January 2013

151 Slater Street, Suite 710
Ottawa, Ontario K1P 5H3
613-233-8891, Fax 613-233-8250
csls@csls.ca

CENTRE FOR THE STUDY OF LIVING STANDARDS

CANADA-U.S. ICT INVESTMENT IN 2011: THE GAP NARROWS

Evan Capeluck
CSLS Research Note 2013-1
January 2013

Canada-U.S. ICT Investment in 2011: The Gap Narrows

Abstract

Growth in labour productivity determines growth in wages (and therefore living standards) in the long-run. Growth in information and communications technology (ICT) investment hastens the pace of labour productivity growth and, consequently, it affects the development of wages and living standards. This report, which is based on the updating of the Centre for the Study of Living Standards (CSLS) ICT database for 2011, investigates the Canada-U.S. ICT gap for the business sector over the between 1987 and 2011, with special attention paid to the 2000-2011 period. We found that the Canada-U.S. ICT gap narrowed in 2011 across all its measures including ICT investment per worker, ICT capital stock per worker, ICT investment as a share of nominal business sector GDP, and ICT investment as a share of total fixed, non-residential business sector investment. Most significantly, the ICT investment per worker gap was 42.2 per cent in 2011, down 3.1 percentage points lower from 46.5 per cent in 2010. Canada's relative success was the result of stronger nominal ICT investment in 2011 compared to the United States, and an appreciation of our purchasing power parity (PPP) in machinery and equipment (M&E).

Canada-U.S. ICT Investment in 2011: The Gap Narrows

Table of Contents

Executive Summary 4
I. Data 6
II. ICT Investment in Canada and the United States 7
A. Nominal ICT Investment Growth 7
B. ICT Prices 8
C. Real ICT Investment Growth 11
D. Nominal ICT Investment per Worker 13
E. Real ICT Investment per Worker 14
F. ICT Investment Shares in Nominal Business Sector GDP 16
G. ICT Investment Shares in Total Nominal Investment 17
III. Canada-U.S. ICT Gap 19
A. Canada-U.S. Relative Nominal ICT Investment per Worker 20
B. Canada-U.S. Relative Nominal ICT Capital Stock per Worker 21
C. Canada-U.S. Relative ICT Investment as a Share of Business Sector GDP 22
D. Canada-U.S. Relative ICT Investment as a Share of Total Investment 23
V. Conclusion 24
References 26

Canada-U.S. ICT Investment in 2011: The Gap Narrows

Executive Summary

This report examines trends and developments in information and communications technology (ICT) investment in Canada and the United States between 1987 and 2011, based on the update of the Centre for the Study of Living Standards (CSLS) ICT database for 2011. This report focuses on nominal and real ICT investment growth in the business sector and the effect of these indicators on the Canada-U.S. ICT investment gap. The following summary highlights the key findings of this report:

- In 2011, business sector nominal ICT investment grew 6.3 per cent in Canada and 4.1 per cent in the United States. This was the first time since 2008 that nominal ICT investment growth in Canada surpassed that in the United States. Between 2000 and 2011, Canada outperformed the United States in terms of nominal ICT investment growth per year (1.6 per cent versus 0.5 per cent).

- In 2011, ICT investment prices decreased 6.2 per cent in Canada and 1.2 per cent in the United States. Prices fell in Canada in 2011 at a greater rate than in the United States for all three ICT investment components: for computers, Canadian prices fell 15.1 per cent while American prices fell 4.2 per cent; for communications equipment, Canadian prices fell 3.5 per cent while American prices fell 2.1 per cent; and for software, the decline of 0.2 per cent in Canadian prices exceeded that of less 0.1 per cent in the United States.

- Canada and the United States' real ICT investment growth (13.3 per cent and 5.3 per cent, respectively) outpaced their nominal ICT investment growth. The difference in real ICT investment compared to nominal ICT investment between Canada and the United States is explained by ICT prices falling more rapidly in this country.

- Nominal ICT investment per worker grew for Canada and the United States in 2011 at 4.8 per cent and 2.6 per cent, respectively. Different nominal ICT investment per worker growth rates were due to differences in nominal ICT investment as both countries experienced business sector employment growth of 1.5 per cent. Real ICT investment per worker grew 11.7 per cent in Canada and 3.8 per cent in the United States in 2011.

- In 2011, the Canada-United States ICT gap decreased for all four indicators (i.e. ICT investment per worker, capital stock per worker, ICT investment as a share of nominal GDP, and ICT investment as a share of total investment), as nominal ICT investment growth in Canada was higher than in the United States.

- In 2011, nominal PPP adjusted ICT investment per worker was $2,273 in Canada compared to $3,931 in the United States (Chart 12). Thus Canada-U.S. relative ICT investment intensity was only 57.8 per cent in 2011, up 3.1 percentage points from 53.5 per cent in 2010.

- The share of nominal ICT investment in business sector GDP has followed a similar trend in both Canada and the United States over the 1987-2011 period. Both countries had their shares of ICT investment in business sector GDP remain unchanged in 2011. Canada's ICT investment share in business sector GDP as a proportion of the U.S. share grew slightly (by 0.3 percentage points) in 2011.

- ICT investment growth failed to surpass total business sector fixed, non-residential investment growth in both counties, which caused their investment shares to decrease from 15.6 to 14.8 per cent in Canada and from 31.1 to 29.3 per cent in the United States between 2010 and 2011. Since the percent decrease in the share of ICT investment in total investment was smaller in Canada, Canadian ICT investment as a share of total investment relative to the U.S. share grew from 50.2 in 2010 to 50.6 in 2011.

Canada-U.S. ICT Investment in 2011: The Gap Narrows

The aim of this report[1] is to provide an overview of recent developments in business sector[2] ICT investment in Canada and the United States in 2011, with particular attention to trends in the ICT investment per worker gap between the two countries. Canada has historically had a large gap in the level of ICT investment per worker relative to the United States. Our lower labour productivity level and weaker labour productivity growth is often partially explained by this phenomenon. Consequently, it is important to monitor (and explain) developments in this gap as part of an overall analysis of Canada's productivity performance.

This report is divided into three sections, all of which offer a focus on ICT investment by component (computer, communications equipment and software) for the business sector. In the first section, the data used in this report are briefly discussed. The second section compares developments in Canada and the United States concerning nominal/real ICT investment, ICT prices, nominal/real ICT investment per worker, ICT investment shares in business sector GDP, and ICT investment shares in total investment. The third section examines the Canada-U.S. gap in ICT investment per worker, ICT capital stock per worker, ICT investment shares in business sector GDP, and ICT investment shares in total investment. The report builds on and extends earlier CSLS work on ICT investment trends.[3]

I. Data

The data in this report are drawn from the ICT database for Canada and the United States, developed and maintained by the CSLS.[4] The database provides estimates of ICT investment and ICT capital stock in Canada and the United States by industry, broken down into 20 two-digit North American Industry Classification System (NAICS) sectors, as well as on a per worker basis. All estimates are expressed in both nominal terms (current dollars) and real terms (chained 2007 dollars). The data are broken down into ICT's three components: computers, communications equipment, and software. ICT estimates by industry are available from 1980 to 2011 for Canada and from 1987 to 2011 for the United States. Consequently, comparisons between Canada and the

[1] Evan Capeluck prepared this report under the supervision of Andrew Sharpe. For comments, please email andrew.sharpe@csls.ca or evan.capeluck@csls.ca.

[2] The total economy can be divided into the business and non-business sectors. The business sector represents approximately 75 per cent of total economy GDP and includes industries whose outputs are marketed. The non-business sector includes industries and activities whose outputs are generally not marketed, such as public administration, healthcare and social assistance, and educational services.

[3] For more from the CSLS on ICT, see the following reports: Sharpe, 2005, 2006 and 2010; CSLS, 2008; Sharpe and Arsenault, 2008a and 2008b; Sharpe and de Avillez, 2010; Sharpe and Moeller, 2011; Sharpe and Andrews, 2012; and Capeluck, 2012.

[4] The CSLS ICT database can be accessed at http://www.csls.ca/data/ict.asp. Statistics Canada and the BEA made large revisions to their ICT investment series for 2009 and 2010 data in their most recent release. Our ICT database was amended to reflect these changes. For example, the nominal ICT investment growth rates between 2009 and 2010 for the Canadian and U.S. business sectors were changed from 3.1 per cent to 1.1 per cent and from 7.1 per cent to 2.6 per cent, respectively.

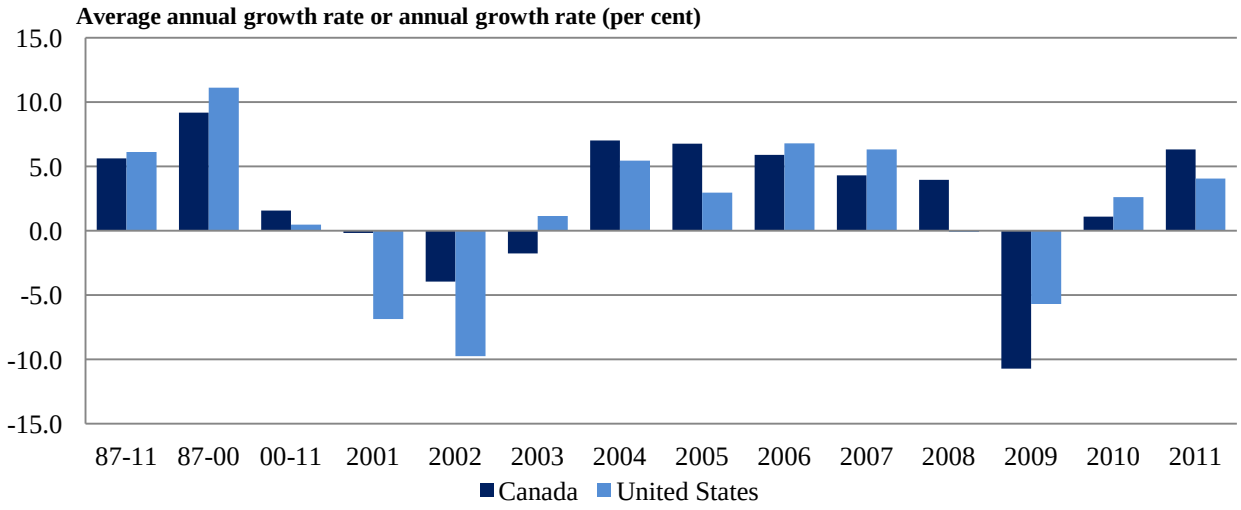
United States are made in the 1987-2011 period, with special attention paid to the 2000-2011 period. The database is based on information collected primarily from Statistics Canada's CANSIM flows and stocks of fixed, non-residential capital stock tables and the Bureau of Economic Analysis's (BEA) fixed asset tables.

II. ICT Investment in Canada and the United States

A. Nominal ICT Investment Growth

In 2011, business sector nominal ICT investment[5] grew 6.3 per cent in Canada and 4.1 per cent in the United States (Chart 1); this was the first time since 2008 that nominal ICT investment growth in Canada surpassed that in the United States. Over the 2000-2011 period, Canada outperformed the United States in terms of nominal ICT investment growth per year (1.6 per cent versus 0.5 per cent), due to a massive fall in U.S. ICT investment in 2001 and 2002 (Chart 3). Nominal ICT investment in the United States withstood and recovered from the impact of the recession better than Canada in 2009 and 2010, as ICT investment in Canada declined more in 2009 (10.7 per cent compared to 5.7 per cent) and grew slower in 2010 (1.1 per cent versus 2.6 per cent). However, Canada's nominal ICT investment growth performance relative to the United States in 2011 signals that the recovery of ICT investment in Canada has accelerated.

Chart 1: Nominal ICT Investment Growth in the Business Sector, 1987-2011



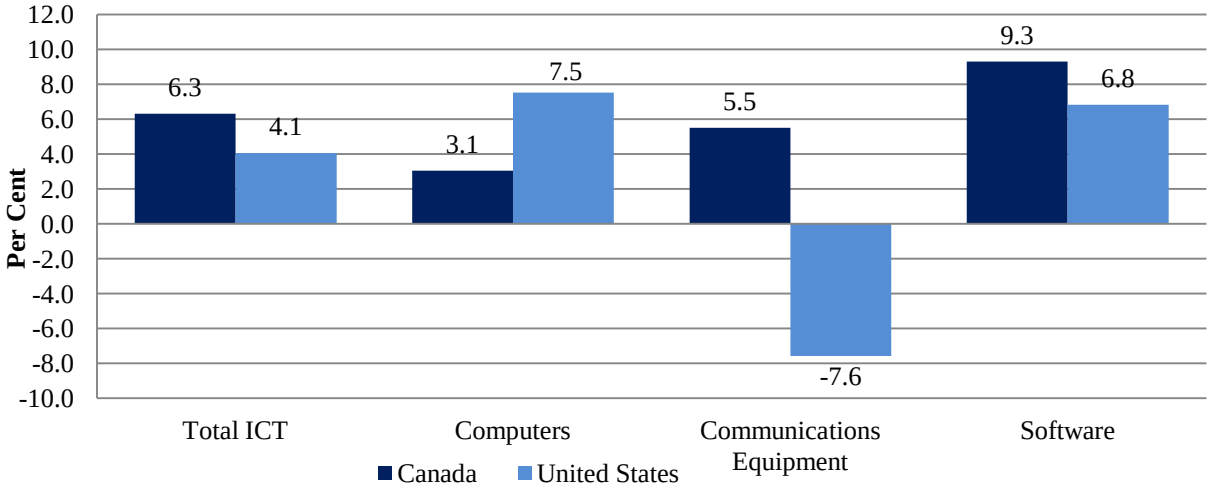
Source: CSLS ICT Database, Summary Table 9

Total ICT investment consists of three components: computer investment, communication equipment investment, and software investment. The faster pace of ICT spending in Canada relative to the United States was due to two ICT components: communications equipment and software. Nominal ICT investment growth in computers in the United States was 7.5 per cent while in Canada it was much lower, at 3.1 per cent. Nonetheless, nominal ICT investment growth

[5] In this paper, all references to total 'investment' values refer to mean 'business sector fixed, non-residential, investment' unless otherwise noted.

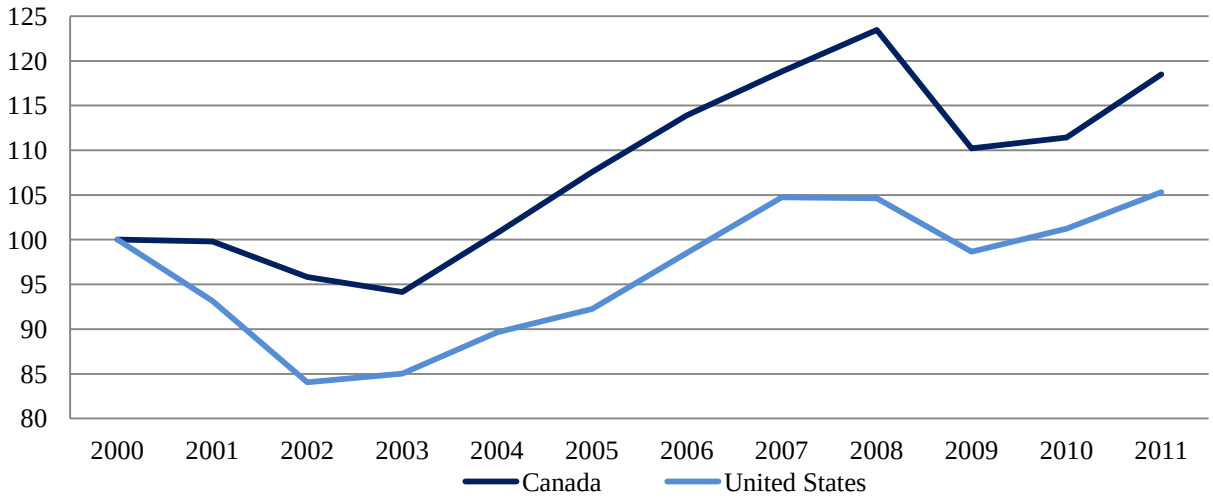
for communications equipment and software was faster in Canada than the United States (5.5 per cent versus -7.6 per cent for communications, and 9.3 per cent and 6.8 per cent for software). It is clear, however, that Canada's total nominal ICT investment grew faster than that in the United States due to the large decline in communications equipment investment in the United States.

Chart 2: Per Cent Change of Nominal ICT Investment in the Business Sector, 2011



Source: CSLS ICT Database, Tables 1 to 4 and 18 to 21

Chart 3: Nominal ICT Investment Levels in the Business Sector, 2000-2011 (2000=100)



Source: CSLS ICT Database, Summary Table 9

B. ICT Prices

By dividing the nominal estimates of ICT investment by the real figures, it is possible to obtain implicit price indices for computers, communications equipment, software, and total ICT investment. In 2011, ICT investment prices decreased 6.2 per cent in Canada and 1.2 per cent in the United States (Chart 4). This represents a return to the trend for Canada, which has a history of falling ICT prices with 2009 being the only exception (Sharpe and De Avillez, 2010: 6). In

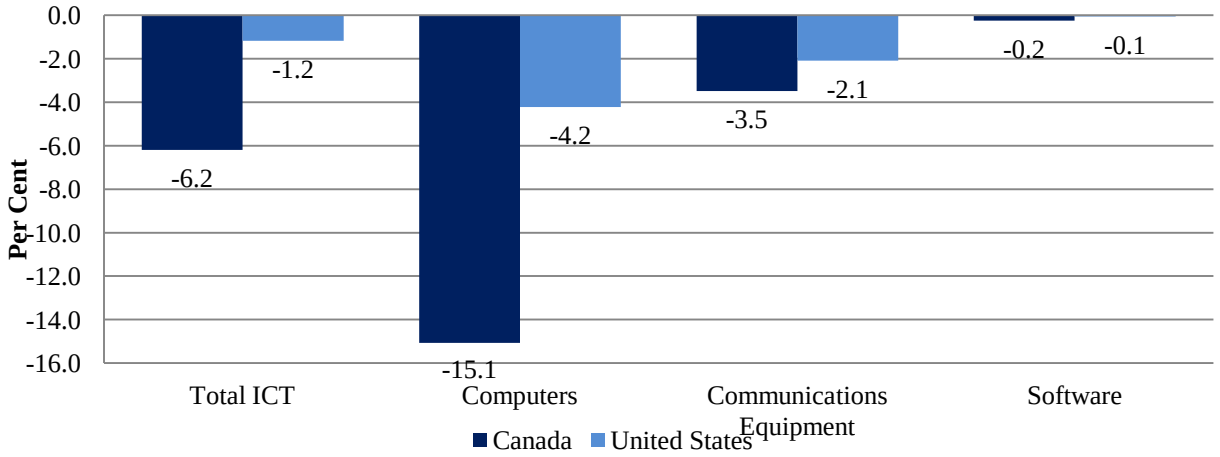
addition, ICT prices have been falling faster in Canada than in the United States by a substantial margin between 2003 and 2011, excluding the 2008-2009 period (Chart 5).

Prices fell in Canada in 2011 at a greater rate than in the United States for all three ICT investment components (Charts 6, 7, 8). In computers, Canadian prices fell 15.1 per cent while American prices fell 4.2 per cent. In communications equipment, Canadian prices fell 3.5 per cent while American prices fell 2.1 per cent. In software, the decline of 0.2 per cent in Canadian prices exceeded that of 0.1 per cent in the United States.

Prices of all ICT components have declined quicker in Canada than in the United States between 2000 and 2011. Computer prices fell most rapidly in Canada (10.7 per cent per year), followed by communication equipment (3.9 per cent per year), and finally software (1.1 per cent per year). It is important to track price movements when dealing with nominal figures, because those figures capture both price and volume effects. Thus, continually falling prices cause ICT investment to grow faster in real terms than in nominal terms.

According to Capeluck (2012), "since 2003 there has been a clear negative correlation between total ICT prices in Canada and the Canada-US exchange rate." This relationship exists because ICT investment goods in Canada are largely imported and, consequently, "an increase in the value of the Canadian dollar (CAD) effectively decreases ICT prices" (Capeluck, 2012). This trend continued in 2011: the exchange rate appreciated 4.1 per cent as ICT prices fell 6.2 per cent. Furthermore, Sharpe and De Avillez (2010) note that the changing valuation of the CAD should have a smaller effect on software prices as imports make up a smaller proportion of the software market than in the markets for the other two ICT components.[6] This holds true, as the decline in ICT prices in 2011 was least significant for software. Please note that correlation does not necessarily imply causation but rather indicates coincident movement.

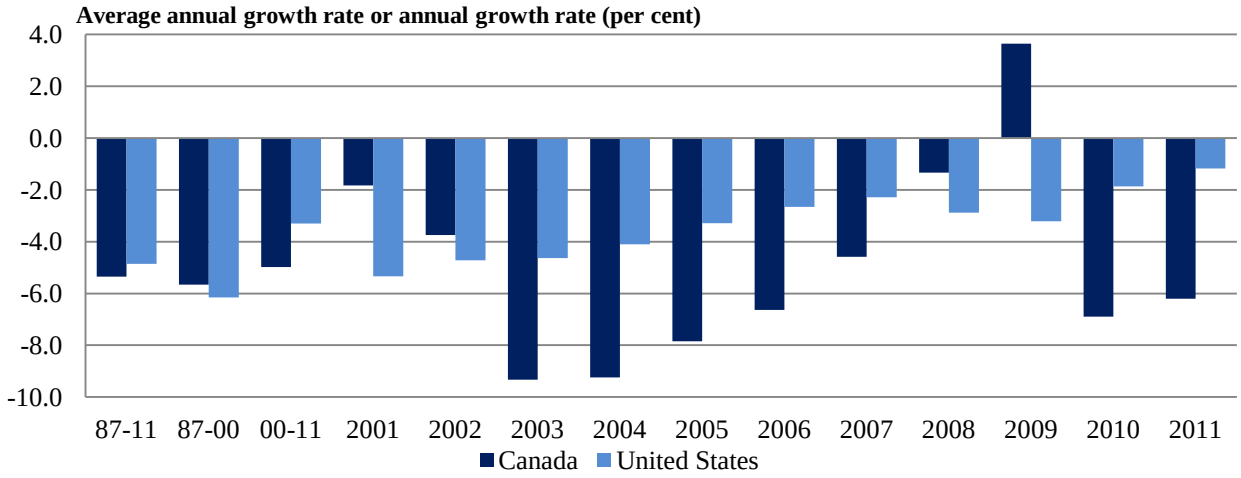
Chart 4: Per Cent Change in ICT Prices in the Business Sector, 2011



Source: CSLS ICT Database, Tables 17v and 34v

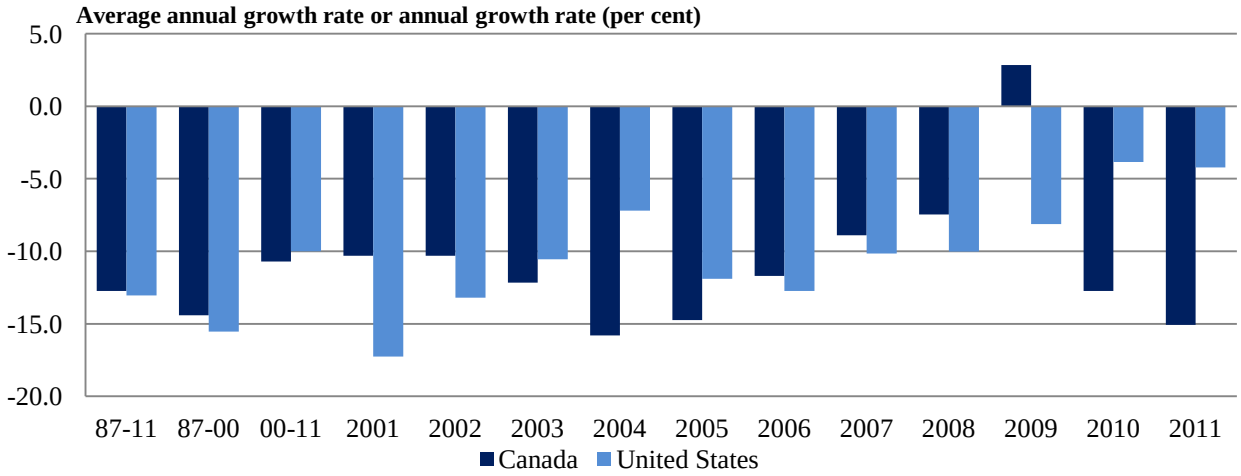
[6] "Software investment" is the aggregate of investment in prepackaged software, custom designed software, and own account software. The latter two are largely produced domestically whereas prepackaged software is largely imported.

Chart 5: Total ICT Price Growth Rates in the Business Sector, 1987-2011



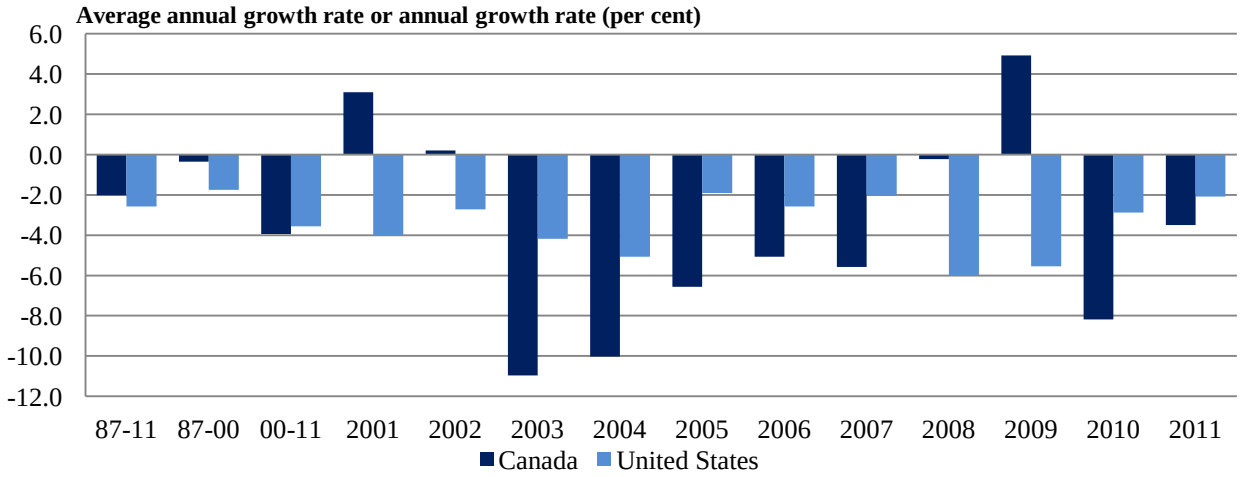
Source: CSLS ICT Database, Tables 17vand 34v

Chart 6: Computer ICT Price Growth Rates in the Business Sector, 1987-2011



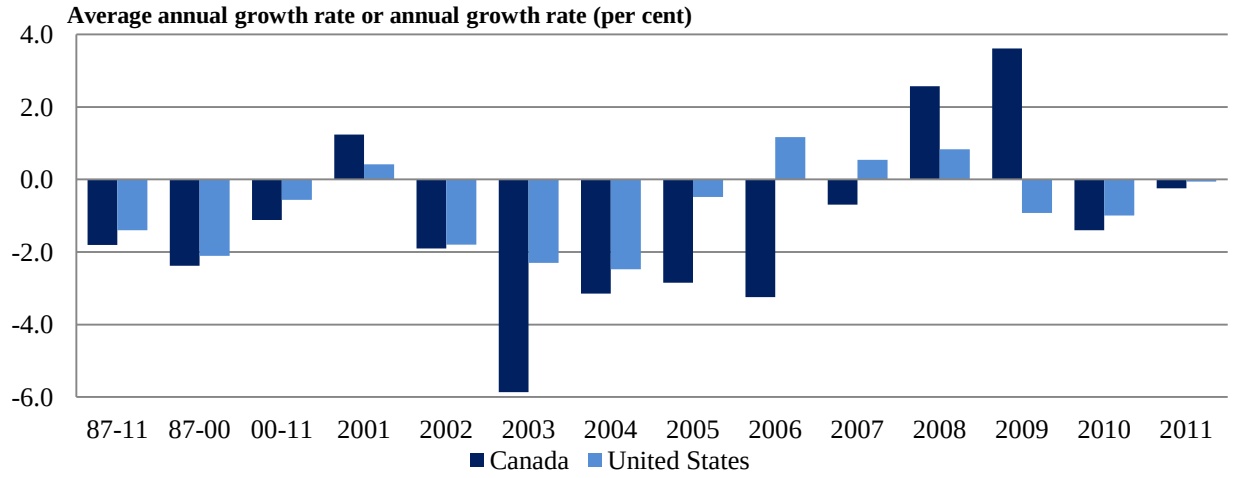
Source: CSLS ICT Database, Tables 17v and 34v

Chart 7: Communications ICT Price Growth Rates in the Business Sector, 1987-2011



Source: CSLS ICT Database, Tables 17v and 34v

Chart 8: Software ICT Price Growth Rates in the Business Sector, 1987-2011

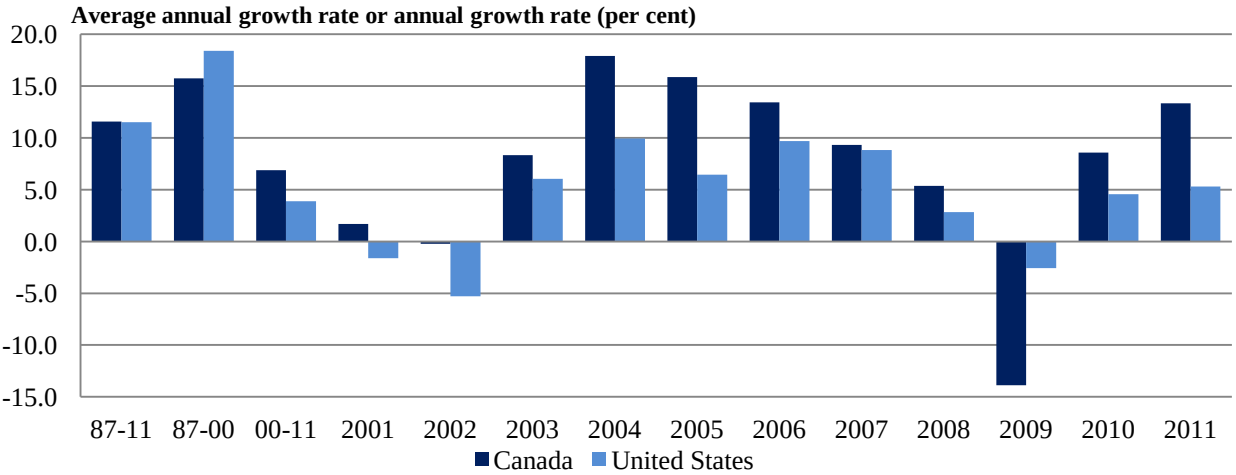


Source: CSLS ICT Database, Tables 17v and 34v

C. Real ICT Investment Growth

In general, continuously falling ICT investment prices in Canada and the United States has led to relatively robust real ICT investment growth (Chart 9). This trend continued into 2011, as Canada's real ICT investment growth of 13.3 per cent outpaced its nominal ICT investment growth of 6.3 per cent, reflecting the 6.2 per cent fall in ICT prices. Similarly, the real ICT investment growth of 5.3 per cent for the United States was larger than its nominal ICT investment growth of 4.1 per cent. Although Canada had higher nominal ICT investment growth than the United States in 2011, most of the difference between their real ICT investment growth rates was due to ICT prices falling more rapidly in this country (6.2 per cent versus 1.2 per cent).

Chart 9: Real ICT Investment Growth in the Business Sector, 1987-2011

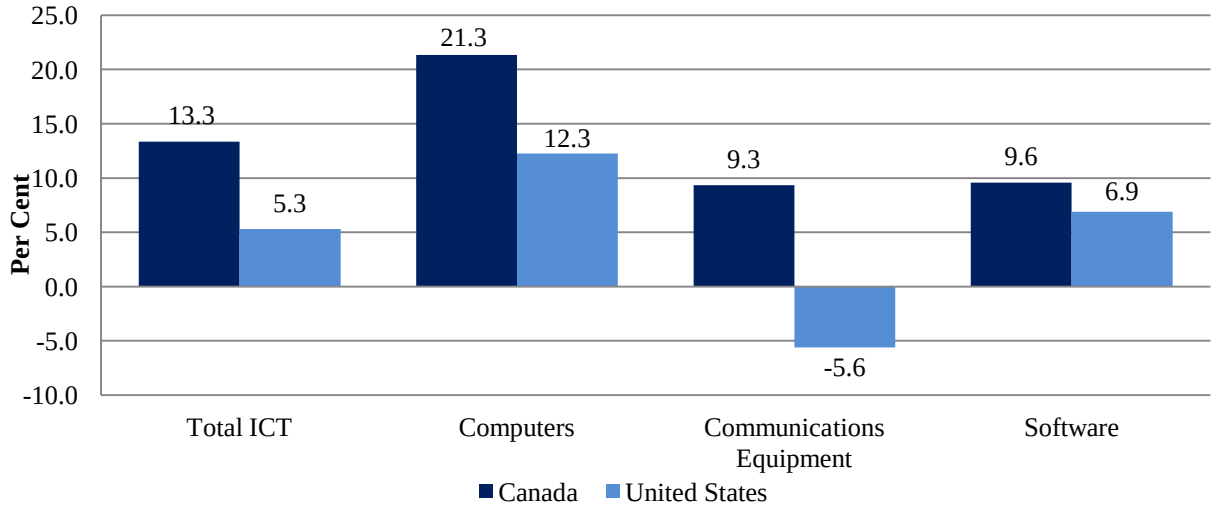


Source: CSLS ICT Database, Tables 5v and 22v

In 2011, real ICT investment growth was greater in Canada than in the United States for all three ICT components: computers (21.3 per cent versus 12.3 per cent), communications

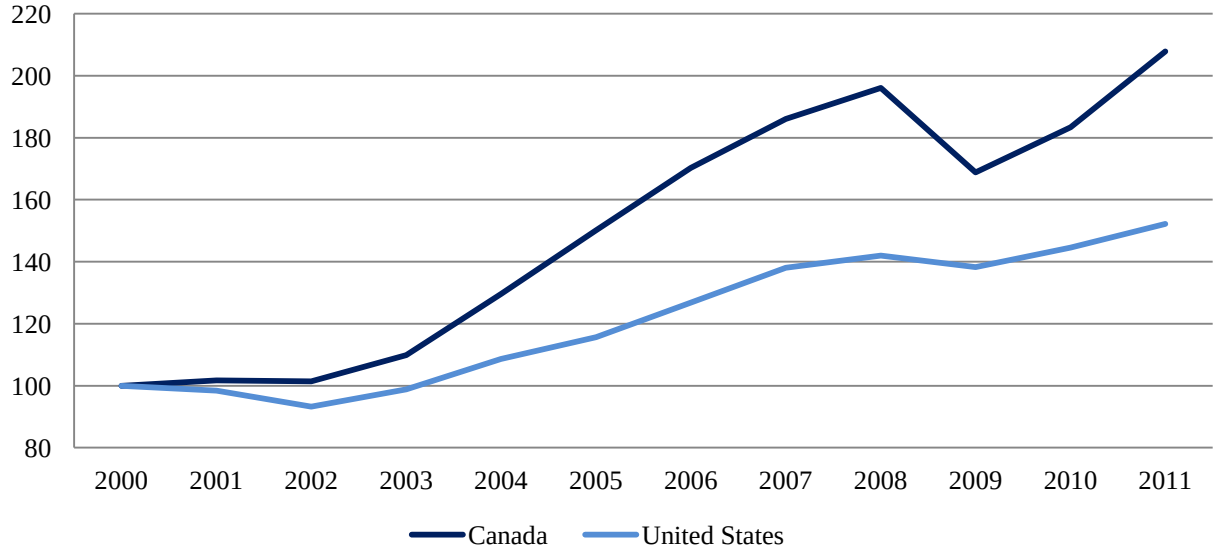
equipment (9.3 per cent versus -5.6 per cent), and software (9.6 per cent versus 6.9 per cent) (Chart 10). The difference between nominal and real growth rates was largest for computers investment in Canada (3.1 per cent versus 21.3 per cent), which is explained by a massive increase in computer prices in 2011 (13.1 per cent). Consequently, computer investment in the United States, which was larger nominally than in Canada, was smaller in real terms. This difference only occurred for the computers component, as the difference in the growth rates of ICT prices in 2011 between Canada and the United States were only significant for the computers component (Chart 4). Over the 2000-2011 period, Canada clearly outperformed the United States in growth of real ICT investment in the business sector; however, investment was hit harder by the recession in this country (Chart 11).

Chart 10: Per Cent Change of Real ICT Investment in the Business Sector, 2011



Source: CSLS ICT Database, Tables 1 to 4 and 18 to 21

Chart 11: Real ICT Investment Levels in the Business Sector, 2000-2011 (2000=100)

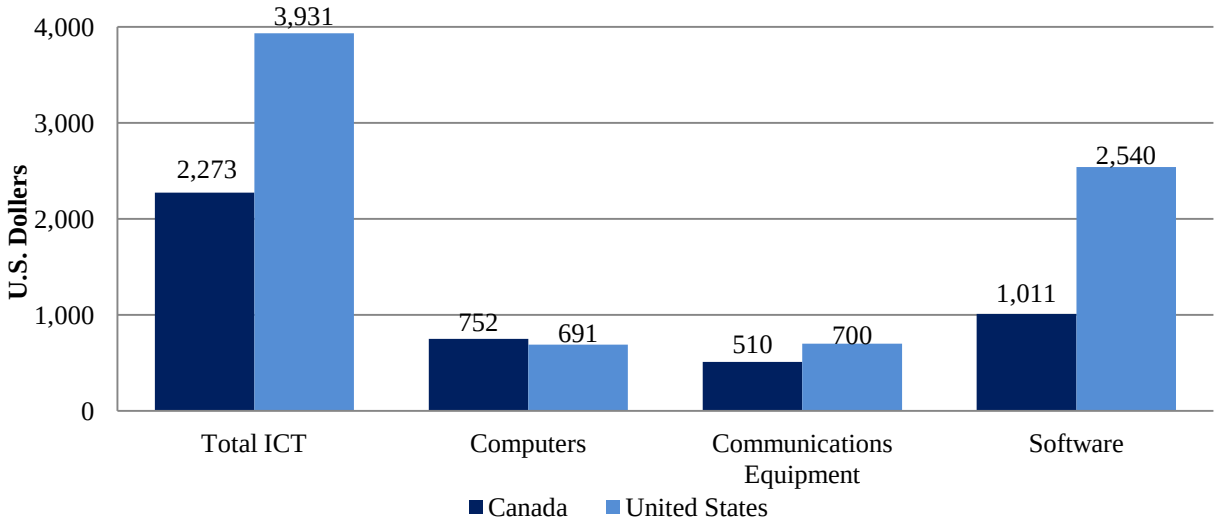


Source: CSLS ICT Database, Tables 5v and 22v

D. Nominal ICT Investment per Worker

In 2011, nominal ICT investment per worker was $2,273 U.S. in Canada compared to $3,931 U.S. in the United States (Chart 12). Thus ICT investment intensity in Canada was only 57.8 per cent that of the United States. The largest component of ICT investment per worker in 2010 in both countries was software: $1,011 U.S. in Canada and $2,540 U.S. in the United States. Computer investment per worker was marginally higher in Canada than in the United States ($752 U.S. versus $691 U.S.) while communications equipment was marginally lower in Canada than in the United States ($510 U.S. versus $700 U.S.).

Chart 12: Nominal ICT Investment per Worker in the Business Sector, 2011[7]

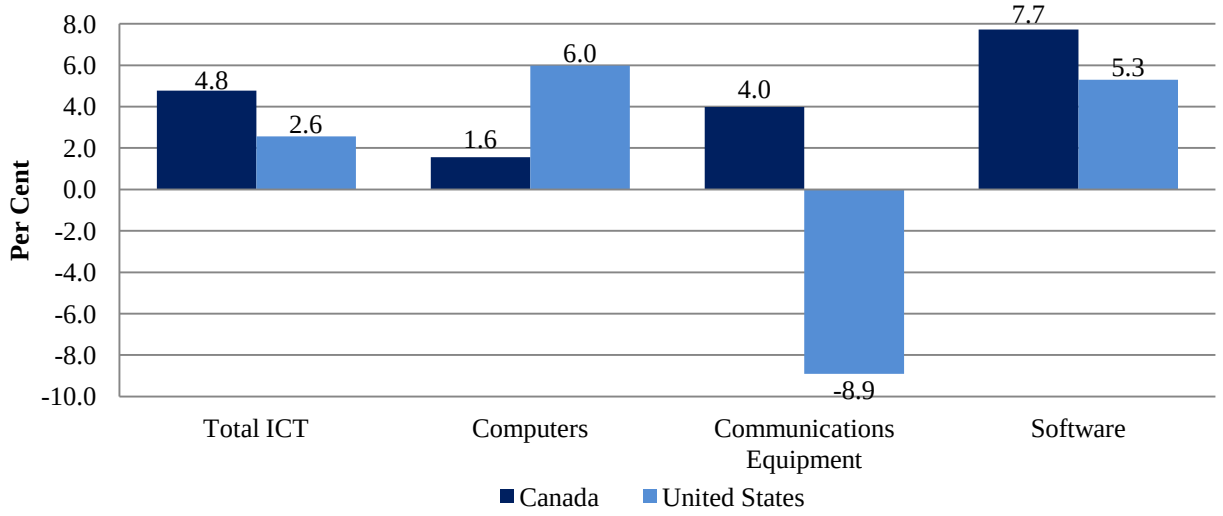


Source: CSLS ICT Database, Summary Tables 1 to 4

Nominal ICT investment per worker grew for both Canada and the United States in 2011 at 4.8 per cent and 2.6 per cent, respectively. Nominal ICT investment per worker growth is a direct consequence of nominal ICT investment growth and employment growth. Different nominal ICT investment per worker growth rates were due to differences in ICT investment as both countries experienced business sector employment growth of 1.5 per cent. Computer investment per worker grew 6.0 per cent in the United States and 1.6 per cent in Canada in 2011, while communications investment per worker declined 8.9 per cent in the United States and increased 4.0 per cent in Canada. In addition, software investment per worker growth was 5.3 per cent in the United States and 7.7 per cent in Canada. Canada also experienced worse growth in nominal ICT investment per worker than the United States over the 2000-2011 period due a large drop in 2009 (Chart 14).

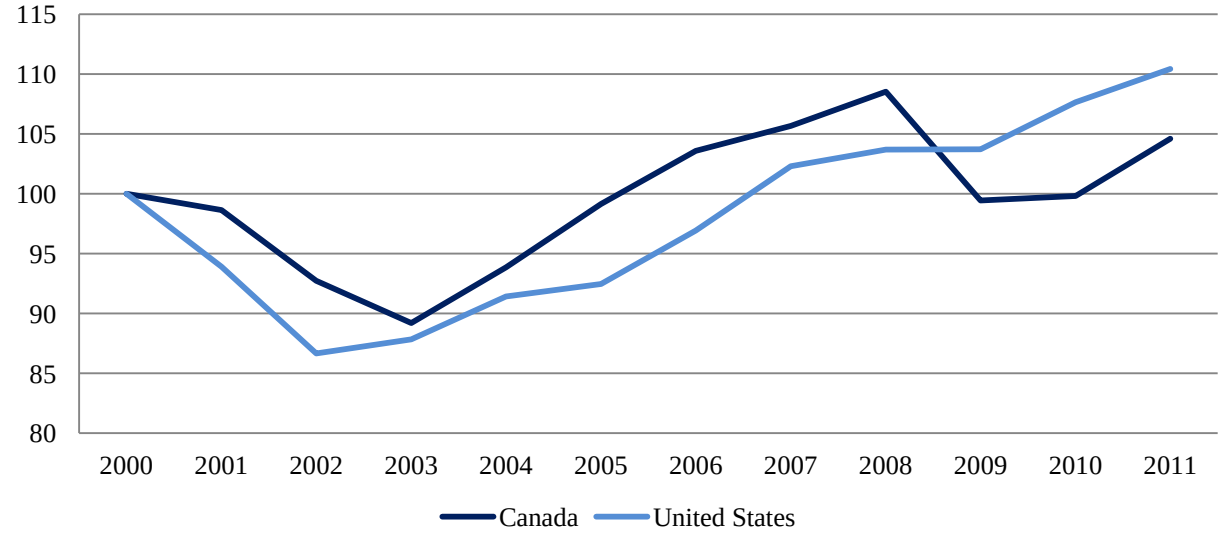
[7] To compare nominal ICT investment per worker in Canada and the United States, Canada's ICT investment per worker was converted from Canadian dollars to U.S. dollars on the basis of purchasing power parities (PPPs).

Chart 13: Per Cent Change of Nominal ICT Investment per Worker in the Business Sector, 2011



Source: CSLS ICT Database, Tables 9 to 12 and 26 to 29

Chart 14: Nominal ICT Investment per Worker in the Business Sector, 2000-2011 (2000=100)



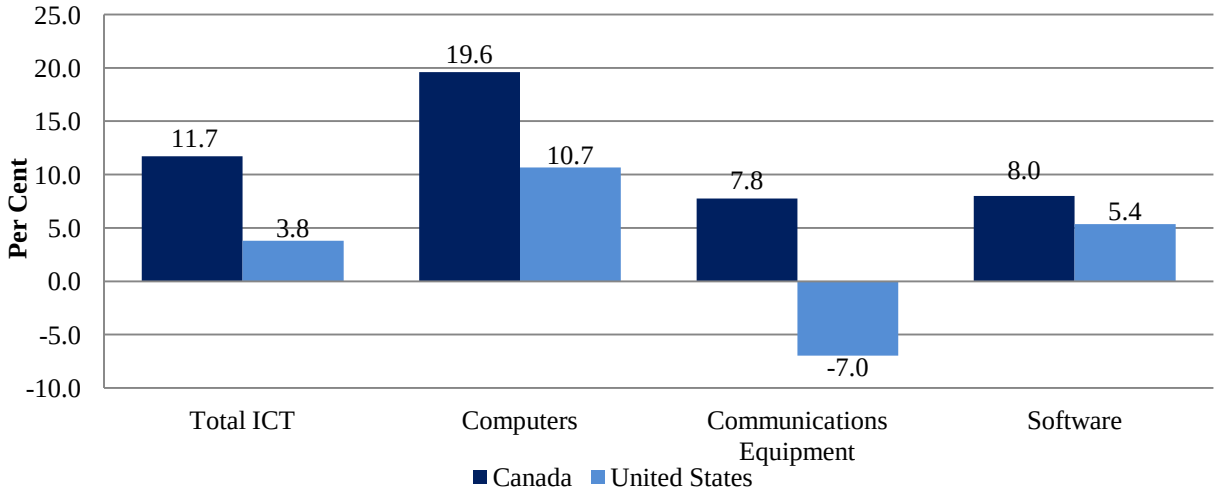
Source: CSLS ICT Database, Summary Table 1

E. Real ICT Investment per Worker

Real ICT investment per worker grew 11.7 per cent in Canada and 3.8 per cent in the United States in 2011 (Chart 15). Real ICT investment per worker growth is a direct consequence of real ICT investment growth and employment growth. As noted in section C, real ICT investment grew at a rate of 13.3 per cent in Canada and 5.3 per cent in the United States in 2011. This was largely due to ICT prices falling more than five times faster in Canada than in the United States (-6.2 per cent compared to -1.2 per cent). Different real ICT investment per worker growth rates were due to differences in real ICT investment as both countries experienced business sector employment growth of 1.5 per cent.

The above result was also found for all three ICT components in 2011. For real computer investment per worker, the United States advanced 10.7 per cent compared to 19.6 per cent in Canada. Similarly, in software, the United States had a growth rate of 5.4 per cent while Canada had a growth rate of 8.0 per cent. On the other hand, in communications it was Canada, with a growth rate of 7.8 per cent, which led the United States, which had a growth rate of -7.0 per cent.

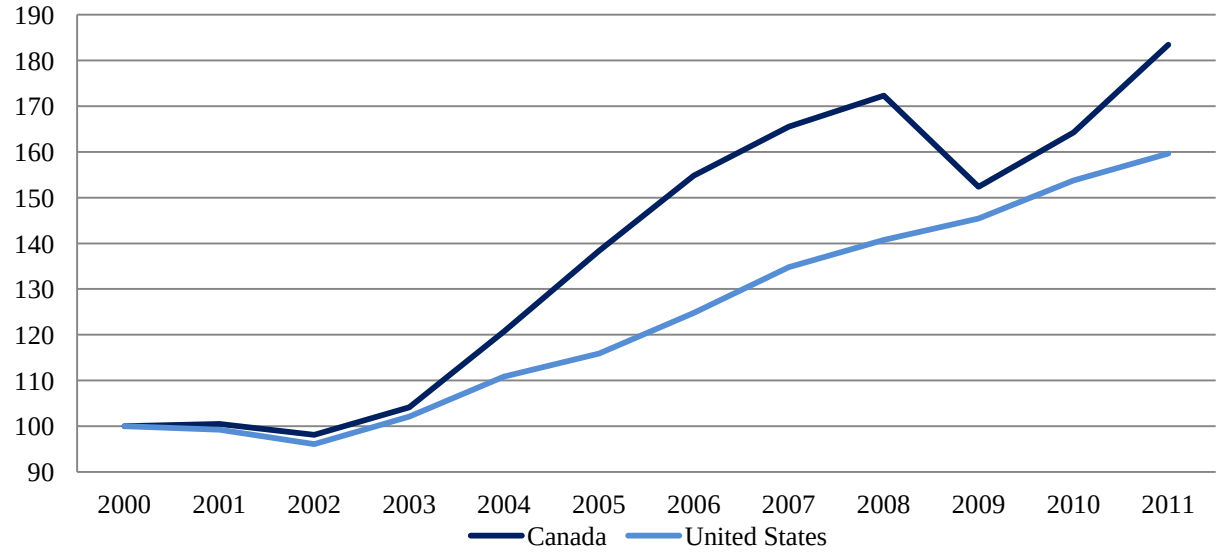
Chart 15: Per Cent Change of Real ICT Investment per Worker in the Business Sector, 2011



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

Interestingly, Canada experienced greater growth in real ICT investment per worker than the United States over the 2000-2011 period (Chart 16). This is explained by Canada's 6.9 per cent per year growth of real ICT investment compared to the 3.9 per cent in the United States, which, in turn, was caused by significantly faster contraction of ICT prices in Canada than in the United States over the same period.

Chart 16: Real ICT Investment per Worker in the Business Sector, 2000-2011 (2000=100)



Source: CSLS ICT Database, Tables 13v and 30v

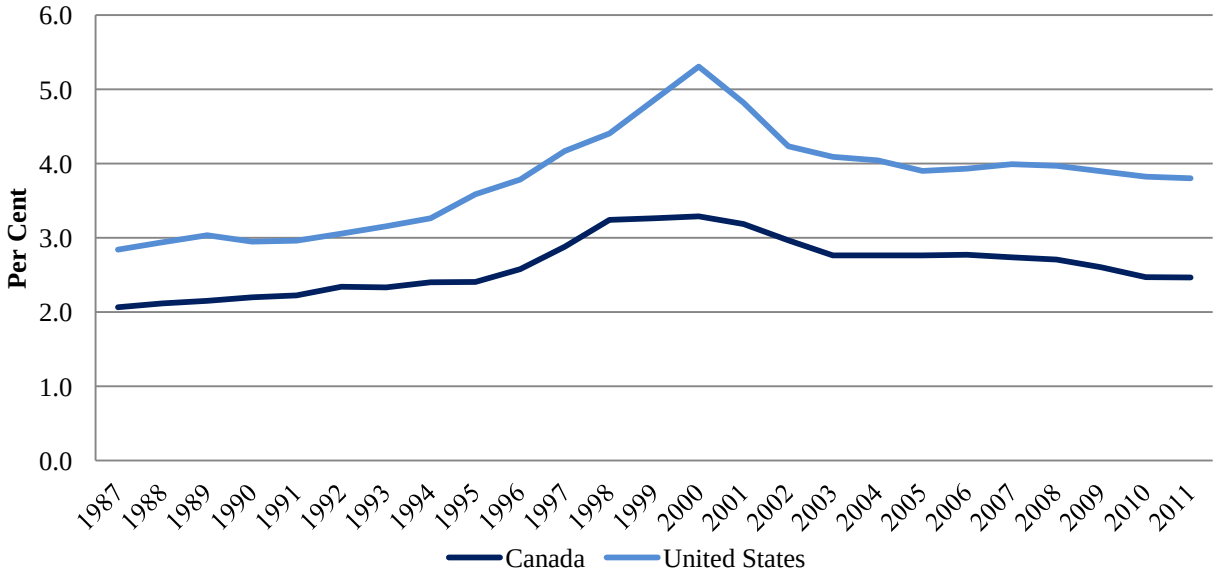
F. ICT Investment Shares in Nominal Business Sector GDP

In 2011, the growth of nominal business sector GDP in Canada outpaced that seen in the United States: 6.4 per cent versus 4.7 per cent. Similarly, nominal ICT investment increased 6.3 per cent in Canada and 4.1 per cent in the United States. Since nominal GDP grew slightly faster than nominal ICT investment in the United States and Canada, the ICT investment share in nominal business sector GDP decreased marginally in the United States but was essentially unchanged in Canada. In Canada, the share remained at 2.47 per cent in 2010 and 2011. In the United States, this share decreased from 3.83 to 3.80 per cent over the same period.

The share of nominal ICT investment in business sector GDP followed a similar trend in both Canada and the United States over the 1987-2011 period (Chart 17). Both Canada and the United States had their shares of ICT investment in business sector GDP increase until peaking in 2000 (the year of the dot-com bubble climax), then their shares steadily decreased until 2011. In 2011, the proportion of ICT investment in business sector GDP was still higher in both countries than it was in 1987.

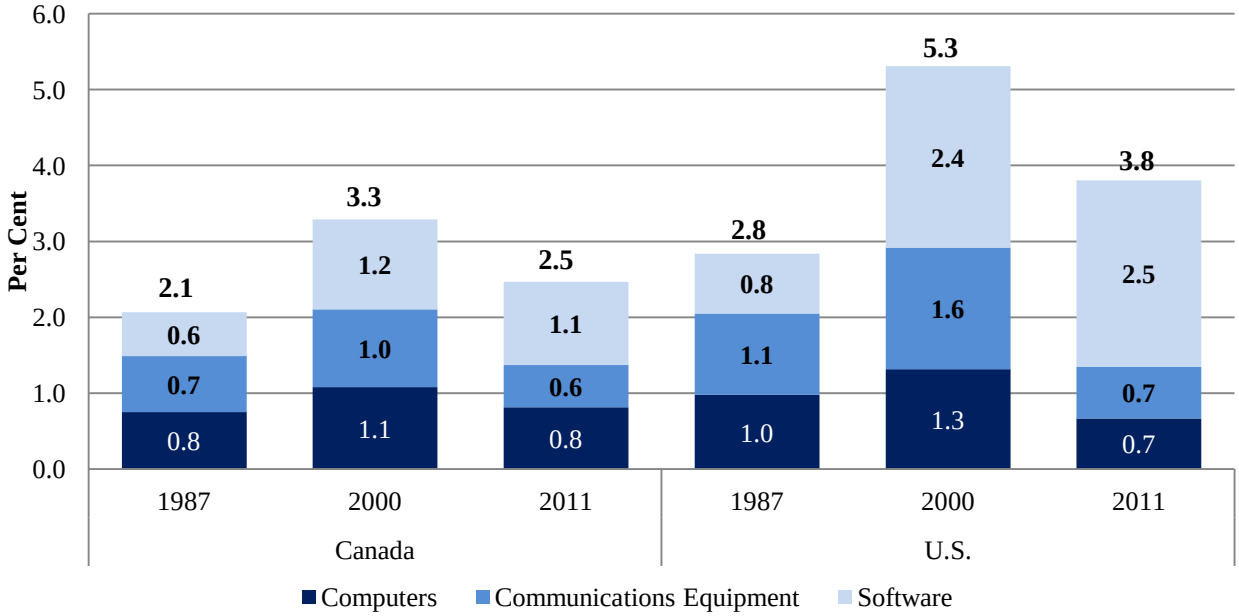
If the shares of nominal ICT investment in business sector GDP are examined on the component level, a more complicated story emerges (Chart 18). Between 1987 and 2011, the increase in the overall share of ICT investment in business sector GDP in both the United States and Canada was completely driven by an increase in software investment. Both communications equipment investment and computers investment experienced slight increases in their shares in business sector GDP between 1987 and 2000 in both countries; however, both components saw their shares decrease from 2000 to 2011, which caused the drop in overall ICT's share in business sector GDP during this period.

Chart 17: Proportion of Nominal ICT Investment in Business Sector GDP, 1987-2011



Source: CSLS ICT Database, Tables 1v and 18v

Chart 18: Contributions of the ICT Components to the Proportion of Nominal ICT Investment in Business Sector GDP in 1987, 2000 and 2011



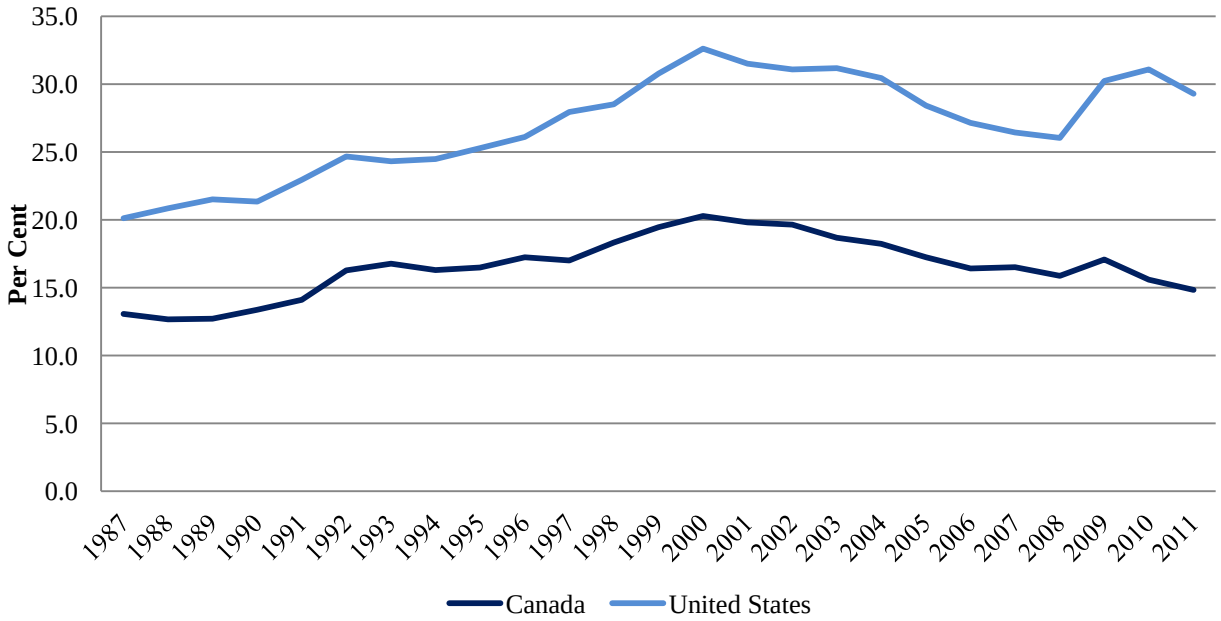
Source: CSLS ICT Database, Tables 2 to 4 and 19 to 21

G. ICT Investment Shares in Total Nominal Investment

In 2011, nominal ICT investment growth failed to surpass total business sector fixed, non-residential nominal investment growth in both Canada and the United States. For this reason, the Canadian and U.S. ICT investment shares decreased between 2010 and 2011 from 15.61 to 14.84 per cent in Canada and from 31.10 to 29.31 per cent in the United States (Chart 19).

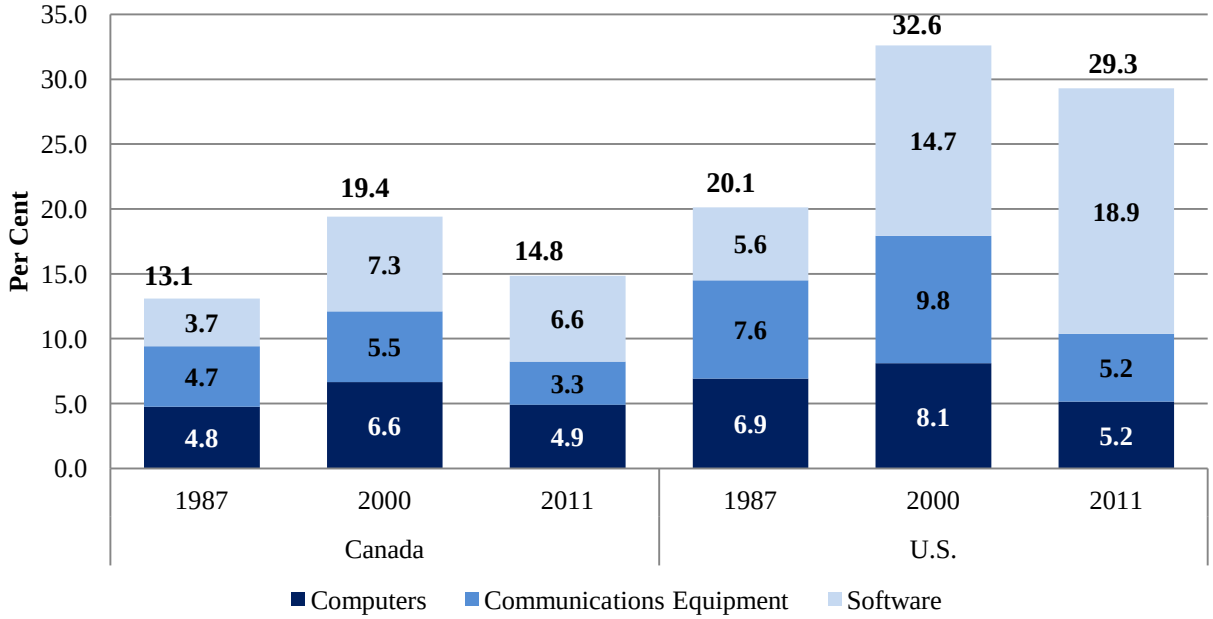
Nominal ICT investment shares in total business sector fixed, non-residential nominal investment succinctly describe the evolving importance of ICT investment in the overall investment decision of firms. ICT investment shares in total investment for both Canada and the United States followed similar trends as ICT investment shares in business sector GDP: rising between 1987 and 2000, then falling from 2000 to 2011 (Chart 19). ICT investment did not fall as rapidly as overall investment in both countries through the recession in 2009, however, which explains its increase as a share in aggregate investment in both countries in that year. At the component level, we see the same trends of the proportion of ICT investment by component in total nominal investment as we did in ICT investment shares by component in nominal business sector GDP (Chart 20).

Chart 19: Nominal ICT Investment Shares in Total Fixed, Non-residential Investment in the Business Sector, 1987-2011



Source: CSLS ICT Database, Tables 1v and 19v

Chart 20: ICT Component Shares in Nominal Total ICT Investment in the Business Sector in 1987, 2000 and 2011

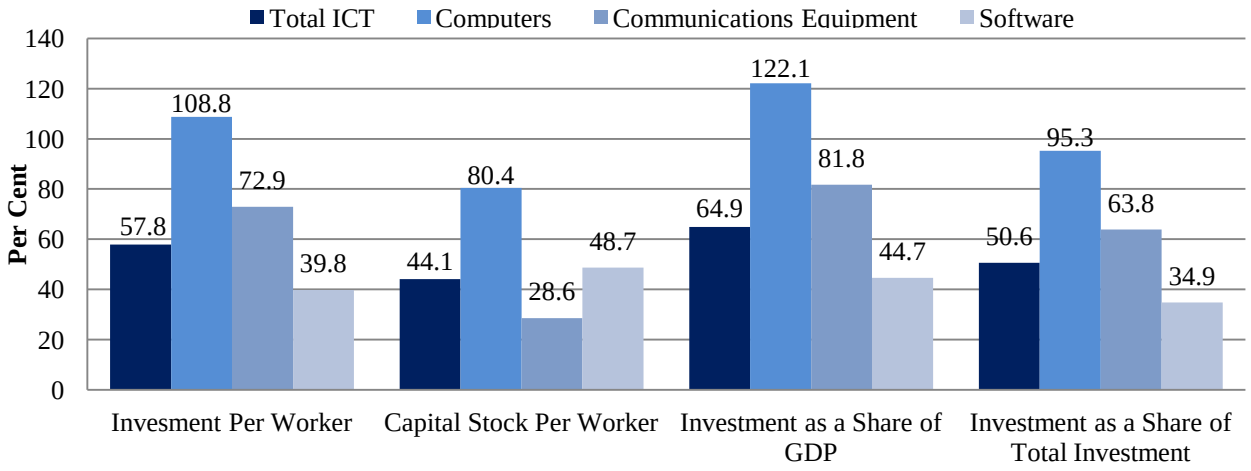


Source: CSLS ICT Database, Tables 2 to 4 and 19 to 21

III. Canada-U.S. ICT Gap[8]

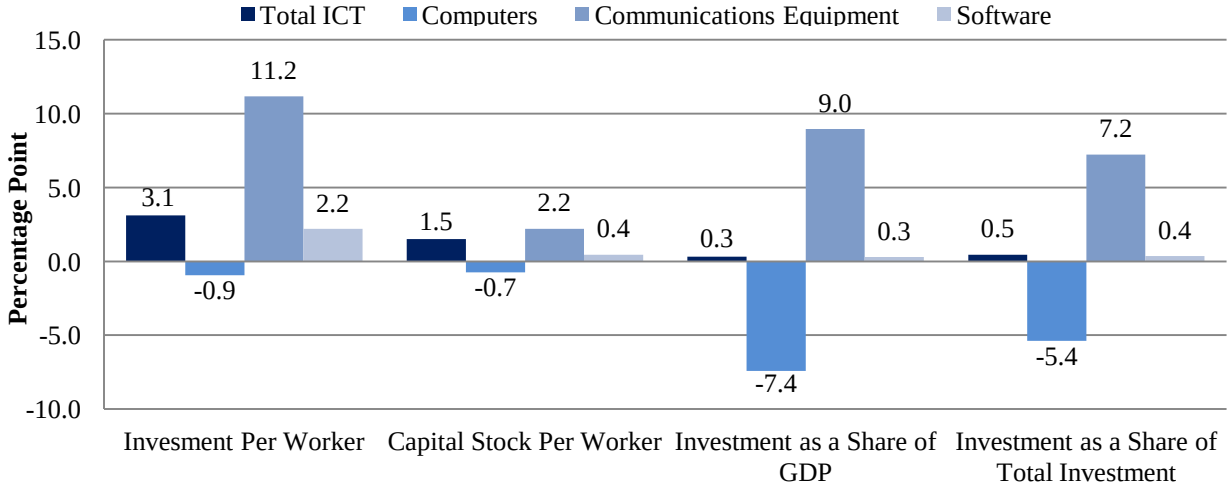
The Canada-U.S. ICT gap drives differences in labour productivity between these countries. This paper details the trends and developments in the Canada-U.S. gap in ICT investment per worker, capital stock per worker, ICT investment as a share of nominal GDP, and ICT investment as a share of total investment. In 2011, the Canada-U.S. ICT gap decreased for all four indicators, as nominal ICT investment growth in Canada was higher than in the United States.

Chart 21: Nominal ICT Indicators for the Business Sector, Canada as a Proportion of the United States, 2011



Source: CSLS ICT Database, Summary Tables 1 to 16

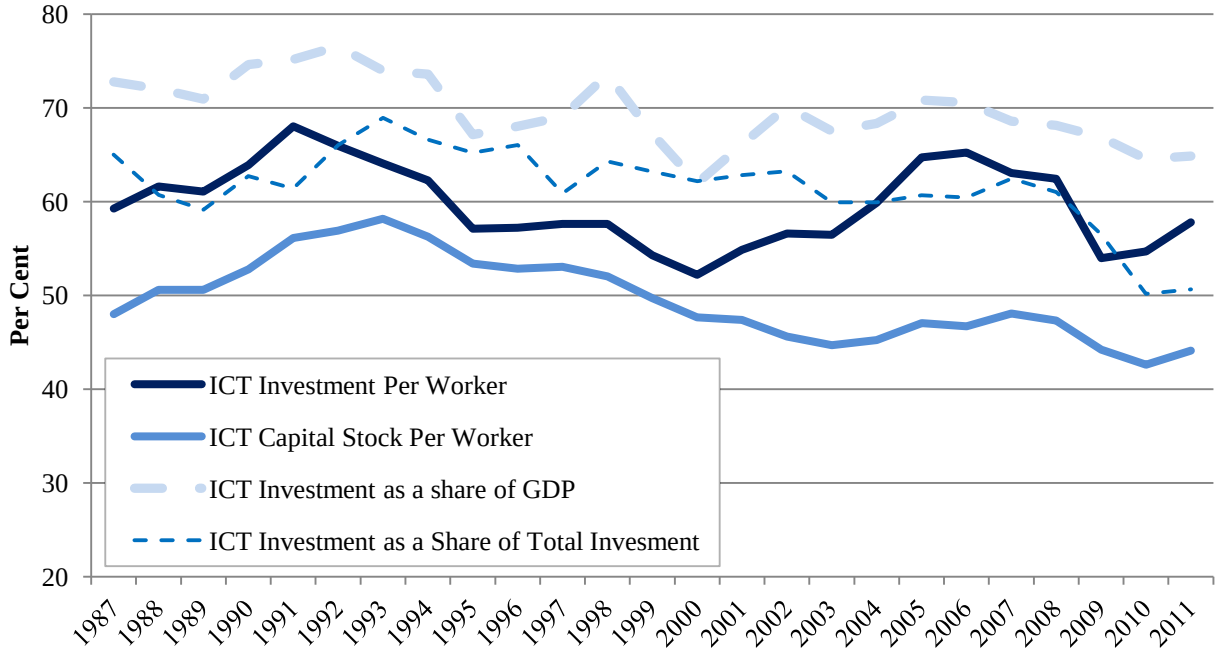
Chart 22: Nominal ICT Indicators for the Business Sector, Percentage Point Change in Canada as a Proportion of the United States, 2011



Source: CSLS ICT Database, Summary Tables 1 to 16

[8] To discuss the Canada-U.S. ICT gap in this section, Canada's ICT investment figures were converted from Canadian dollars to U.S. dollars on the basis of purchasing power parities (PPPs) using the annual machinery and equipment (M&E) PPP produced by Statistics Canada. In addition, please note that the Canada-U.S. ICT gap is examined by comparing ICT indicators for Canada relative to the U.S. (i.e. Canadian values divided by U.S. values). Please note that the gap (in percent) is simply 100 per cent minus the relative (in percent) by definition.

Chart 23: Nominal ICT Indicators for the Business Sector, Canada as a Proportion of the United States, 1987-2011



Source: CSLS ICT Database, Summary Tables 1 to 16

A. Canada-U.S. Relative Nominal ICT Investment per Worker

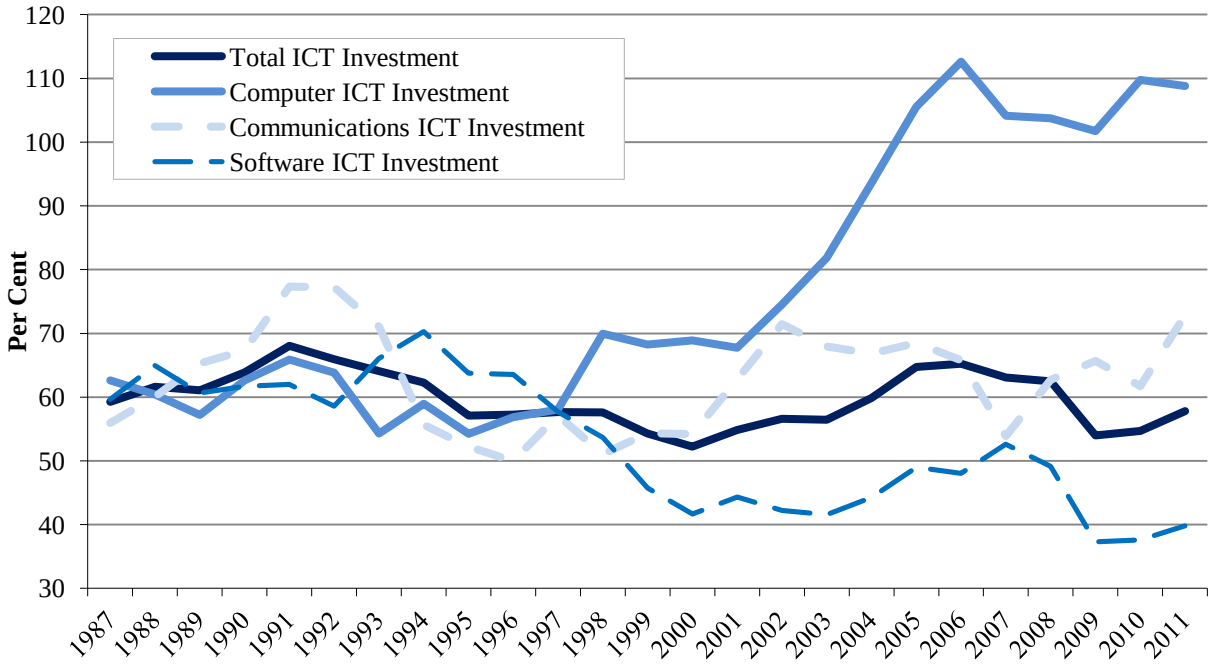
Three factors determine trends in Canada-U.S. relative nominal ICT investment per worker: the ratio of Canadian ICT investment to U.S. investment, the ratio of Canadian employment to U.S. employment, and changes in the machinery and equipment (M&E) purchasing power parity (which is applied to Canadian nominal ICT figures to obtain estimates comparable with the U.S. figures).

The Canada-U.S. nominal ICT investment per worker gap continued to shrink in 2011 as in 2010, after a large increase in 2009. Canada's ICT investment per worker was 57.8 per cent of the United States' in 2011 (Chart 21), up 3.1 percentage points from 53.5 per cent in 2010 (Chart 22). The Canada-U.S. ICT investment per worker gap, which is simply 100 per cent minus the relative, was 42.2 per cent in 2011, down 3.1 percentage points lower from 46.5 per cent in 2010. This represents acceleration from 2010, when Canada's ICT investment per worker relative to that in the United States increased 0.7 percentage points (Chart 23). An increase in the Canada-U.S. PPP for M&E from $0.87 U.S. in 2010 to $0.90 U.S. in 2011 and faster growth in nominal ICT investment in Canada caused the narrowing of the ICT investment per worker gap in 2011.

When studying the ICT components, it is clear that communications investment growth drove the narrowing of the ICT investment per worker gap in 2011 (Chart 22). Nominal communications investment per worker in Canada in 2011 was 72.9 per cent of that in the United States, up from 61.7 per cent in 2010; this means the Canada-U.S. gap fell 11.2 percentage points

from 38.3 per cent in 2010 to 27.1 per cent in 2011. Investment per worker in Canada relative to the United States also grew for software (by 2.2 percentage points); however, the ICT per worker investment gap was still largest for this component as Canadian investment per worker was 39.8 per cent of the U.S. level (a gap of 60.2 per cent). The Canada-U.S. relative investment per worker actually fell marginally for computers (by 0.9 percentage points). Nonetheless, computers investment per worker has been higher in Canada than the United States since 2005, signifying a negative Canada-U.S. computers investment per worker gap (Chart 24).

Chart 24: Nominal ICT Investment per Worker in the Business Sector by Component, Canada as a Proportion of the United States, 1987-2011



Source: CSLS ICT Database, Summary Tables 1 to 4

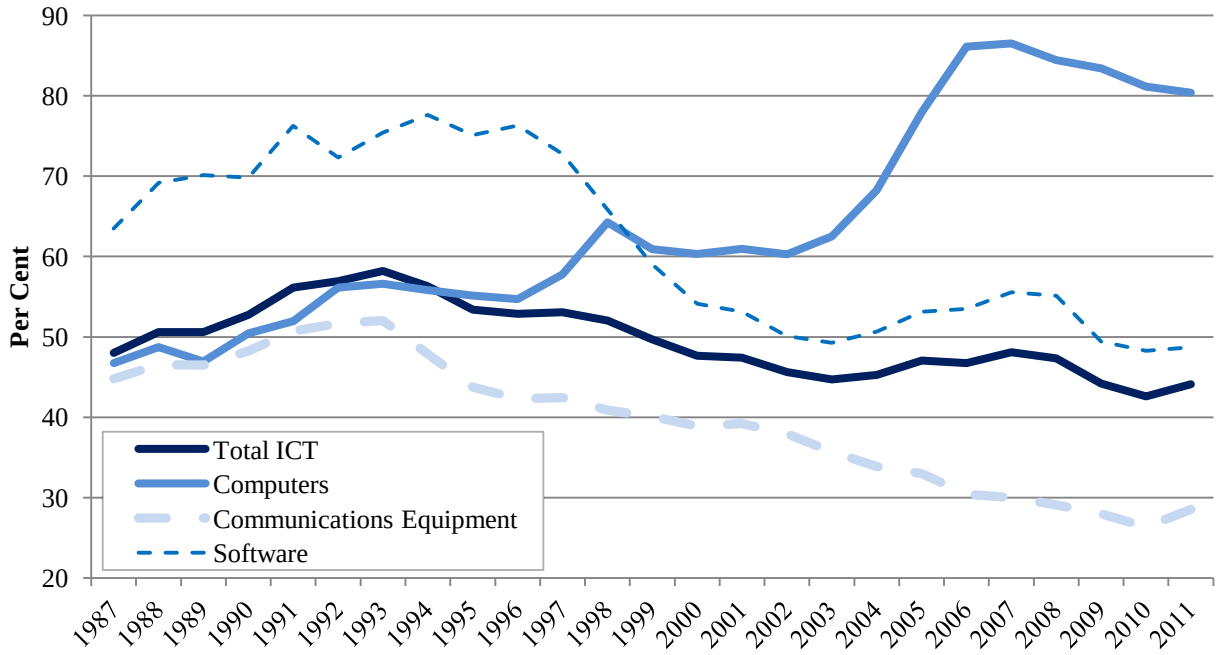
B. Canada-U.S. Relative Nominal ICT Capital Stock per Worker[9]

Canadian nominal ICT capital stock per worker as a proportion of that in the United States exhibited the same trends in 2011 as ICT investment per worker, as changes in investment determine changes in capital stock. However, it is useful to note that ICT capital stock per worker in Canada relative to the United States was larger than it was for investment for total ICT, computers and communications equipment, but smaller for software (Chart 21). Nevertheless, the growth of ICT capital stock was qualitatively the same as investment per worker for all ICT components in 2011 (Chart 22).

[9] Official capital stock data are currently not comparable between Canada and the United States. Statistics Canada and U.S. BEA are using very different depreciation rates in estimating capital stock for ICT assets (e.g., the depreciation rate for communication equipment used by Statistics Canada is 0.22 while in the U.S. it is 0.13). Consequently, for the same level of investment, Canada's communication equipment stock will be much lower than that for the U.S. This is why communication equipment capital stock per worker in Canada was only 28.6 percent of the U.S. level while investment per worker was 72.9 in 2011.

Since the mid-1990s, Canada-U.S. relative ICT capital stock per worker shrunk substantially for both communications equipment (from 77.6 per cent in 1994 to 48.7 per cent in 2011) and software (from 47.8 per cent in 1994 to 28.6 per cent in 2011) (Chart 25). For computers investment, however, the capital stock per worker in Canada as a proportion of that in the United States grew considerably between 2003 and 2008 (24.2 percentage points). Unfortunately, this trend reversed in 2008 and the Canada-U.S. relative capital stock per worker has fallen by 4.1 percentage points since then.

Chart 25: Nominal ICT Capital Stock per Worker in the Business Sector by Component, Canada as a Proportion of the United States, 1987-2011



Source: CSLS ICT Database, Summary Tables 5 to 8

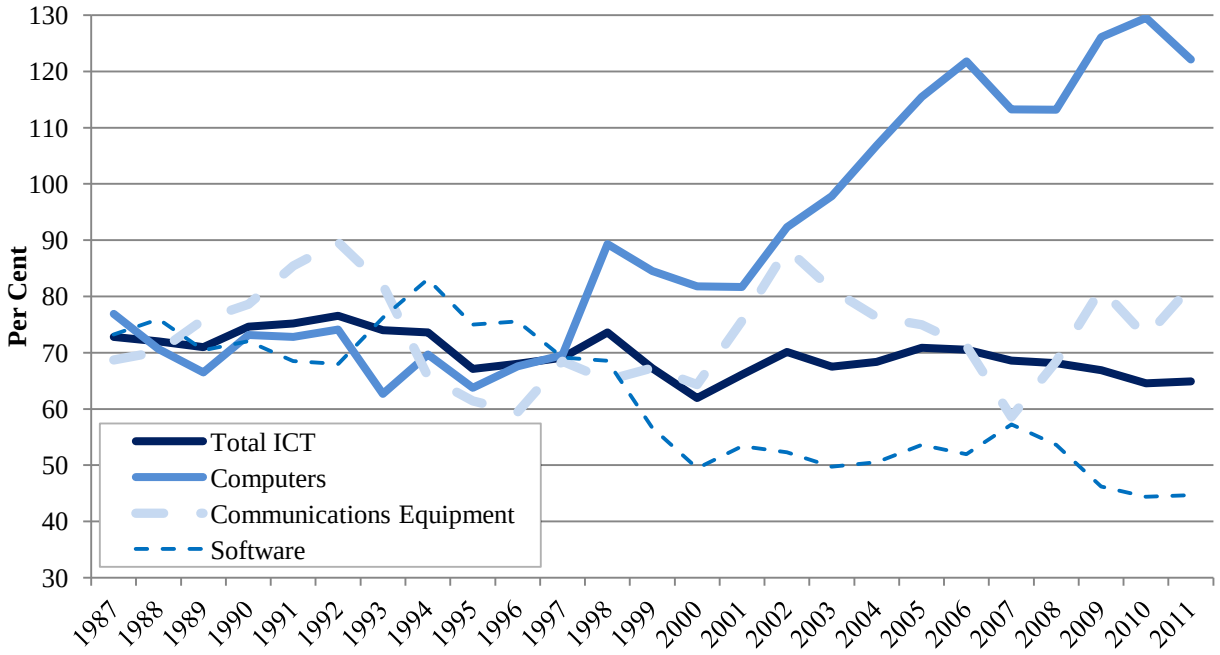
C. Canada-U.S. Relative ICT Investment as a Share of Business Sector GDP

The ICT investment share in nominal business sector GDP decreased marginally in Canada and the United States in 2011, as nominal GDP grew slightly faster than nominal ICT investment in both countries. Since it decreased more in the United States, the ICT investment as a share of business sector GDP in Canada relative to that in the United States grew slightly (by 0.3 percentage points) between the two countries in 2011 (Chart 22).

The share of nominal ICT investment in business sector GDP has followed a similar trend in both Canada and the United States over the 1987-2011 period (Chart 17). Both Canada and the United States had their shares of ICT investment in business sector GDP increase until peaking in 2000 (the year in which the dot-com bubble climaxed), then their shares steadily decreased until

2011. Consequently, ICT investment as a share of GDP in Canada as a proportion of that in the United States has remained relatively unchanged over the 1987-2011 period (Chart 26).

Chart 26: Nominal ICT Investment as a Share of Business Sector GDP by Component, Canada as a Proportion of the United States, 1987-2011

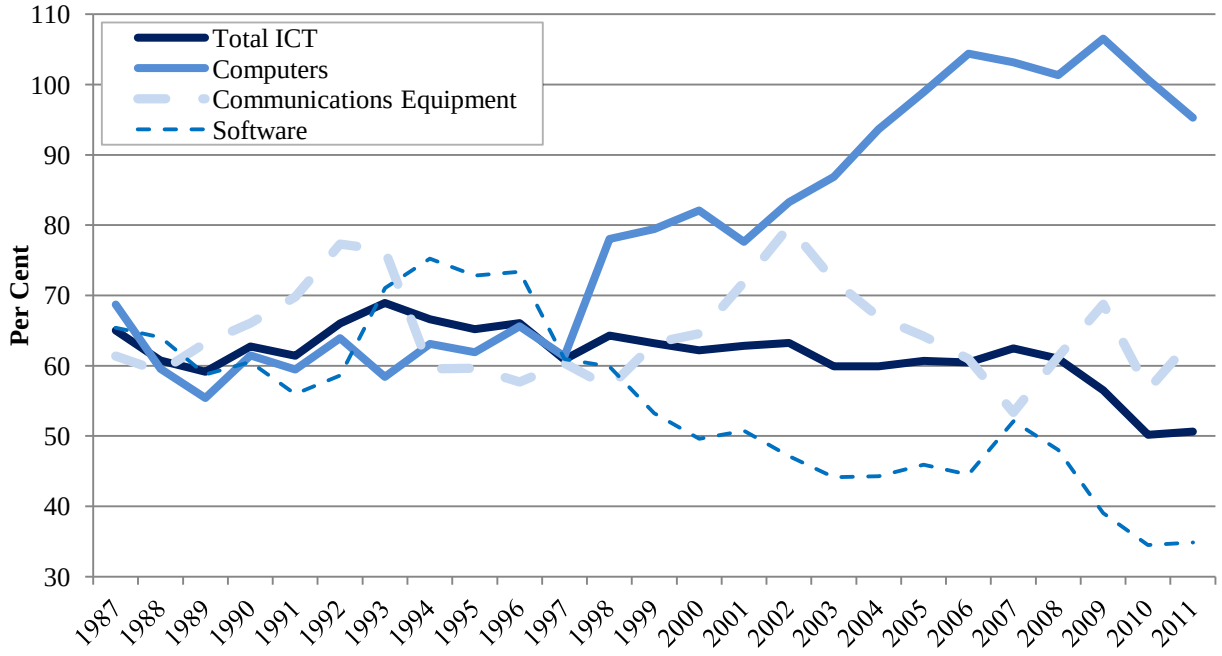


Source: CSLS ICT Database, Summary Tables 9 to 12

D. Canada-U.S. Relative ICT Investment as a Share of Total Investment

In 2011, total fixed, non-residential business sector investment growth outpaced ICT investment growth in Canada, leading to a fall in the share of ICT investment in total investment to 14.84 per cent from 15.61 per cent in 2010 (a 4.9 per cent decrease). The United States had a similar experience, resulting in a decrease in the relative importance of ICT in total investment from 31.10 per cent in 2010 to 29.31 per cent in 2011 (a 5.8 per cent decrease). Since the percent decrease in the share of ICT investment in total investment was smaller in Canada than in the United States, ICT investment as a share of total investment in Canada relative to that in the United States grew from 50.2 per cent in 2010 to 50.6 per cent in 2011 (Chart 21). This was experienced by all components of ICT investment, except for computers.

Chart 27: Nominal ICT Investment as a Share of Total Fixed, Non-residential Investment in the Business Sector by Component, Canada as a Proportion of the United States, 1987-2011



Source: CSLS ICT Database, Summary Tables 13 to 16

V. Conclusion

This research report describes the trends and developments in the Canada-U.S. gap in ICT investment per worker, capital stock per worker, ICT investment as a share of nominal GDP, and ICT investment as a share of total investment. In 2011, the Canada-U.S. ICT gap decreased for all four indicators, as nominal ICT investment growth in Canada was higher than in the United States. Studying the ICT gap between Canada and the United States is important, as it is considered a major determinant of labour productivity differentials between these two countries. For a summary of this report's finding on the ICT gap between 2000 and 2011, see Table 1.

ICT investment per worker in Canada as a proportion of that in the United States grew from 53.5 per cent in 2010 to 57.8 per cent in 2011. Stronger nominal ICT investment growth in Canada and a rising PPP contributed to this 4.3 percentage point decrease in the Canada-U.S. ICT investment per worker gap. In 2011, business sector nominal ICT investment grew 6.3 per cent in Canada and 4.1 per cent in the United States. Nominal ICT investment per worker grew for Canada and the United States in 2011 at 4.8 per cent and 2.6 per cent, respectively. Different nominal ICT investment per worker growth rates were due to differences in ICT investment as both countries experienced business sector employment growth of 1.5 per cent.

Both Canada and the United States saw their shares of ICT investment in business sector GDP decline slightly in 2011, but it declined by more in the United States. Consequently, the ICT investment shares of business sector GDP gap narrowed slightly between the two countries.

ICT investment growth failed to surpass aggregate investment growth in both counties, causing their investment shares to decrease. Since the percent decrease in the share of ICT investment in total investment was smaller in Canada, the ICT investment as a share of total investment gap shrunk from 50.2 in 2010 to 50.6 in 2011.

Table 1: Summary of the Canada-U.S. ICT Gap Indicators for the Business Sector, 2000-2011

	Total ICT	Computers	Communications Equipment	Software
Nominal ICT investment per worker growth, Canada as a proportion of the United States (level or percentage point Δ)				
2000	52.2	47.6	62.0	62.2
2009	54.0	44.2	66.9	56.5
2010	54.7	42.6	64.6	50.2
2011	57.8	44.1	64.9	50.6
Δ 2011	3.1	1.5	0.3	0.5
Δ 00-11	5.6	-3.5	2.9	-11.5
Nominal ICT capital stock per worker growth, Canada as a proportion of the United States (level or percentage point Δ)				
2000	47.6	60.3	38.9	54.1
2009	44.2	83.4	28.0	49.4
2010	42.6	81.2	26.4	48.3
2011	44.1	80.4	28.6	48.7
Δ 2011	1.5	-0.7	2.2	0.4
Δ 00-11	-3.5	20.1	-10.3	-5.4
Nominal ICT investment as a share of GDP, Canada as a proportion of the United States (level or percentage point Δ)				
2000	62.0	81.8	64.3	49.5
2009	66.9	126.1	81.4	46.2
2010	64.6	129.5	72.8	44.4
2011	64.9	122.1	81.8	44.7
Δ 2011	0.3	-7.4	9.0	0.3
Δ 00-11	2.9	40.3	17.4	-4.8
Nominal ICT investment as a share of total fixed, non-residential investment, Canada as a proportion of the United States (level or percentage point Δ)				
2000	62.2	82.1	64.6	49.6
2009	56.5	106.5	68.8	39.0
2010	50.2	100.7	56.6	34.5
2011	50.6	95.3	63.8	34.9
Δ 2011	0.5	-5.4	7.2	0.4
Δ 00-11	-11.5	13.2	-0.7	-14.8

Source: CSLS ICT Database

References

Capeluck, Evan (2012) "Overview of Developments in ICT Investment in Canada, 2011," CSLS Research Note 2012-02, September, available online at http://www.csls.ca/notes/Note2012-2.pdf.

Centre for the Study of Living Standards (2008) "The Canada-U.S. ICT Investment Gap in 2007: Narrowing but Progress Still Needed," CSLS Research Note 2008-01, November, available online at http://www.csls.ca/notes/Note2008-1.pdf.

Sharpe, Andrew (2005) "What Explains the Canada-US ICT Investment Gap?," CSLS Research Report 2005-06, December, available online at http://www.csls.ca/reports/csls2005-06.pdf.

Sharpe, Andrew (2006) "The Relationship between ICT Investment and Productivity in the Canadian Economy: A Review of the Evidence," CSLS Research Report 2006-05, December, available online at http://www.csls.ca/reports/csls2006-05.pdf.

Sharpe, Andrew (2010) "The Canada-U.S. ICT Investment Gap in 2008: Gains in Communications Equipment and Losses in Computers," CSLS Research Note 2010-01, February, available online at http://www.csls.ca/notes/Note2010-01.pdf.

Sharpe, Andrew and Brendan Andrews (2012) "The Canada-U.S. ICT Investment Gap in 2010: The Widening Continues," CSLS Research Note 2012-01, May, available online at http://www.csls.ca/notes/Note2012-1.pdf.

Sharpe, Andrew and Dylan Moeller (2011) "Overview of Developments in ICT Investment in Canada, 2010: Rebounding from the Recession," CSLS Research Note 2011-02, June, available online at http://www.csls.ca/notes/Note2011-2.pdf.

Sharpe, Andrew and Jean-Francois Arsenault (2008a) "ICT Investment and Productivity: A Provincial Perspective," CSLS Research Report 2008-06, September, available online at http://www.csls.ca/reports/csls2008-6.pdf.

Sharpe, Andrew and Jean-Francois Arsenault (2008b) "The Canada-US ICT Investment Gap: An Update," CSLS Research Report 2008-01, February, available online at http://www.csls.ca/reports/csls2008-1.pdf.

Sharpe, Andrew and Ricardo de Avillez (2010) "Canada-US ICT Investment in 2009: The ICT Investment per Worker Gap Widens," CSLS Research Report 2010-08, November, available online at http://www.csls.ca/reports/csls2010-08.pdf