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CENTRE FOR  
THE STUDY OF  
LIVING  
STANDARDS

## **The Canada-U.S. ICT Investment Gap in 2007: Narrowing but Progress Still Needed**

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Prepared for the Information Technology Association of Canada

# The Canada-U.S. ICT Investment Gap in 2007: Narrowing but Progress Still Needed

## Executive Summary

This report is based on the Centre for the Study of Living Standards (CSLS) Information and Communication Technology (ICT) database for Canada and the United States that has been updated to 2007. It provides a brief overview of developments in ICT investment in the business sector for both Canada and the United States, focusing on developments in 2007. The report's key findings are the following:

- Measured in domestic currency, growth in nominal ICT investment spending in the United States (8.0 per cent) continued to outpace that in Canada (6.4 per cent) in 2007. Growth in ICT investment per worker in Canada (4.2 per cent) was also lower than that of the United States (7.2 per cent) in 2007, when measured in current dollars.
- ICT prices continued to decline in both Canada and the United States in 2007. However, a strong appreciation (6.1 per cent) of the Canadian dollar lowered ICT prices in Canada relative to the United States.
- Canada's relatively weak performance in nominal ICT investment growth reflects the steeper fall in ICT prices in Canada. When measured in constant 2002 dollars, real ICT investment increased by 20.0 per cent in Canada, compared to 12.8 per cent in the United States. Real ICT investment per worker also increased at a higher rate in Canada (17.5 per cent) than in the United States (11.9 per cent) in 2007.
- Due to the sharper ICT price declines in Canada, Canadian firms invested more in terms of ICT per worker than their American counterparts, when expressed in a common currency. This led to a 2.0 percentage-points decrease in the Canada-U.S. ICT investment per worker gap in 2007, measured in Purchasing Power Parity (PPP)-adjusted dollars. The ICT investment per worker gap remained significant however, with PPP-adjusted ICT investment per worker in Canada still at 62.6 per cent of investment per worker in the United States.
- The size of the Canada-U.S. ICT investment per worker gap has significantly narrowed in the computers ICT component, but has changed little in the communication equipment and software components. Measured in the same currency, computer investment per worker in Canada as a proportion of that of the United States reached 99.8 per cent in 2007, while communication equipment investment per worker was 58.0 per cent of that of the United States, and software investment was 49.4 per cent of that of the United States.

# The Canada-U.S. ICT Investment Gap in 2007: Narrowing but Progress Still Needed

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## I. Introduction

This report is based on the Centre for the Study of Living Standards (CSLS) Information and Communication Technology (ICT) database for Canada and the United States that has been updated to 2007.<sup>1</sup> The ICT database provides real and current dollar estimates of ICT investment and ICT capital stock in Canada and the United States for 20 North American Industry Classification System (NAICS) sectors, and on a per worker basis. The data are presented for the three ICT components: computers, communication equipment, and software. The report provides a brief overview of developments in ICT investment in the business sector for both Canada and the United States, focusing on developments in 2007. It complements a report prepared by CSLS for the Information Technology Association of Canada (ITAC) in July 2008, which focused exclusively on developments in Canadian ICT spending in 2007, and provides an update of a CSLS research report published in February 2008, which examined the Canada-U.S. ICT investment gap.<sup>2</sup>

## II. ICT Investment in Canada and the United States

### A. Nominal ICT Investment Growth

ICT investment growth in the business sector in 2007 was higher than that of 2006 for both Canada and the United States. Measured in domestic currency, nominal growth of ICT investment spending in the United States continued to outpace nominal growth in Canada in 2007 (Chart 1). When measured in domestic currencies, business sector ICT investment increased by 6.4 per cent to 29.7 billion dollars in Canada, and by 8.0 per cent to 419.8 billion dollars in the United States, in 2007 (Table 1).

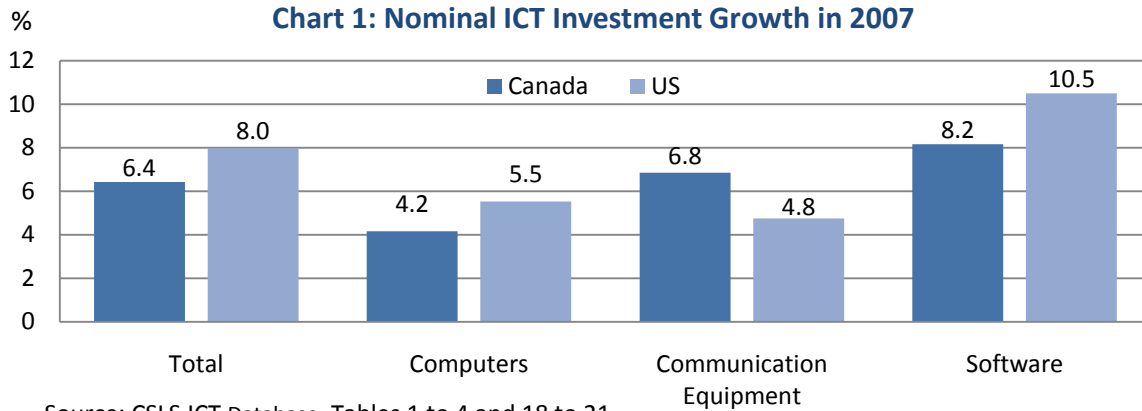
Nominal growth in investment in the computer and software components<sup>3</sup> was slower for Canada than for the United States in 2007, while investment in communication equipment grew at a higher rate in Canada (Chart 1).

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<sup>1</sup> Available online at <http://www.csls.ca/data/ict.asp>.

<sup>2</sup> The document "Overview of Development in ICT Investment in Canada, 2000-2007" was prepared for the Information Technology Association of Canada (ITAC) in July 2008. The CSLS report "The Canada-US ICT Investment Gap: An Update" (2008) is available on the CSLS website: <http://www.csls.ca/reports/csls2008-1.pdf>

<sup>3</sup> Statistics Canada has recently revised ICT investment and capital stock data, converting preliminary data from 2004 and 2005 into final data, and data intentions from 2006 into preliminary data. Total ICT investment has not been significantly altered as the revisions involved an offsetting shift in ICT investment across components. In the revised data, current dollar investment in 2006 was 24.0 per cent higher in computers, 25.0 per cent lower in communication equipment, and 2.6 per cent lower in software investment. As a result, total nominal ICT investment decreased by 1.4 per cent.

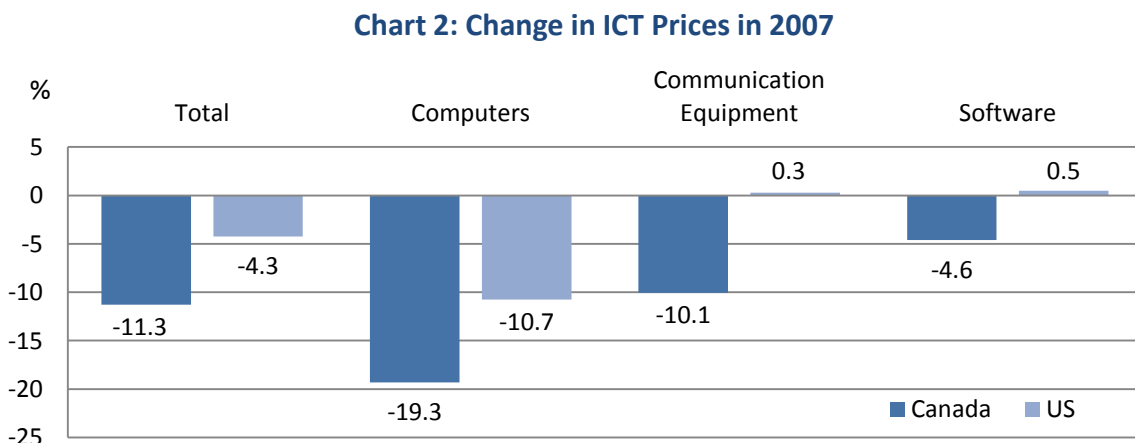


The average annual growth in ICT investment between 2000 and 2007 for Canada (1.5 per cent) remained higher than that of the United States (0.6 per cent) due to the faster recovery of investment growth in computers in Canada that followed the severe drop in investment in computers and in communication equipment in both countries in 2000 and 2001.

## B. ICT Prices

Nominal prices continued to fall in 2007 for all ICT components in Canada, resulting in a decline of 11.3 per cent in overall ICT prices (Chart 2). In particular, computer prices which declined by 10.2 per cent in 2006, declined further by 19.3 per cent in 2007 (Table 1). Communication equipment prices in Canada also declined sharply by 10.1 per cent in 2007, while software prices fell by 4.6 per cent.

In contrast, in the United States, communication equipment and software prices increased in 2007. These price increases were not sufficient to offset the 10.7 per cent decline in computer prices, however, resulting in an overall 4.3-per-cent decline in ICT prices in the United States.



**Table 1: Growth in ICT Investment in the Business Sector in Canada and the United States, 2000-2007**

Canada					United States			
	Total	Computers	Communication Equipment	Software	Total	Computers	Communication Equipment	Software
<b>Nominal ICT investment growth, domestic currencies (annual or average annual, %)</b>								
<b>2006</b>	4.8	1.9	3.9	8.0	7.4	8.7	10.6	5.4
<b>2007</b>	6.4	4.2	6.8	8.2	8.0	5.5	4.8	10.5
<b>2000-2007</b>	1.5	2.1	-2.2	3.5	0.6	-1.1	-3.2	3.7
<b>2005-2007</b>	5.6	3.0	5.4	8.1	7.7	7.1	7.7	7.9
<b>Nominal ICT investment per worker growth, domestic currencies (annual or average annual, %)</b>								
<b>2006</b>	3.1	0.3	2.2	6.3	5.5	6.7	8.6	3.5
<b>2007</b>	4.2	2.0	4.6	5.9	7.2	4.7	4.0	9.7
<b>2000-2007</b>	-0.2	0.3	-3.9	1.7	0.3	-1.5	-3.5	3.4
<b>2005-2007</b>	3.7	1.1	3.4	6.1	6.3	5.7	6.3	6.6
<b>Growth in ICT prices (annual or average annual, %)</b>								
<b>2006</b>	-7.0	-10.2	-4.7	-5.3	-6.7	-12.9	-1.0	1.3
<b>2007</b>	-11.3	-19.3	-10.1	-4.6	-4.3	-10.7	0.3	0.5
<b>2000-2007</b>	-7.3	-13.3	-5.7	-3.1	-5.6	-12.6	-2.6	-0.6
<b>2005-2007</b>	-9.2	-14.9	-7.4	-5.0	-5.5	-11.8	-0.4	0.9
<b>Exchange rate appreciation (annual or average annual, %)</b>								
<b>2006</b>					6.8			
<b>2007</b>					6.1			
<b>2000-2007</b>					4.8			
<b>2005-2007</b>					6.4			
<b>Real ICT investment growth, domestic currencies (annual or average annual, %)</b>								
<b>2006</b>	12.8	13.5	9.0	14.1	15.1	24.9	11.8	4.1
<b>2007</b>	20.0	29.1	18.8	13.4	12.8	18.2	4.5	10.0
<b>2000-2007</b>	9.5	17.8	3.7	6.8	6.6	13.2	-0.6	4.3
<b>2005-2007</b>	16.3	21.0	13.8	13.7	13.9	21.5	8.1	7.0
<b>Real ICT investment per worker growth, domestic currencies (annual or average annual, %)</b>								
<b>2006</b>	10.9	11.6	7.3	12.3	13.0	22.6	9.7	2.2
<b>2007</b>	17.5	26.4	16.3	11.0	11.9	17.4	3.7	9.2
<b>2000-2007</b>	7.7	15.8	1.9	5.0	6.2	12.8	-0.9	4.0
<b>2005-2007</b>	14.2	18.8	11.7	11.6	12.5	19.9	6.7	5.6

Source: CSLS ICT Database, Summary Tables

The steeper decline in ICT prices in Canada can be largely attributed to the appreciation of the Canadian dollar against the U.S. dollar, of 6.1 per cent in 2007 (Table 1), as the United States continues to be a major source of Canada's ICT imports.<sup>4</sup> Having a stronger currency means that Canadian firms can purchase more ICT goods, at the same level of planned spending, relative to their American counterparts. Price declines attributable to a currency appreciation are more significant in the computers and communication

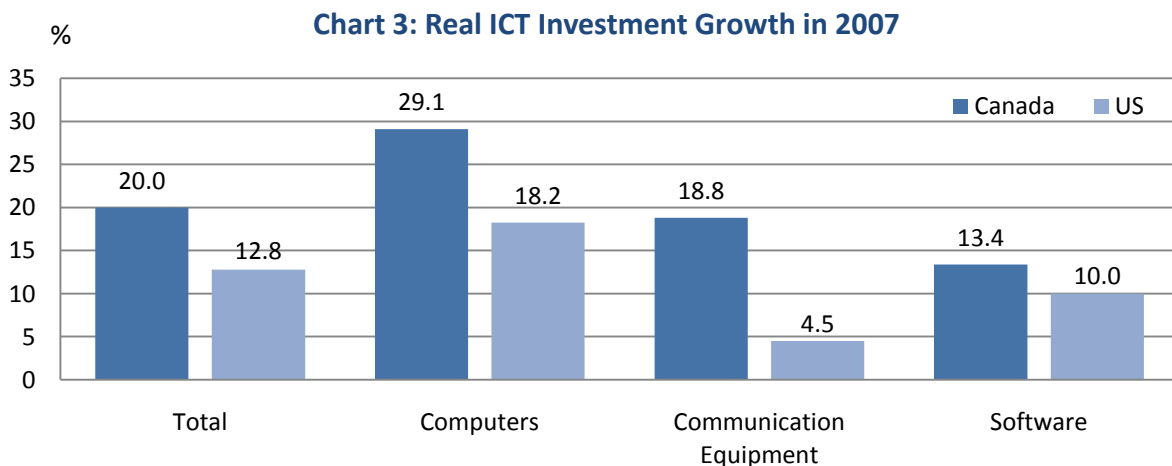
<sup>4</sup> In 2007, the U.S. share in Canadian imports was 64.8 percent in software, 31.1 percent in computer imports, and 17.7 per cent in communication equipment. Software imports include products comprised in Harmonized System (HS) codes 8523 and 8524. Computer imports include products comprised in HS 8471 (automatic data process machines, magnetic reader, etc., computer hardware). Communications Equipment imports include products comprised in HS 8517 to HS 8522 and HS-8525 to HS-8529. Data source: Industry Canada, Trade Data Online.

equipment components, for which the Canadian imports share of ICT investment is larger than the domestic production share.<sup>5</sup>

The strong Canadian currency and the ensuing decline in relative ICT prices therefore have two offsetting effects: On the one hand, Canadian firms' demand for ICT goods increases as the prices they face decline. On the other hand, Canadian firms have less need to increase their ICT budget than their American counterparts – an effect reflected in the slower nominal growth in ICT investment spending in Canada. On a net basis, however, the relative decline in prices has prompted Canadian firm to increase ICT investment spending, as demonstrated by a narrowing of the Canada-U.S. ICT investment per worker gap, measured in Purchasing Power Parity (PPP)-adjusted dollars, which is further discussed in Section III.

### C. Real ICT Investment Growth

A major implication of the sharp decline in ICT prices in Canada is that real ICT investment growth, which is a more relevant measure from a productivity perspective<sup>6</sup>, has been significantly higher than nominal ICT investment growth. In real terms, total ICT investment grew at a higher rate in Canada (20.0 per cent) than in the United States (12.8 per cent) in 2007. In fact, Canada's real investment growth outpaced that of the United States in all three ICT expenditure categories in 2007 (Chart 3).



Source: CSLS ICT Database, Tables 13 to 16, and 30 to 33

<sup>5</sup> Machinery and equipment price indexes (MEPI) for domestic and imported commodities suggest that, unlike computers and communication equipment, which are mostly imported, domestic software accounts for a large share of software investment in Canada (Statistics Canada, CANSIM Table 327-0041). Although MEPI are weighted indexes based on 1997 domestic production and import data, imports continue to account for the largest share of computers and communications equipment investment in Canada.

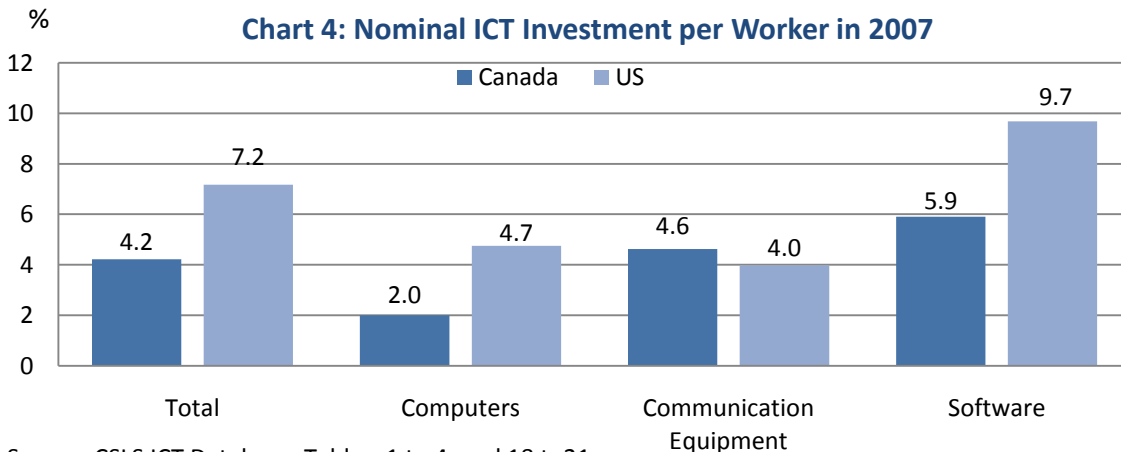
<sup>6</sup> The CSLS report "The Relationship between ICT Investment and Productivity in the Canadian Economy: A Review of the Evidence" (2006) provides an analysis of the implications of real ICT investment growth for productivity. The report is available on the CSLS website: <http://www.csls.ca/reports/csls2006-05.pdf>

## D. Nominal Growth in ICT Investment per Worker

Nominal growth in ICT investment per worker<sup>7</sup> in Canada (4.2 per cent) remained lower than in the United States (7.2 per cent) in 2007. Nominal growth in investment per worker in all ICT components remained positive in 2007 for both Canada and the United States. However, Canada continued to lag behind the United States in the computer and software components (Chart 4).

The average annual growth in nominal ICT investment per worker between 2000 and 2007 in Canada remained negative, due to the negative growth (-3.9 per cent annually, on average) in investment per worker in communication equipment (Table 1). Average annual growth in total ICT investment per worker in the United States was positive between 2000 and 2007, due to positive growth in nominal software investment per worker, coupled with the sustained increase of the software share in total ICT investment during this period. In fact, the share of ICT investment spending going to software increased by 10.3 percentage points for the United States, and by 5.3 percentage points for Canada over the 2000-2007 period (Table 2).

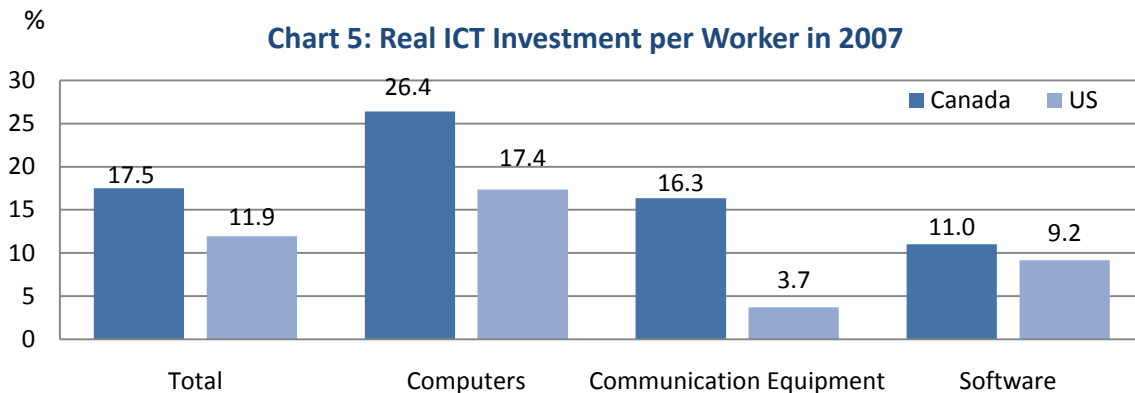
In the computers component, nominal growth in investment per worker in Canada was positive between 2000 and 2007, with an annual average of 0.3 per cent, contrary to that of the United States, which declined at an average annual rate of 1.5 per cent (Table 1).



<sup>7</sup> The number of workers in the business sector for Canada has been revised in this report. It is now calculated as all NAICS industries excluding Health care and social assistance [62], Educational services [61] and Public administration [91]. In previous reports, the figure was taken from Statistics Canada's Productivity Accounts datasets, where the business sector included some health, education or public administration workers. As a result, the number of business sector workers had previously been higher, thus artificially lowering Canadian investment per worker figures relative to the United States figures, which have always been computed using a NAICS-based worker count. For instance, with the revised (NAICS-based) number of workers, Canadian ICT investment per worker relative to that of the United States in 2006, calculated in a common currency, is 3.7 percentage points higher than obtained using the Productivity Accounts-based number of workers.

## E. Real Growth in ICT Investment per Worker

While the United States continued to outpace Canada in terms of nominal ICT investment per worker growth in 2007, Canada performed better in terms of real growth in ICT investment per worker. In fact, ICT investment per worker measured in real dollars, increased by 17.5 per cent in Canada in 2007, compared to 11.9 per cent in the United States. Real investment per worker increased at a higher rate in Canada than in the United States in all ICT expenditure categories in 2007 (Chart 5).



Source: CSLS ICT Database, Tables 13 to 16 and 30 to 33

Canada's real ICT investment per worker increased at a higher average annual rate (7.7 per cent) than that of the United States (6.2 per cent) between 2000 and 2007 (Table 1).

**Table 2: Current Dollar ICT Investment Shares in the Business Sector in Canada and the United States, 2000-2007**

	Canada				United States			
	Total	Computers	Communication Equipment	Software	Total	Computers	Communication Equipment	Software
<b>ICT Investment as a share of GDP (level and percentage point change)</b>								
2000	3.2	1.1	0.9	1.2	5.2	1.3	1.6	2.3
2006	2.5	0.9	0.5	1.0	3.8	0.9	0.9	2.0
2007	2.5	0.9	0.5	1.1	3.9	0.9	0.9	2.1
$\Delta$ 2000-2007	-0.7	-0.2	-0.4	-0.1	-1.3	-0.4	-0.7	-0.2
$\Delta$ 2007	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
<b>ICT Investment as a share of Total Investment (level and percentage point change)</b>								
2000	20.1	6.9	5.7	7.5	32.5	8.2	10.1	14.3
2006	15.5	5.6	3.4	6.5	27.6	6.3	6.7	14.6
2007	15.9	5.6	3.5	6.8	27.9	6.2	6.6	15.1
$\Delta$ 2000-2007	-4.2	-1.2	-2.2	-0.7	-4.6	-2.0	-3.5	0.9
$\Delta$ 2007	0.4	0.0	0.1	0.3	0.4	-0.1	-0.1	0.5
<b>ICT Component Share of Total ICT Investment (level and percentage point change)</b>								
2000		34.1	28.5	37.4		25.2	30.9	43.9
2006		36.2	21.8	42.0		22.8	24.3	52.9
2007		35.5	21.8	42.7		22.2	23.6	54.1
$\Delta$ 2000-2007		1.3	-6.6	5.3		-3.0	-7.3	10.3
$\Delta$ 2007		-0.8	0.1	0.7		-0.5	-0.7	1.2

Source: CSLS ICT Database, Summary Tables



## F. ICT Investment Shares in Nominal Business Sector GDP

In 2007, ICT investment as a share of nominal GDP in the business sector was largely unchanged across all components for both Canada and the United States. A large ICT investment share gap remained between Canada, where ICT investment accounted for 2.5 per cent of business sector GDP in 2007, and the United States, where the ICT investment share was 3.9 per cent of business sector GDP (Table 2).

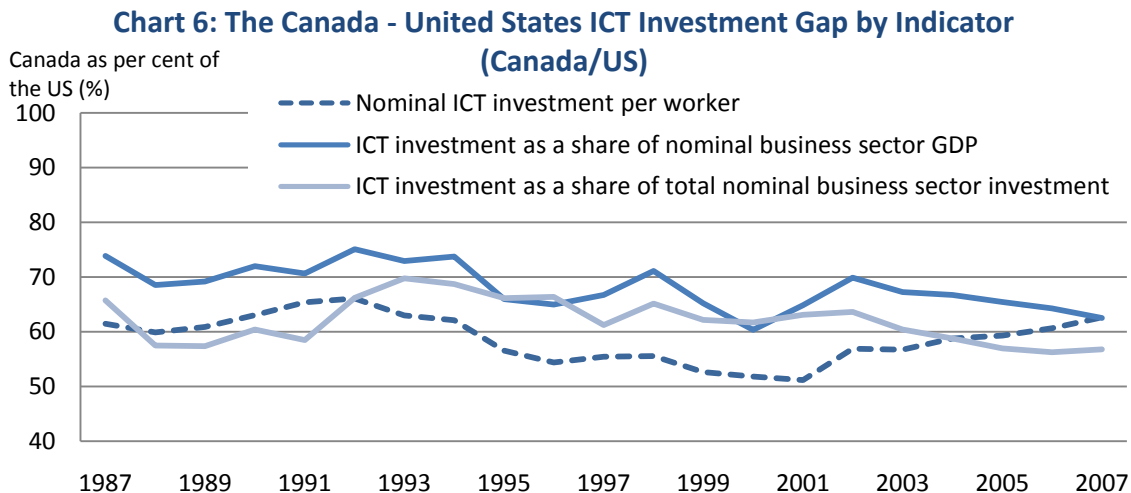
Between 2000 and 2007, ICT investment as a share of nominal business sector GDP declined by 0.7 percentage points in Canada and by 1.3 percentage points in the United States, as ICT investment growth fell short of GDP growth in both economies.

## G. ICT Investment Shares in Total Nominal Investment

ICT investment as a share of total investment increased by 0.4 percentage points in both Canada and the United States in 2007, but remained at a higher level in the United States (27.9 per cent) than in Canada (15.9 per cent) (Table 2). In the United States, the negative growth in computers and communication equipment investment shares of total investment was offset by a growth in investment in the software component, which accounted for 54.1 per cent of all ICT spending in the United States business sector in 2007.

## III. Canada-U.S. ICT Investment Gap

In 2007, the Canada-United States ICT investment gap narrowed in terms of nominal PPP-adjusted ICT investment per worker, and in terms of nominal investment share of total investment (Chart 6). In particular, measured in a common currency, ICT investment per worker in Canada as a proportion of that of the United States has increased by 10.8 percentage points between 2000 and 2007 (Table 3). This relative increase in ICT investment spending was likely fuelled by the sharper decrease in ICT prices for Canada during these years.



Source: CSLS ICT Database, Tables S1, S9 and S13

ICT investment as a share of nominal business sector GDP in Canada relative to that of the United States declined steadily since 2002 (Chart 6). In 2007, it fell by 1.7 percentage points to 62.5 per cent of that of the United States (Table 3). This decline is a reflection of both a slower growth in nominal ICT investment spending in Canada (6.4 per cent) relative to the United States (8.0 per cent), and a higher growth rate of nominal GDP in Canada (5.9 per cent) relative to the United States (4.5 per cent) in 2007.

**Table 3: Canada-United States ICT Investment Gap in the Business Sector, 2006-2007**

	Total	Computers	Communication Equipment	Software
<b>Nominal ICT investment per worker in Canada as a share of Nominal ICT investment per worker in the United States, PPP adjusted<sup>8</sup> (%)</b>				
2000	51.8	70.2	47.7	44.2
2006	60.7	96.5	54.2	48.2
2007	62.6	99.8	58.0	49.4
<b>Percentage points change</b>				
Δ 2000-2007	10.8	29.6	10.2	5.2
Δ 2007	2.0	3.3	3.7	1.2
<b>ICT investment as a share of Nominal GDP in Canada as a proportion of that of the United States (%)</b>				
2000	60.4	81.7	55.6	51.5
2006	64.3	102.3	57.5	51.1
2007	62.5	99.6	57.9	49.3
<b>Percentage points change</b>				
Δ 2000-2007	2.2	17.9	2.3	-2.1
Δ 2007	-1.7	-2.7	0.4	-1.7
<b>ICT investment as a share of Nominal Total Investment in Canada as a proportion of that of the United States (%)</b>				
2000	61.7	83.6	56.8	52.6
2006	56.2	89.5	50.3	44.7
2007	56.8	90.5	52.5	44.8
<b>Percentage points change</b>				
Δ 2000-2007	-4.9	6.9	-4.3	-7.8
Δ 2007	0.6	1.0	2.3	0.1

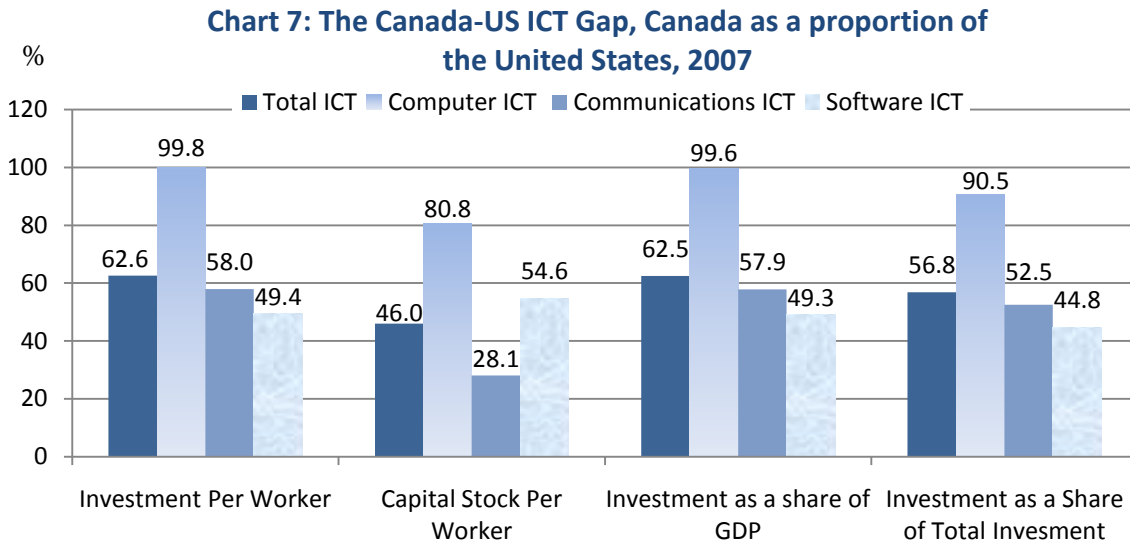
Source: CSLS ICT Database, Summary Tables

The ICT investment share of total nominal investment in Canada as a proportion of that of the United States, which had also been steadily declining since 2002 (Chart 6), increased by 0.6 percentage points in 2007 (Table 3). This increase occurred despite a slower growth in nominal ICT investment spending in Canada relative to the United States, reflecting a higher growth in total investment spending in the United States (6.6 per cent) than in Canada (4.0 per cent) in 2007.

Nominal PPP-adjusted ICT investment per worker in Canada steadily increased relative to the United States between 2003 and 2007 (Chart 6) but remained at a relatively low level (62.6 per cent of that of the United States) in 2007, with negative consequences

<sup>8</sup> Using exchange rate-adjusted figures, ICT investment per worker in Canada as a share of ICT investment per worker in the United States was 60.0 per cent in 2007, or 2.6 percentage point lower than the ratio obtained by using PPP-adjusted figures. The ratio decreases by 4.3 per cent for computers, 2.6 per cent for communication equipment and 2.1 per cent for software.

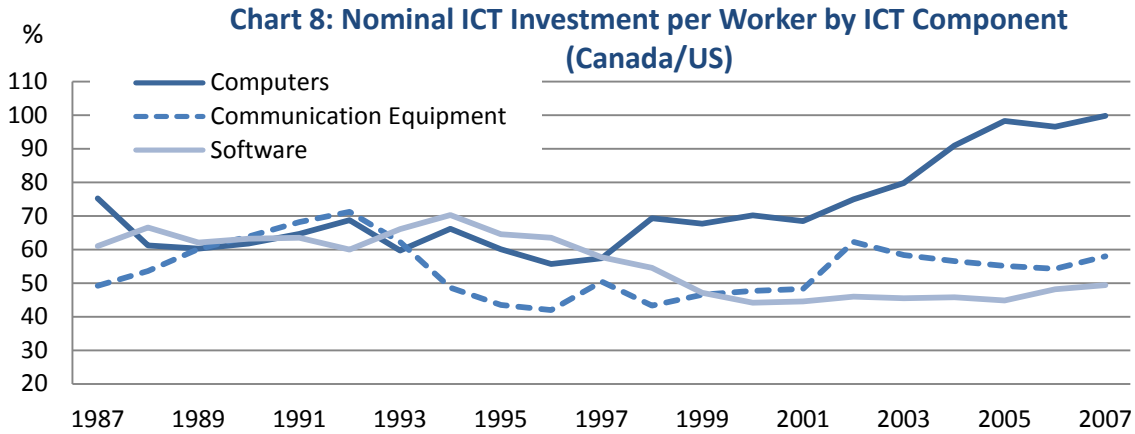
for productivity growth. Some insight for policymaking may be provided by a further analysis of ICT investment per worker by ICT component.



The ICT investment gap in the computer ICT component has nearly disappeared in 2007, with Canada being nearly at the same level as the United States in terms of nominal PPP-adjusted investment per worker, and in terms of investment as a share of nominal business sector GDP (Chart 7).<sup>9</sup>

Measured in the same currency, nominal computer investment per worker in Canada as a proportion of that of United States increased by 29.6 percentage points between 2000 and 2007, partly driven by the relative decline in computer prices in Canada (Table 3).

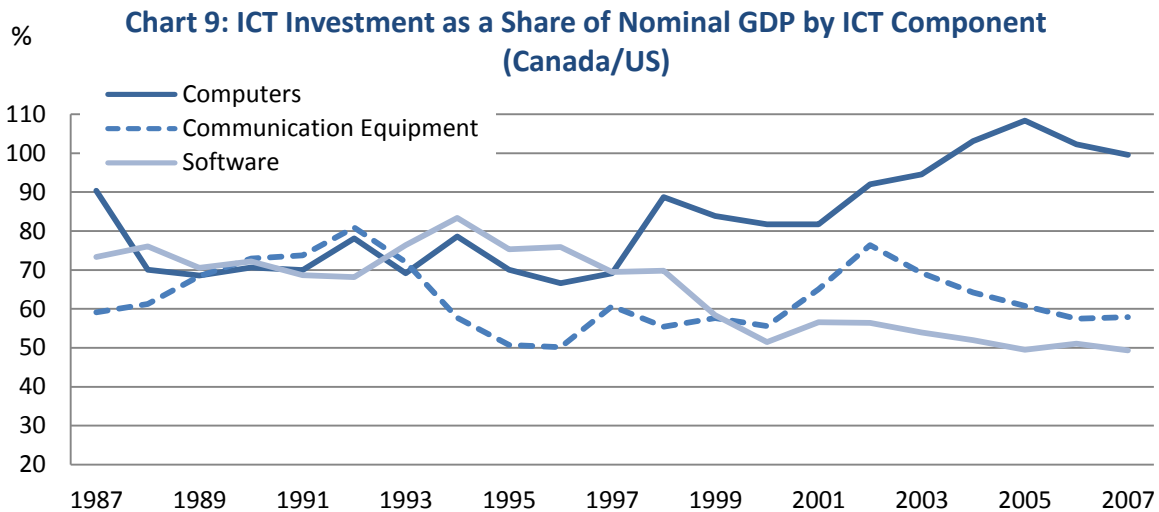
<sup>9</sup> ICT component shares presented in this report are based on the most recent Statistics Canada data, which has been revised since the completion of previous issues of this report (see footnote 3). The narrowing of the Canada-U.S. computer investment per worker gap based on newly revised data is more significant than stated in previous reports. Although the revisions decreased the Canada-U.S. ICT investment per worker gap by 0.8 percentage point in 2006, the difference was more significant by component. The shift *decreased* the computer investment per worker gap by 17.1 percentage points, *increased* the communication equipment investment per worker gap by 17.1 percentage points, and *increased* the software investment per worker gap by 1.2 percentage points. Furthermore, using the NAICS-based number of workers instead of the Productivity Accounts-based number (explained in footnote 7) resulted in an additional 3.8 percentage point *decrease* in the Canada-U.S. ICT investment per worker gap in 2006. The *decrease* in the investment per worker gap by ICT component, attributable to the change in number of workers was 4.6 percentage points for computers, 4.5 percentage points for communication equipment and 3.1 percentage points for software in 2006.



Source: CSLS ICT Database, Tables S1 to S4

The Canada-U.S. ICT investment gap in communication equipment was slightly smaller in 2007. Measured in a common currency, communication equipment spending per worker in Canada as proportion of the United States level increased by 3.7 percentage points in 2007, but remained at a low level of 58.0 per cent (Chart 8).

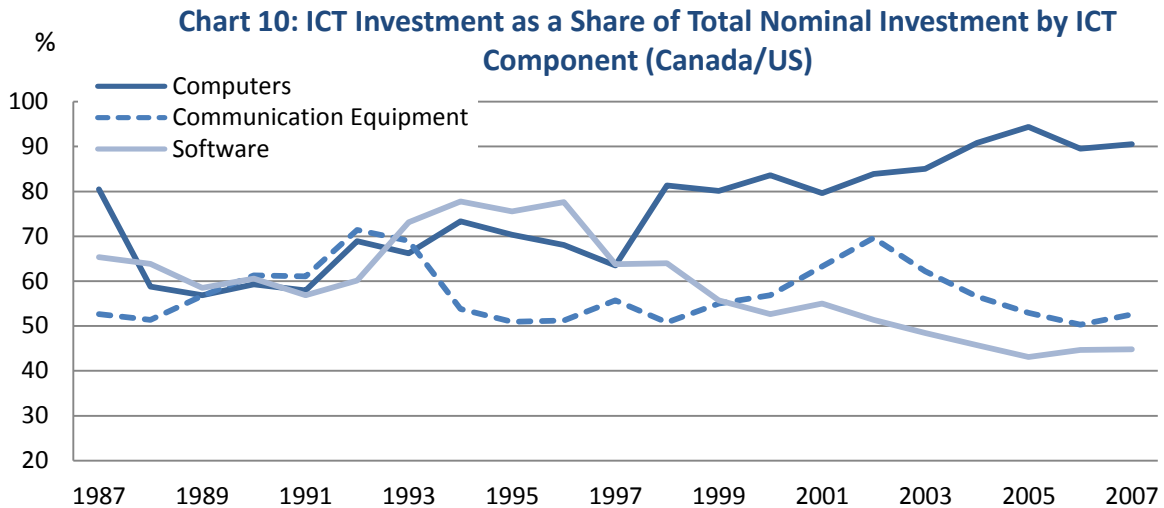
Investment in communication equipment as a share of total nominal investment in Canada increased by 2.3 percentage points to reach 52.5 per cent of that of the United States (Chart 10), while investment in communication equipment as a share of nominal business sector GDP in Canada increased by 0.4 percentage points to 57.9 percent of the United States level (Table 3).



Source: CSLS ICT Database, Tables S9 to S12

The Canada-U.S. ICT investment gap remained the largest in the software component, using all three measures. In 2007, PPP-adjusted ICT investment per worker in the software sector was only 49.4 per cent of that of the United States (Chart 8), investment in software as a share of business sector GDP in Canada as a proportion of that of the

United States was 49.3 per cent (Chart 9), and software investment as a share of total investment in Canada as a proportion of that of the United States was 44.8 percent (Chart10).



Source: CCLS ICT Database, Tables S13 to S16

## IV. Conclusion

In 2007, strong economic growth in Canada and the appreciation of the Canadian dollar in relation to the U.S. dollar were reflected in ICT spending developments. In particular, an appreciated currency lowered ICT prices in Canada relative to the United States. The lower ICT prices have led Canadian firms to increase their ICT spending, relative to their American counterparts. This resulted in a 2.0 percentage point narrowing of the ICT investment gap in terms of PPP-adjusted nominal ICT investment per worker in 2007. The gap remained significant however, with PPP-adjusted nominal ICT investment per worker in Canada amounting to 62.6 per cent of nominal ICT investment per worker in the United States.

The Canada-U.S. ICT investment gap varies in size across ICT components. It has significantly narrowed in the computers component, due to relatively larger decline of computer prices in Canada. In 2007, as computer prices dropped by 19.3 per cent in Canada compared to 10.7 per cent in the United States, PPP-adjusted ICT investment per worker in computers in Canada increased by 3.3 percentage points to 99.8 per cent of the United States level. Canada still lags significantly behind the United States in the other two ICT components, with communications equipment investment per worker at 58.0 per cent of the United States level, and software investment per worker at only 49.4 per cent of the United States level in 2007.