why ICT investment is less in Canada than the United States. The Centre for the Study of Living Standards is currently investigating this issue for the Information Technology Association of Canada. The study is nearing completion. Differences in the definition of ICT between the two countries do not appear to account for the differences in ICT investment. Nor do differences in the methodologies used to compile the data. According to the CD Howe Institute, the marginal effective tax rate for ICT investment in 2005 is very similar in the two countries (although it was somewhat higher in Canada in the past) so tax differences cannot explain the gap.

Chart 11: Total ICT Investment Per Worker by Industry in Canada and the United States, current US dollars, 2003



Note : Management of Companies and Enterprises is not shown. Industries with an asterisk are industries for which Canada has higher ICT investment per worker than the United States

Source : Table S17

Three factors have been found so far to account for the gap. First, Canada has lower employment shares than the United States in the high ICT intensity information and cultural industries and finance and insurance. If US employment shares prevailed in Canada, the ICT investment/GDP gap would fall 4 percentage points or 7 per cent. Second, Canada has a greater proportion of jobs in small enterprises that invest less per worker. If the structure of employment by enterprise size were the same in the two countries, the gap would be fall another 2-3 points. Third, labour compensation is about 20 per cent lower in Canada than in the United States. ICT prices tend to be the same price in both countries. The lower price of labour relative to ICT capital results in less substitution of ICT capital for labour and hence less ICT investment.

Does Canada Have an ICT Investment Problem?

The issue of whether Canada has an ICT investment problem is of great policy relevance. If it is concluded that such a problem exists, action may be needed. Some argue that low ICT investment as a share of GDP and per worker in Canada relative to that of our major trading partner is a strong indication that a problem exists. They believe that there are externalities associated with ICT investment that make a shortfall in this area a major weakness for the economy. Network effects are said to be associated with the complementary use of computers and telecommunications equipment and there effects are said to justify government subsidies to promote ICT investment.

On the other hand, some argue that despite the low ICT intensity, there is no indication that Canada is deficient in its use of communications equipment, software and computers. Since telecom services compare very favourably with other OECD countries including the United States in terms of quality and penetration rates, there would appear to be no shortfall in terms of telecom investment. The falling price of computers means that anyone who can make effective use of such technology has a PC on her desk. This means that the marginal product of additional computers would be low. Since firms are rational, current ICT investment levels are the result of profit maximizing behaviour and should be accepted as optimal given relative factor prices unless proven otherwise.

What Should Government Do to Promote ICT Investment

Even if ICT investment is not found to have been responsible for Canada's low productivity growth rate since 2000, greater ICT investment could contribute to better productivity performance. From this perspective, policies that promote ICT investment are desirable.

Two types of policies to promote ICT will be briefly considered. The first is the development of a general ICT strategy. The second is specific tax measures to incent greater ICT investment.

An ICT strategy could involve various components. It could involve the creation of an ICT agency. Possible activities of such an organization might include the coordination of ICT policy across government departments, benchmarking international best practices in ICT use, and promoting complementary investments such as training and organizational change that are needed to made ICT use effective. The creation of a Cabinet Committee on ICT is another suggestion that has been made.

Evidence of the need for an ICT strategy for Canada comes from the Networked Readiness Index produced by the World Economic Forum. In 2004, Canada ranked 10th overall out of 104 countries, down from sixth in 2002 and 2003. But Canada did extremely poorly in ICT promotion. We ranked 45th out of 104 countries in the government success of ICT promotion, 42nd in the government priorization of ICT, and 35th in government procurement of ICT. It is very surprising that the World Economic Forum's Executive Opinion Survey ranked Canada so low (below such countries as Mali, Nigeria, and Uganda) in ICT promotion given the existence of such programs as BRAND and SchoolNet. Nevertheless, Canada could undoubtedly do better in the area of ICT promotion.

As noted earlier, the marginal effective tax rate (METR) on ICT investment in Canada is about comparable to that of the United States. But it is high by world standards and lower taxes could have a positive effect on ICT investment. The METR consists of different components: the statutory corporate tax rate, the sales tax rate on ICT investment goods, capital taxes, investment tax credits, and the difference between capital consumption allowances and economic depreciation.

The policy that would have the most impact on the METR would be the elimination of the provincial sales tax on ICT investment goods. According to simulations run by the CD Howe Institute, this one measure would reduce the METR on ICT investment in 2005 from 53 per cent to 38 per cent. Only five Canadian provinces continue to impose the PST on investment goods, and two of those provinces, Ontario and British Columbia account for over 85 per cent of PST collected on ICT investment goods. The replacement of the PST on investment goods by a value added tax (as has happened in Quebec and in Atlantic Canada except PEI) would reduce the costs of these investment goods to firms and promote investment.

The elimination of capital taxes would also reduce the cost of ICT investment. But the impact of such a measure on the METR would be small as capital taxes are overall small and declining in importance. The current CCA for computers is 45 per cent, up from 30 per cent in 2004. It is estimated that the economic depreciation rate of computers is 47 per cent so there is currently a good match between CCA and true economic depreciation. An increase in the CCA for computers from 45 per cent to 50 per cent would only reduce the METR by 0.5 percentage points. Further CCA increases have limited merit from the point of view of an efficient tax system as they would reduce asset neutrality by favouring ICT investment.

The federal government does not currently have a general investment tax credit for ICT investment, although certain provinces (Manitoba and Saskatchewan) do. Such a measure might be considered at the federal level if it were felt that ICT investment merits a tax incentive. Canada's R&D tax credit system is already generous by international standards and does not directly affect ICT investment, as opposed to the R&D conducted by firms in the ICT sector.

Conclusion

ICT investment is the driving force behind productivity growth. It therefore makes sense to promote ICT adoption in the most effective manner possible. Canada has work to do in this area.