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The Issue: *ICT and Productivity*

Over the past five years, the link between investment in information and communications technology (ICT) and productivity growth has evolved from hypothesis to mainstream economic and public policy orthodoxy.

A paper from the Federal Reserve Board (The Resurgence of Growth in the Late 1990s: Is Information Technology the Story" by Stephen D. Oliver, Daniel E. Schiel) was among the first to identify the contribution that IT had made to the dramatic growth in labour productivity in the United States in the 1990s. This work contributed to transformation of Federal Reserve Board Chairman Alan Greenspan from a skeptic to a believer in the productivity improving power of ICT. He famously credited the resurgence of American productivity to "the revolution in information technology growth".

"At a fundamental level, the essential contribution of information technology is the expansion of knowledge and its obverse, the reduction in uncertainty. Before this quantum jump in information availability, most business decisions were hampered by a fog of uncertainty. Businesses had limited and lagging knowledge of customers' needs and of the location of inventories and materials flowing through complex production systems. In that environment, doubling up on materials and people was essential as a backup to the inevitable misjudgments of the real-time state of play in a company. Decisions were made from information that was hours, days, or even weeks old."¹

The first study of the impact of ICT investment on Canadian productivity growth was released in November of 2000 by the Conference Board of Canada. The study concluded:

"The recent surge in information technology investment in Canada has made a significant contribution to both labour productivity and output growth in the last decade. This has been especially true over the 1996 to 1999 period. We found that IT investment increased its contribution to the

GDP growth rate from virtually nothing in the 1980s to about 0.4 percentage points in the last 1990s, up from about 0.1 percentage points in the early 1990s. This is a significant and accelerating change. In fact, the impact on GDP growth of investment in IT capital is almost as much as that of investment in non-IT capital. This is especially remarkable when IT capital accounts for only about 5 per cent of the capital stock, and non-IT capital the other 95 per cent.

The Canadian results follow a similar pattern to that found for the United States, although the Canadian numbers tend to be somewhat weaker. The difference is attributable to several factors, including a stronger U.S. economy over the past ten years as well as a sharp upturn in labour productivity in that country. However, our investment in IT is now increasing at a stronger pace than the U.S. and as such, we are in a position to play catch up in the coming years."²



A number of studies followed examining the sectoral impact of ICT investment and the role that relative levels of investment in ICT play in accounting for the growing productivity gap

¹ Greenspan, Alan. Speech before Boston College Conference on the New Economy, March 6, 2000.

² Conference Board of Canada, Jim Frank, Luc Bussiere, "IT and the New Economy: The Impact of Information Technology on Labour Productivity Growth".

between Canada and the United States. Andrew Sharpe, of the Centre for the Study of Living Standards, published a paper in the Spring of 2003 that analyzed factors contributing to this gap. He estimated that the lower capital intensity of economic activity in Canada was a key contributor to the gap.³

Peter Nicholson's 2003 review of Canada's prospects for economic growth also underscored the importance of innovation and technology adoption:

"An economy grows (i) when more people are put to work (growing labour supply); and/or (ii) when workers collectively produce more value of goods and services in successive intervals of time (growing productivity). To enhance productivity, one can invest to augment raw labour with (a) increasing amounts of "human capital" (e.g. formal education; on-the-job training; or simply acquired experience) and (b) increasing amounts of physical capital. Thus *investment*, and the savings needed to finance it, lies at the heart of the growth process.

The other key determinant is *innovation* interpreted broadly to encompass not only activity associated with lab coats, but also incremental improvements emanating from the shop floor; more effective managerial techniques (working smarter); entrepreneurial creativity; and acts of sheer imagination that end up creating new sources of value."⁴

One of the strongest affirmations of the link between innovation, ICT adoption and productivity appears in the Budget Plan of 2004. "...The Government recognizes the importance of information and communications (ICT) equipment. Improved productivity in several countries since the mid 1990s, including the U.S., has been associated with higher ICT investment. Similarly, in Canada, productivity growth is faster and has increased more rapidly since 1997 in ICT-intensive sectors, most notably in services.⁵ This argument and supporting data was used to explain an increase in the capital cost allowance rate applying to computer equipment, broadband and Internet infrastructure, thereby reducing a disincentive to investment in this technology.

More recently, published work from key departments underscores the link between ICT investment and growth in productivity and

³ Andrew Sharpe, "Why are Americans More Productive than Canadians," International Productivity Monitor 6, Spring 2003.

⁴ Peter Nicholson, "The Growth Story: Canada's Long-run Economic Performance and Prospects," International Productivity Monitor 7, Fall 2003.

⁵ The Budget Plan 2004, page 150.

competitiveness. Economists with Finance Canada declare, "The increase in ICT investment in Canada was followed by an acceleration in labour productivity growth in the latter part of the 1990s," and conclude "... Our analysis contributes cross-sectional evidence for Canada that computer use, university education and computer skills development are associated with higher productivity."⁶ Another article examining organizational innovation and ICT adoption concludes:

"Our analysis suggests that Canadian firms have actively engaged in organizational changes in the areas of production and efficiency practices, HRM practices and product and quality-related practices. These practices combined with ICT are strongly associated with better firm performance. We find that the firms that implement organizational changes and introduce ICT have a higher incidence of productivity improvement, and also of sales and profit increase and product and process innovation."⁷

And an Industry Canada study of four of Canada's economic clusters stresses the productivity enabling impact of ICTs. "The importance of ICT as an enabler of broad economic development has surpassed that of ICT as an economic sector in its own right In this regard, it is important to facilitate ICT technology development and lever ICT skills capacity at the interface between the ICT sector and other sectors of the economy."⁸

In another recent paper, Andrew Sharpe ponders the post-2000 improvement in productivity growth in light of the fall-off in ICT investment in recent years. He concludes that more research is needed on this, but offers the following explanation:

"But in my view the most probable factor behind the acceleration is the more effective use of ICT investments. The full productivity impact of ICT investment has taken time. It has required changes in organizational structures and a higher level of workforce computer literacy. These developments have now happened and the productivity payoff from ICT is now being realized."⁹

The body of research linking ICT investment and productivity is substantive and likely will continue to

⁶ Julie Turcotte and Lori Whewell Robinson, "The Link Between Technology Use, Human Capital, Productivity and Wages: Firm Level Evidence," International Productivity Monitor 9, Fall 2004.

⁷ Surendra Gera and Walong Gu, "The Effect of Organizational Innovation and Information and Communications Technology on Firm Performance," International Productivity Monitor 9, Fall 2004.

⁸ Strategis.

⁹ Andrew Sharpe, "Ten Productivity Puzzles Facing Researchers," International Productivity Monitor 9, Fall 2004.

attract contributions from economists and policy makers. ITAC believes that the case is well documented. New evidence is welcome. But the time has come to move past research and analysis into action. ICTs are a key driver of productivity growth. If Canada is serious about improving its productivity performance, it's time to adopt measures to spur the use of these tools throughout our economy.



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