

September 2012



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

OVERVIEW OF DEVELOPMENTS IN ICT INVESTMENT IN CANADA, 2011

Evan Capeluck

CSLS Research Note 2012-2

September 2012

Prepared for the Information Technology Association of Canada

Overview of Developments in ICT Investment in Canada, 2011

Executive Summary

This report is based on an updating of the CSLS ICT database for Canada for 2011. ICT investment is comprised of three key components: computer equipment, communication equipment, and software investment. The database contains data on these variables by industry since 1980. The following summary gives a brief overview of developments in ICT investment since 2000, focusing primarily on 2011.

- ICT investment performance in Canada for 2011 remained on an upward trend, but was less impressive than revised numbers reveal for 2010. Following the decline in ICT investment during the 2009 recession, ICT investment continued to rebound in both nominal and real terms for all three components.
- Total economy nominal ICT investment (current dollars) rose 3.7 per cent in 2011, higher than the average growth rate of 2.6 per cent experienced during the 2000-2010 period, and similar to the 3.9 per cent increase total economy nominal investment (fixed, non-residential) experienced in 2011. Nominal ICT investment growth in the business sector was strong (4.9 per cent), whereas ICT investment in the non-business sector actually declined (-1.2 per cent). Nominal ICT investment increased 5.7 per cent in computers, 6.1 per cent in communications, and 1.7 per cent in software.
- Total economy real ICT investment (chained 2002 dollars) rose 10.5 per cent in 2011, above both the average growth rate of 7.7 per cent experienced during the 2000-2010 period, and the 3.3 per cent increase in total economy investment (fixed, non-residential) seen in 2011. Real ICT investment growth in 2011 was driven by ICT investment in the business sector, which increased 12.2 per cent, while ICT investment in the non-business sector increased by only 3.6 per cent. Real ICT investment in 2011 increased 26.3 per cent in computers, 11.3 per cent in communication, and 2.3 per cent in software.
- In 2011, as was the case in 2010, ICT investment prices continued their downward trend, following an increase in 2009. Prices for all three ICT components fell in 2011, with prices of total economy ICT investment goods decreasing by 6.2 per cent. Computer prices fell the most steeply (16.3 per cent), followed by communication equipment (4.6 per cent), and finally software (0.5 per cent). This price decrease largely reflected a 4.1 per cent appreciation in the value of the Canadian dollar relative to the US dollar in 2011.

Overview of Developments in ICT Investment in Canada, 2011¹

The aim of this report is to provide an overview of recent developments in information communication technology (ICT) investment in Canada. The analysis is based on an updating of the ICT database for Canada, developed and maintained by the Centre for the Study of Living Standards (CSLS), for 2011.² This report is divided into three sections, all of which offer a focus on ICT investment by component (computer, communication equipment and software). The first section reviews developments in current dollar ICT investment. It looks at ICT investment as a share of GDP, ICT investment in both the business and non-business sector, ICT investment by industry, and ICT investment per worker. The second section then reviews developments in ICT prices. Finally, the third section analyzes the major developments in constant dollar (chained 2002 dollars) ICT investment, focusing on the same dimensions examined under nominal ICT investment. The report builds on and extends earlier CSLS work on ICT investment trends.³

I. Nominal ICT Investment⁴

In 2011, total economy nominal ICT investment (current dollars) in Canada increased 3.7 per cent to \$42.6 billion. The 2011 growth rate was larger than the average annual increase of 2.6 per cent experienced in the 2000-2010 period and the 5.6 per cent increase in the previous year (Charts 1-2); Total economy fixed non-residential investment increased 3.9 per cent to \$254.6 billion in 2011, recovering from a 12.5 per cent decline in 2009 (Chart 3). During the 2000-2010 period, nominal total economy investment (fixed, non-residential) grew at an average rate of 4.5 per cent per year, considerably faster than nominal ICT investment growth in the same period.

A. Nominal ICT Investment in Business and Non-business Sectors

The total economy can be divided into the business and non-business sectors. The business

¹ This report was prepared for the Information Technology Association of Canada by Evan Capeluck under the supervision of Andrew Sharpe. We would like to thank Lynda Leonard, Senior Vice-President of ITAC, for her support. For comments, please email andrew.sharpe@csls.ca or evan.capeluck@csls.ca.

² 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 NAICS sectors, as well as on a per worker basis. All estimates are expressed in both nominal terms (current dollars) and real terms (chained 2002 dollars). Data relevant to this paper were retrieved from CANSIM on June 10, 2012. The data are broken down by the three ICT components: computers, communications, and software. ICT estimates by industry are available from 1980 to 2011.

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

⁴ Statistics Canada significantly revised both nominal and real ICT investment data for the years 2008-2010. Total nominal ICT investment was revised to an increase of 5.6 per cent in 2010 from an original estimate of 1.6 per cent. This was caused by an upward revision of nominal ICT investment in the non-business sector from a 4.2 per cent decrease to a 7.7 per cent increase and in the business sector from 3.1 per cent to 5.1 per cent. These revisions are reflected in all three ICT components: nominal computer investment growth was revised upward from 3.3 per cent to 7.1 per cent in 2010, nominal communication investment growth in 2010 changed from 4.8 per cent to 10.4 per cent, and nominal software investment was revised from a 0.2 per cent decrease in 2010 to a 3.3 per cent increase.

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.

The increase of 3.7 per cent in total economy nominal ICT investment in 2011 was driven entirely by an expansion of nominal ICT investment in the business sector, which grew 4.9 per cent to \$34.2 billion (Charts 1-2). ICT investment in the non-business sector did not fare as well, decreasing 1.2 per cent to \$8.4 billion. This is an unusually weak performance for the non-business sector, given that during the 2000-2010 period, non-business sector ICT investment experienced an average annual growth rate of 5.0 per cent, even after suffering an 18.6 per cent decline in 2002.⁵ For the 2000-2010 period, the business sector ICT investment growth rates were comparatively less impressive, averaging 2.0 per cent a year.

B. Nominal ICT Investment by Component

Total ICT investment consists of three components: computer investment, communication equipment investment, and software investment. Nominal computer investment increased 5.7 per cent to \$12.8 billion in 2011, recovering from its large decline of 12.1 per cent in 2009 (Charts 4-5). Nonetheless, nominal computer investment growth was 1.4 percentage points lower than in 2010. Communications equipment investment increased 6.1 per cent to \$7.4 billion in 2011, 4.3 percentage points less than the 2010 growth rate. Software investment increased 1.7 per cent to \$22.4 billion after weathering the financial storm with an increase of 1.4 and 3.3 per cent in 2009 and 2010, respectively. These numbers differ from the pattern established during the 2000-2010 period, when nominal investment in communication equipment fell 1.7 per cent per year, while investment in computers and software grew at an average rate of 0.6 and 6.1 per cent respectively. In other words, investment in computers and communication equipment experienced uncharacteristically high growth, while software investment was the only ICT component to experience unusually slow growth in 2011.

C. Nominal ICT investment by Sector

There was large variation in the growth rates of nominal ICT investment by sector in 2011. ICT investment increased in seven of the twelve NAICS industries for which total ICT investment data are available (Chart 6).⁶ The industry with the highest growth in ICT investment in 2011 was arts, entertainment and recreation (25.8 per cent). This was followed by the manufacturing sector (18.1 per cent) and the mining, oil and gas extraction sector (7.5 per cent). The real estate, rental and leasing industry exhibited the poorest performance in ICT investment in

⁵ In 2011, non-business sector ICT investment decreased largely as a result of a 1.6 per cent decrease in public administration investment.

⁶ Total ICT investment data was only available for twelve of the twenty NAICS industries that the CSLS collects data on, because the publication of data on telecommunications equipment investment in some industries is suppressed by Statistics Canada to meet the confidentiality requirements of the Statistics Act.

2011, down 7.5 per cent from the previous year. The professional, scientific and technical services sector experienced the second worst decline in ICT investment in 2011 (-3.8 per cent) with the public administration sector (-1.6 per cent) close behind.

D. Nominal ICT Investment as a share of GDP

In 2011, total economy ICT investment in current dollars accounted for 2.65 per cent of nominal GDP (Chart 7), down 0.04 percentage points from 2010, despite rising investment. Nominal ICT investment was a lower share of nominal GDP, because GDP increased 5.2 per cent in 2011 while ICT investment increased only 3.7 per cent.

Total nominal ICT investment as a proportion of GDP was stable at 1.59 to 1.68 per cent of GDP between 1981 and 1985, after which it started growing at a relatively steady pace until 1996, reaching 2.48 per cent of GDP that year (Chart 7). It then gained momentum and started growing at a much higher rate until 1999, when it peaked at 3.20 per cent of GDP. Since then, it dropped back to 2.70 per cent of GDP in 2003 and remained stable in the 2.65 to 2.75 per cent range ever since. In 2011, total nominal ICT investment as a share of GDP was at its lowest level since 1996.

In 2011, software investment as a proportion of GDP was 1.40 per cent, down from 1.45 per cent of GDP in 2010, a 0.05 percentage point decrease (Chart 7). Communications equipment investment represented 0.46 per cent of GDP in 2011, 0.01 percentage point higher than the 2010 share of 0.45 per cent of GDP. Finally, computer investment represented 0.79 per cent of GDP in 2011, the same proportion of GDP as the previous year. Evidently, only computer and communication ICT investment have remained stable in their shares of GDP. It is important to note that the 2011 figure for software investment as a proportion of GDP was almost double that of the computer component and more than three times that of the communications equipment component.

In 2011, business sector ICT investment was 2.62 per cent of business sector GDP, practically identical to the previous year. Non-business sector ICT investment, on the other hand, was 2.80 per cent of non-business sector GDP in 2011, down 0.20 percentage points from 2010. The non-business sector ICT investment/GDP ratio reached its peak at 3.58 per cent in 1999, whereas business sector ICT investment as a proportion of business GDP peaked at 3.16 per cent in 2000 (Chart 8). ICT investment as a proportion of GDP in the non-business sector has generally been slightly above that of the business sector since the late-1980s.

E. Nominal ICT Investment per Worker

ICT investment intensity is defined as nominal ICT investment divided by the number of persons employed. In 2011, nominal ICT investment increased 3.7 per cent, and the number of people employed increased by 1.6 per cent (Chart 9). This resulted in a 2.1 per cent increase in nominal ICT investment per worker (Chart 10), almost double the average annual growth rate of

1.1 per cent for the 2000-2010 period. The 2011 rate was only half as strong as the growth experienced in 2010 (4.2 per cent), but represented a major improvement from the decline in 2009 (-2.0 per cent). Nominal total ICT investment per worker reached \$2,459 in 2011. Overall, growth in total ICT investment per worker has been volatile since 2000, with negative growth in the first part of the decade, significant mid-decade increases and moderate increases later in the decade.

Nominal computer ICT investment per worker increased 0.4 per cent in 2011, above the average annual decrease of 0.9 per cent observed in the 2000-2010 period. Communication investment per worker increased 4.5 per cent in 2011, which is significantly higher than the average annual decrease of 3.1 per cent for this component over the 2000-2010 period. Finally, software investment per worker increased 0.2 per cent in 2011, below the average annual increase of 4.6 per cent between 2000 and 2010.

II. ICT Prices

By dividing the current dollar estimates of ICT investment by the 2002 chained dollar figures, it is possible to obtain implicit price indices for computer, communication equipment, software and total ICT investment.⁷ Overall, prices for ICT investment goods decreased in 2011. Prices of total economy ICT investment goods decreased by 6.2 per cent (Chart 11), compared to the 2000-2010 period, when ICT prices decreased on average 4.7 per cent per year. The 2011 rate was similar to the 5.9 per cent decline in 2010. The price decrease in 2011 represents a continuation of the usual trend of falling prices, as total ICT investment prices fell to their lowest level to date. Software investment prices were the only exception, as they fell slightly from the 2009 level but are identical to the 2005 level.

In 2011, computer investment prices decreased 16.3 per cent, putting its price level at 28 per cent of the price level observed in 2000 (Chart 12). Among the three ICT components, computer investment prices experienced the largest decrease in the last decade, dropping on average 10.3 per cent per year between 2000 and 2010. The rate of price decrease decelerated from 2005 to 2009; however, it has accelerated since the 2009 recession (Chart 11).

Communications equipment investment prices decreased 4.6 per cent in 2011, putting its price level at 63 per cent of the 2000 price level (Chart 12). The average annual price change from 2000 to 2010 was -4.0 per cent but, again, the rate of price decreases decelerated from 2004 until 2009 (Chart 11).

In 2011, software investment prices decreased 0.5 per cent, and its price level was 88 per cent of the 2000 price level (Chart 12). During the 2000-2010 period, software investment prices

⁷ Price series for the business and the non-business ICT investment (and their components) were also calculated, but since the price movements of the two sectors were relatively similar, they will not be discussed in detail in this report. Business sector ICT investment prices decreased by 6.5 per cent in 2011, while non-business sector ICT investment prices decreased by 4.7 per cent. During the 2000-2011 period, business sector and non-business sector ICT investment prices decreased at an average rate of 4.9 and 4.3 per cent, respectively.

experienced an average annual decrease of 1.2 per cent per year. Compared to computer and communications investment prices, software investment prices declined at a slower pace from 2003 to 2007, after which prices for this component actually increased for 2008 and 2009 before decreasing again in 2010 and 2011 (Chart 11).

To summarize, prices of all ICT components have declined substantially since 2000, with computer prices falling the most (72 per cent), followed by communication equipment (37 per cent) and finally software (12 per cent). It is important to track price movements when dealing with nominal figures, because those figures capture both price and volume effects. Thus, continually dropping prices caused total economy ICT investment to grow faster in real terms than in nominal terms.

The decline in the price of ICT investment goods during the 2000-2011 period embodies both the decline in the absolute price of the components and the increase in their quality. Prices are adjusted for changes in the quality of ICT investment goods to reflect the fact that firms can now purchase much more powerful products for lower levels of investment. Hence, increases in the level of real ICT investment can be the result of (i) an increase in the quantity produced/purchased, (ii) an increase in the quality of the ICT investment goods, or (iii) an increase in both quantity and quality. In general, an increase in real ICT investment is the result of both an increase in the quantity of goods purchased and an increase in the quality of goods purchased.

Since 2003, there has been a clear negative correlation between total ICT prices and the Canada-US exchange rate (Chart 14). Because ICT investment goods in Canada are largely imported, an increase in the value of the Canadian dollar effectively decreases ICT prices. This trend is evident starting in 2003, when a 12.1 per cent increase in the value of the Canadian dollar in 2003 led to a large fall in ICT prices (-9.2 per cent) (Chart 13). The progressively smaller appreciations during the 2004-2008 period led to progressively smaller declines in ICT prices. When the exchange rate depreciated in 2009, total ICT prices rose significantly. In 2010, the situation reversed itself as total ICT prices fell 5.9 per cent, reflecting a 10.8 per cent appreciation of the Canadian dollar. This trend continued in 2011: the exchange rate appreciated 4.1 per cent as ICT prices fell 6.2 per cent.

III. Real ICT Investment

This section examines trends in real ICT investment by looking at data measured in chained 2002 dollars. Total economy real ICT investment rose 10.5 per cent to \$68.9 billion in 2011 (Chart 15-16), above the average rate of increase of 7.7 per cent per year in the 2000-2010 period and worse than the 2010 rate of 12.2 per cent. In 2011, ICT investment grew faster in real terms than it did in nominal (10.5 per cent versus 3.7 per cent) because of declining ICT investment prices (Chart 17). Real ICT investment also greatly outperformed total economy investment (fixed, non-residential), which grew 3.3 per cent in 2011 (Chart 18). The improvement

in real ICT investment is explained by the 6.2 per cent decrease in ICT prices as well as the 3.7 per cent increase in nominal ICT investment in 2011.

A. Real ICT Investment in the Business and Non-Business Sectors

The increase of 10.5 per cent in total economy real ICT investment in 2011 was driven primarily by expansion in the business sector, which grew 12.2 per cent to \$56.6 billion, while the non-business sector grew relatively slow at 3.6 per cent (Chart 15), putting it at a value of \$12.3 billion. Despite much higher business sector growth in 2011 relative to the non-business sector, non-business sector ICT investment experienced a higher average annual growth rate during the 2000-2010 period (9.7 per cent versus 7.2 per cent in the business sector). Furthermore, the 12.2 per cent increase in the business sector in 2011 followed a 9.2 per cent decline in 2009 and a 12.1 per cent increase in 2010, while the low growth in the non-business sector followed a 3.7 per cent increase in 2009 and 12.7 per cent increase in 2010. Overall, the business sector's ICT investment growth was unusually high in 2011 while it was unusually low in the non-business sector.

B. Real ICT Investment by Component

In 2011, real investment in computers increased 26.3 per cent to \$36.2 billion, even higher than its average annual growth rate of 12.1 per cent for the 2000-2010 period (Charts 19-20). The increase in computer investment was similar to the 22.9 per cent growth experienced in 2010. This jump owes both to a large decrease in computer prices (-16.3 per cent), and to an increase in nominal investment (5.7 per cent). Compared to 2010, however, the increase in real computer investment in 2011 was more so linked to a drop in prices (-16.3 per cent in 2011 versus -12.8 per cent in 2010) than it was linked to an increase in nominal investment (5.7 per cent in 2011 versus 7.1 per cent in 2010).

Real investment in communication equipment increased 11.3 per cent to \$12.0 billion in 2011, well above the average annual growth rate of 2.4 per cent per year experienced over the 2000-2010 period. The increase in communication investment was notably worse than the 20.1 per cent growth experienced in 2010 due to the smaller fall in communication investment prices (-4.6 per cent in 2011 versus -8.1 per cent in 2010) and a smaller increase in nominal communications investment (6.1 per cent in 2011 versus 10.4 per cent in 2010).

Real investment in software only increased 2.3 per cent to \$25.4 billion in 2011, compared to an average annual growth rate of 7.4 per cent for the 2000-2010 period. This below-average growth was due to a lackadaisical increase in nominal software investment (1.7 per cent in 2011 versus 6.1 per cent in 2000-2010) and stable software investment prices (-0.5 per cent). The 2011 increase in real software investment rate was lower than 4.7 per cent in 2010; nonetheless, both years experienced unusually weak growth in software investment.

C. Real ICT Investment as a Share of GDP

In 2011, real ICT investment expressed as a proportion of real GDP (chained 2002 dollars) rose 0.39 percentage points to its all-time highest level (5.44 per cent) (Chart 21). Real ICT investment as a share of GDP grew steadily between 1981 and 2011; however, two short-term downturns occurred in 2002 and 2009. The rising real share of ICT investment reflects the impact of falling ICT prices.

By examining trends in real investment for computers, communications equipment and software as a proportion of total GDP, we can see that overall levels of investment as a proportion of GDP have increased significantly over the years for all components. The rise of real investment in computers as a proportion of GDP is the most dramatic, followed by software investment, and finally communications equipment investment. The fact that computer ICT investment accounts for the largest proportion of GDP is unsurprising given that it also experienced the largest fall in prices. Real investment in computers as a proportion of GDP increased from 0.01 per cent in 1981 to 2.86 per cent in 2011. The proportion of real investment in software as a share of GDP has also increased, from 0.13 in 1981 to 2.00 per cent in 2011. Finally, real investment in communication equipment as a proportion of GDP increased from 0.45 per cent in 1981 to 0.95 per cent in 2011 (Chart 21).

Real business sector ICT investment as a proportion of business sector GDP was 5.38 per cent in 2011 (up 0.45 percentage points from 2010), whereas non-business sector ICT investment represented 5.73 per cent of non-business sector GDP in the same year (up 0.12 percentage points from 2010) (Chart 22). In the business sector, investment as a share of GDP followed a similar course to that of the total economy: it has grown steadily since 1981, with the exception of slight declines in 2002 and 2009. In the non-business sector, however, growth of real ICT investment as a share of GDP has been positive for all but three years (2002, 2008 and 2010). In addition, the share in the non-business sector has been higher than that of the business sector since 2003.

D. Real ICT Investment per Worker

Total economy real ICT investment per worker increased by 8.8 per cent in 2011 (Chart 23), with increases in the investment intensity of all ICT components (24.3 per cent for computers, 9.6 per cent for communication equipment and 0.7 per cent for software). Despite the negative growth in 2009 (-5.4 per cent), total economy real ICT investment per worker grew a cumulative 97.2 per cent since 2000, equivalent to an average annual growth rate of 6.4 per cent for the 2000-2011 period. The 2011 increase, however, was inferior to the 2010 growth rate of 10.7 per cent.

It is interesting to note, once again, that ICT investment intensity trends in chained dollars and in current dollars do not necessarily correspond. Total ICT investment per worker in current dollars increased only 13.9 per cent cumulatively during the 2000-2011 period, an average annual increase of 1.2 per cent. Furthermore, during this same period, nominal investment per worker by component fell for computers and communication equipment, and increased for software. In

contrast, all three real ICT investment components experienced much higher growth than is reflected in the nominal data. In addition, the software investment had the least difference between nominal and real terms in 2011, which is explained by the fact that this ICT component had the smallest decrease in prices. As discussed earlier, higher real growth rates relative to nominal growth rates reflect the fact that prices fell over the period.

IV. Conclusion

In 2011, ICT investment continued to make a strong comeback in Canada following the decline in investment during the 2009 recession; however, ICT investment performance was not as strong as enjoyed in 2010. Tepid ICT investment growth in the non-business sector put downward pressure on total economy ICT investment growth, but the business sector's solid ICT investment growth offset the non-business sector's poor performance.

Total economy nominal ICT investment increased 3.7 per cent in 2011 to \$42.6 billion, slightly above the average growth rate of 2.6 per cent experienced during the 2000-2010 period but lower than the 5.6 per cent growth experienced 2010. Total economy real ICT investment fared particularly well in 2011, increasing 10.5 per cent to \$68.9 billion (2002 dollars) due to a combination of falling price levels and increasing nominal investment. This price decrease is partly due to the significant appreciation of the Canadian dollar relative the US dollar in 2010 and 2011 (10.8 per cent and 4.1 per cent, respectively), given that much of Canada's ICT investment is imported.

On a per worker basis, ICT investment growth has been positive since the 2009 recession. In 2011, nominal ICT investment intensity grew 2.1 per cent compared to 4.2 per cent in 2010 and the 2000-2010 average growth rate of 1.1 per cent. In real terms, the increase in ICT investment intensity was more impressive at 8.8 per cent in 2011 (versus 10.7 per cent in 2010, and 6.1 per cent on average between 2000 and 2011).

References

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 2008-1, available online at <http://www.csls.ca/notes/Note2008-1.pdf>.

Sharpe, Andrew (2005) “What Explains the Canada-US ICT Investment Gap?” *International Productivity Monitor*, Fall, pp. 21-38.

Sharpe, Andrew (2006) “The Relationship between ICT Investment and Productivity in the Canadian Economy: A Review of the Evidence,” CSLS Research Report 2006-05, 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, 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, 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, available online at <http://www.csls.ca/notes/Note2011-2.pdf>.

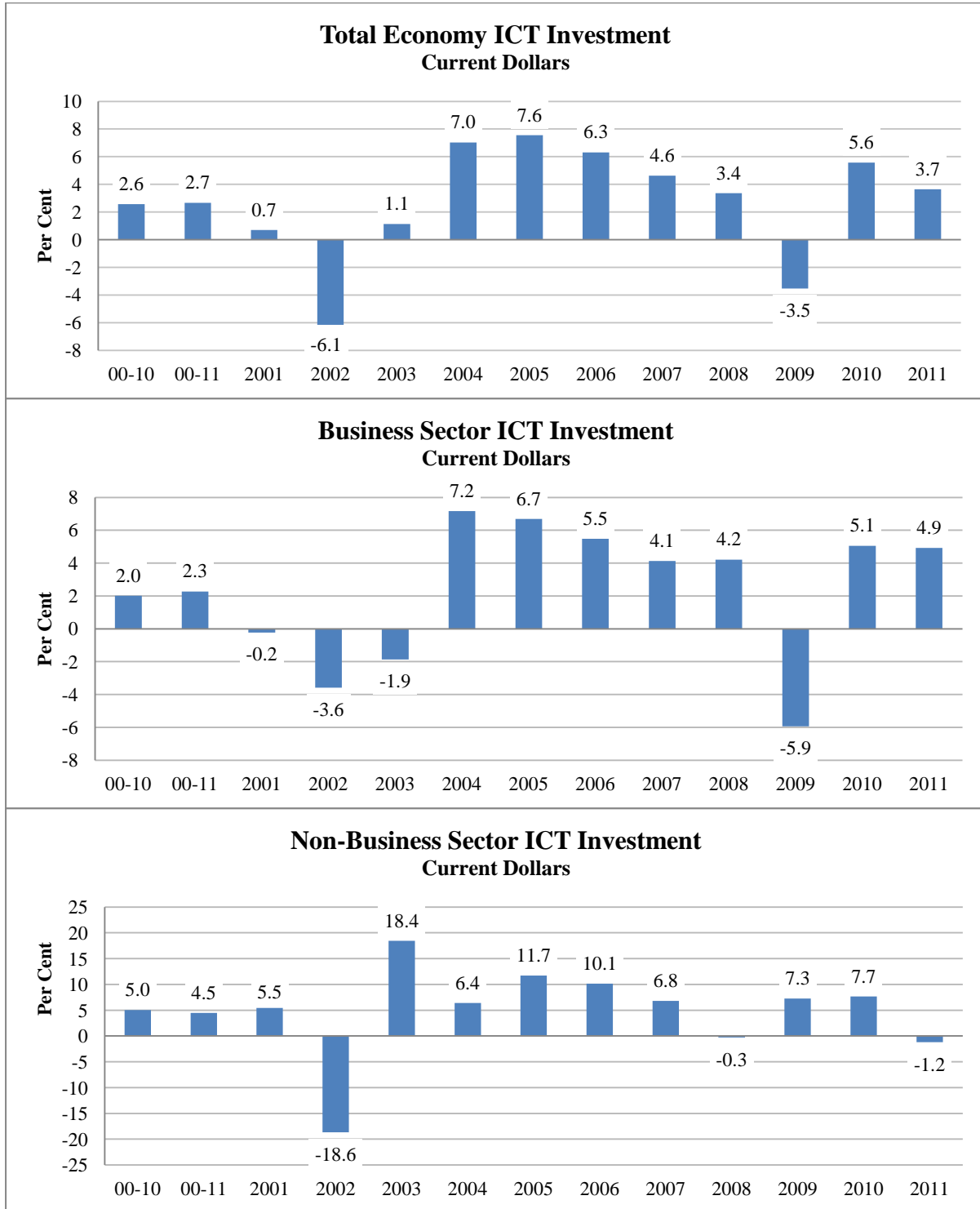
Sharpe, Andrew and Jean-Francois Arsenault (2008a) “ICT Investment and Productivity: A Provincial Perspective,” CSLS Research Report 2008-6, available online at <http://www.csls.ca/reports/csls2008-6.pdf>.

Sharpe, Andrew and Jean-Francois Arsenault (2008b) “The Canada-US ICT Investment Gap: An Update,” CSLS Research Report 2008-1, 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, available online at <http://www.csls.ca/reports/csls2010-08.pdf>

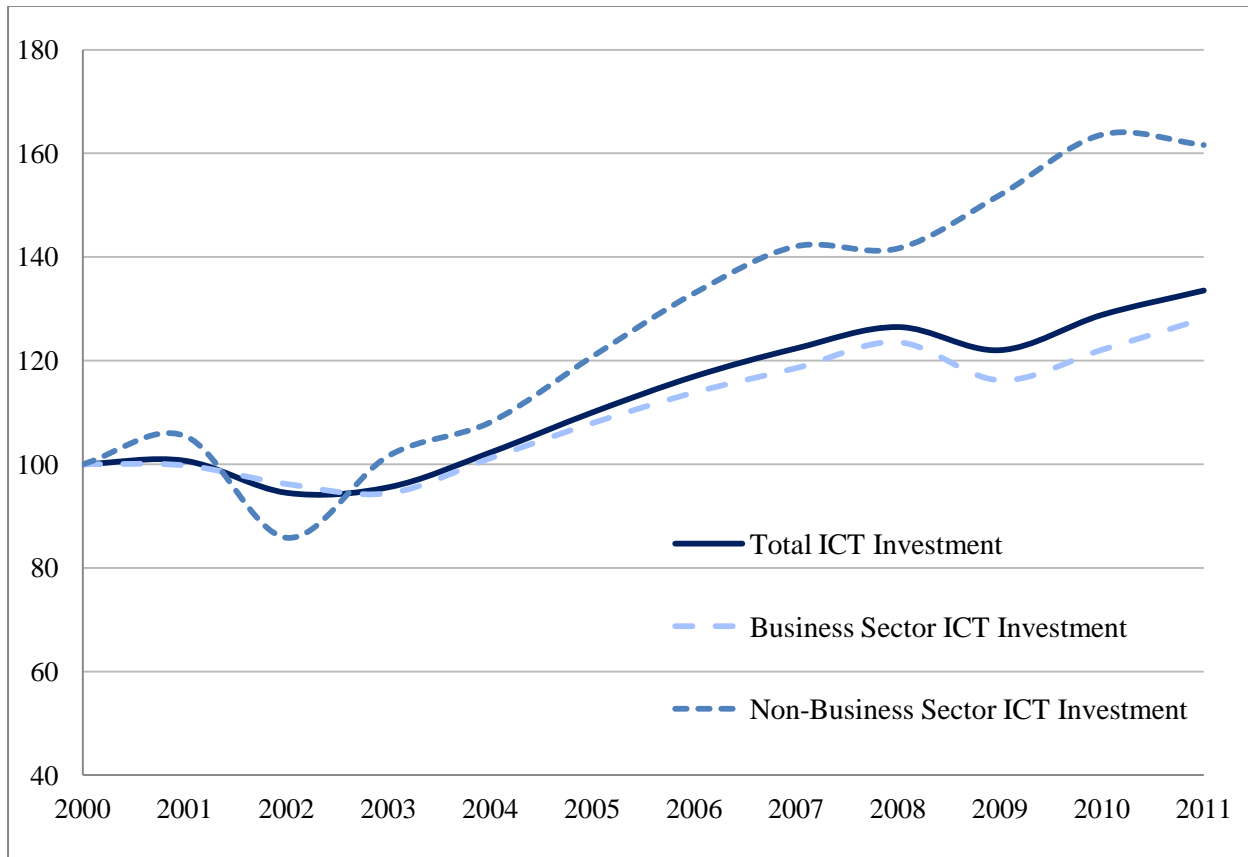
Charts

Chart 1: Trends in ICT Investment by Sector, 2000-2011, Current Dollars (Average Annual and Annual Growth Rates, per cent)



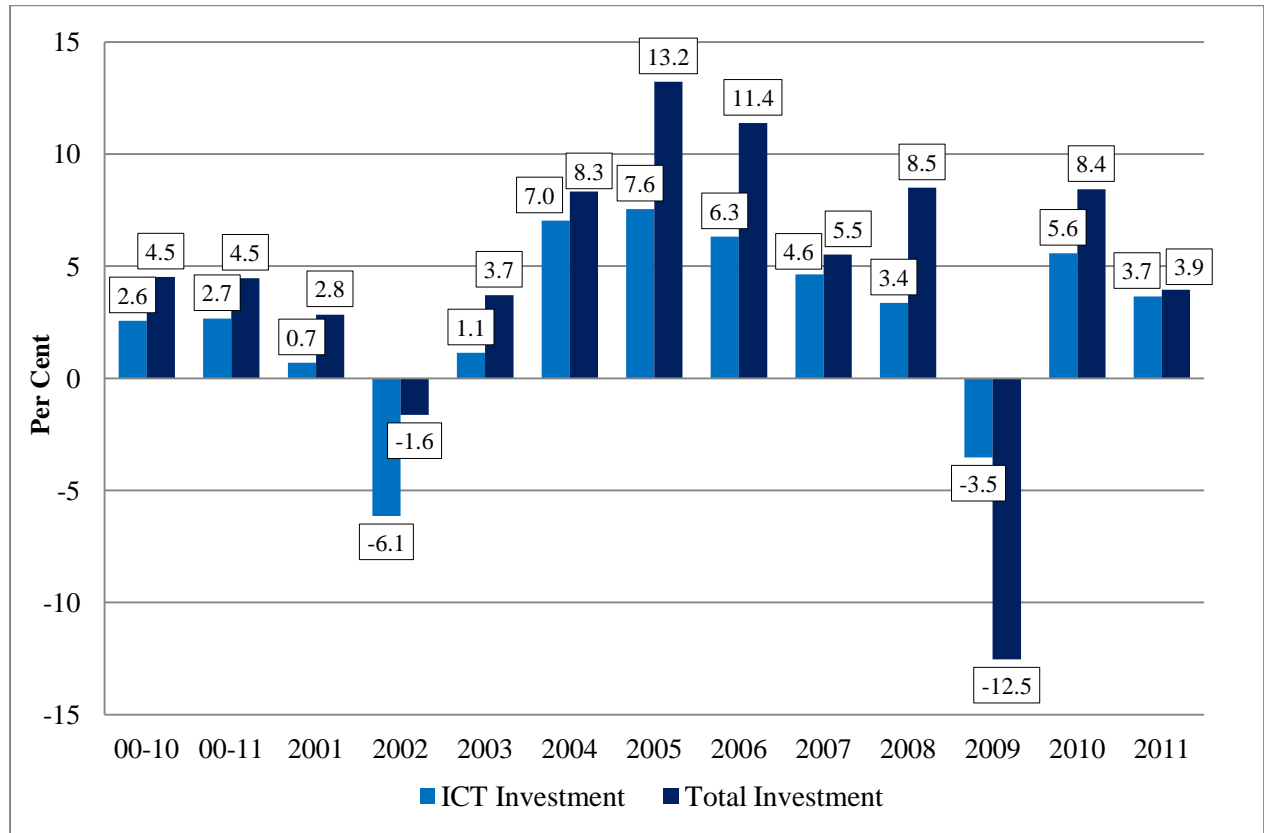
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

**Chart 2: Trends in ICT Investment by Sector, 2000-2011, Current Dollars
(Indexed to 2000=100)**



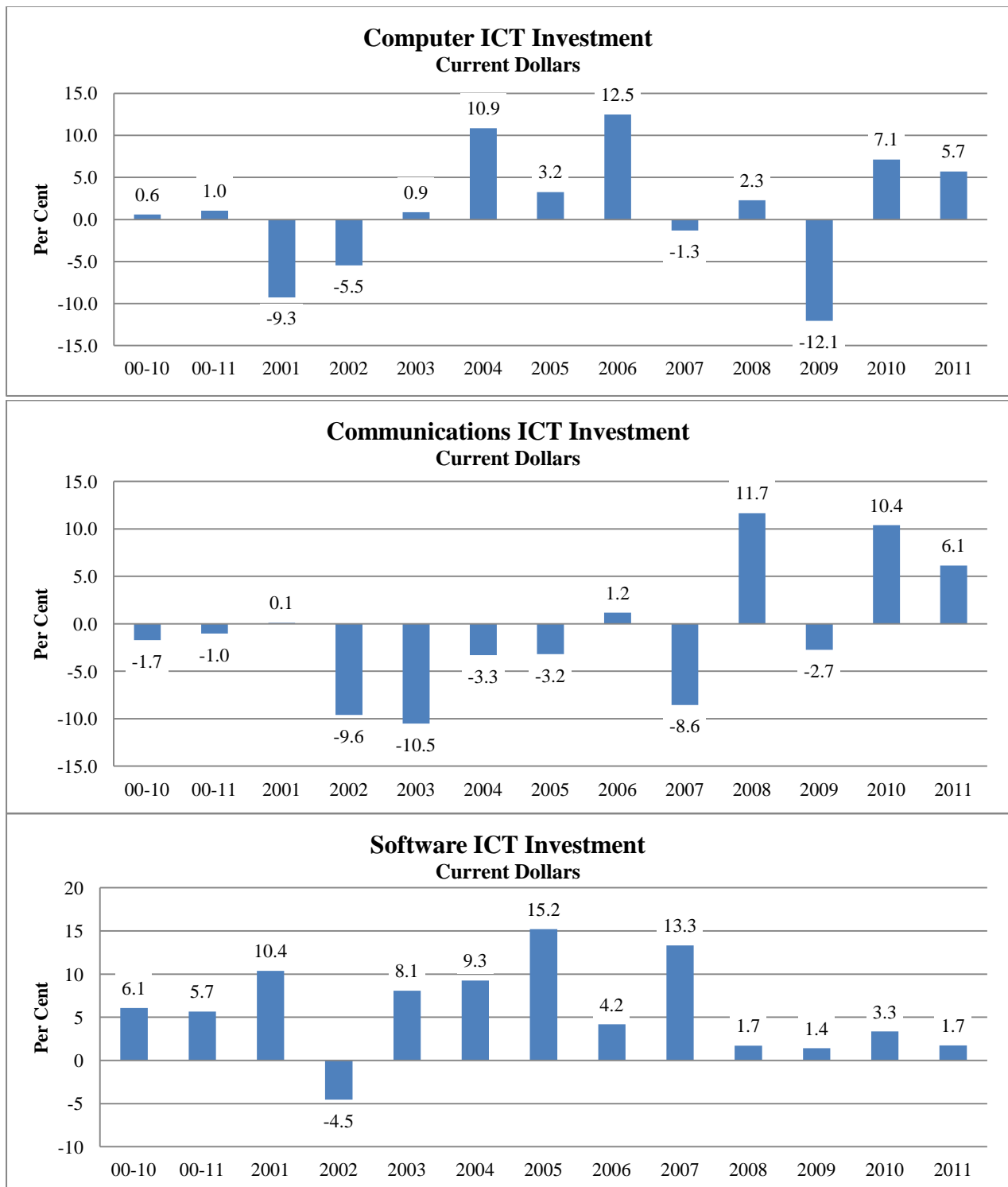
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

**Chart 3: Total Economy ICT Investment and Total Economy Investment (Fixed, Non Residential), 2000-2011, Current Dollars
(Average Annual and Annual Growth Rates, per cent)**



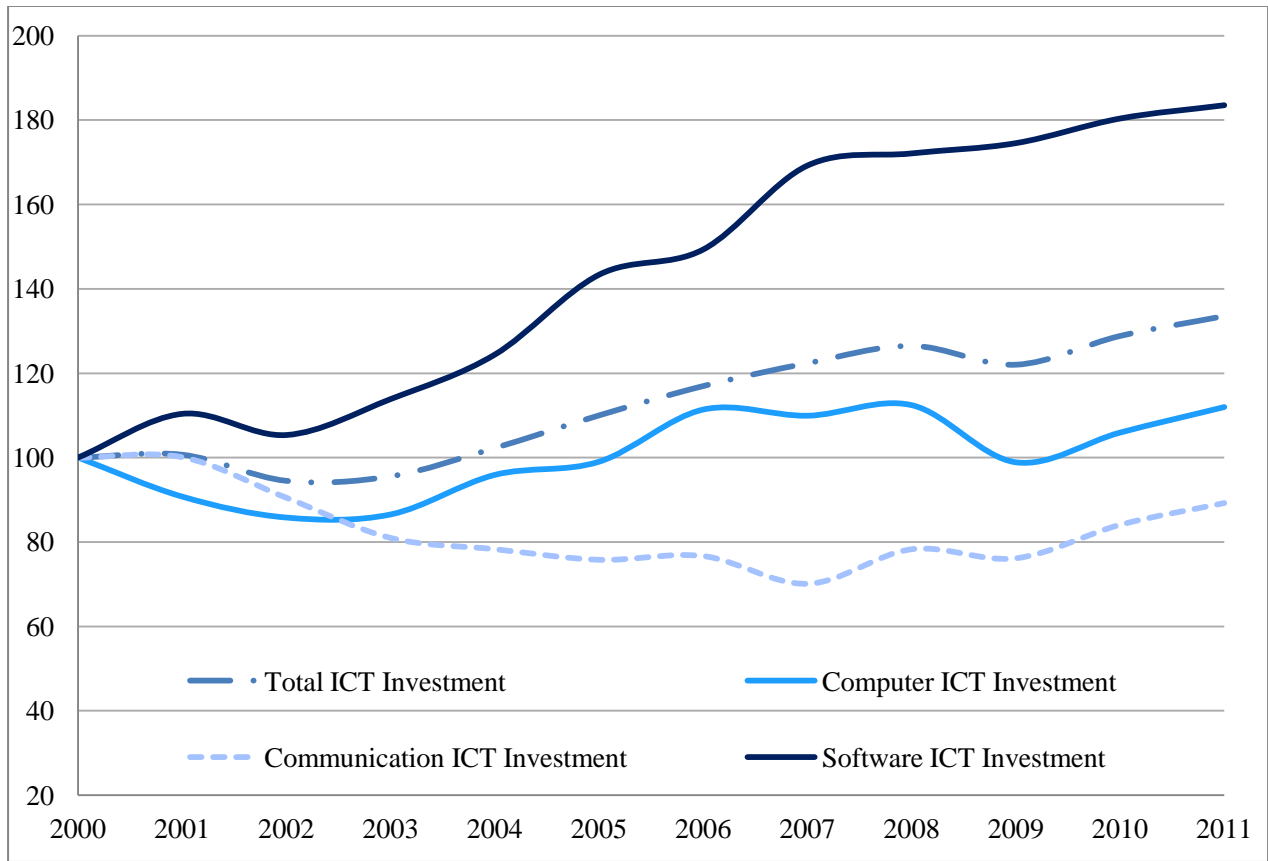
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 4: Trends in ICT Investment by Component, 2000-2011, Current Dollars (Average Annual and Annual Growth Rates, per cent)



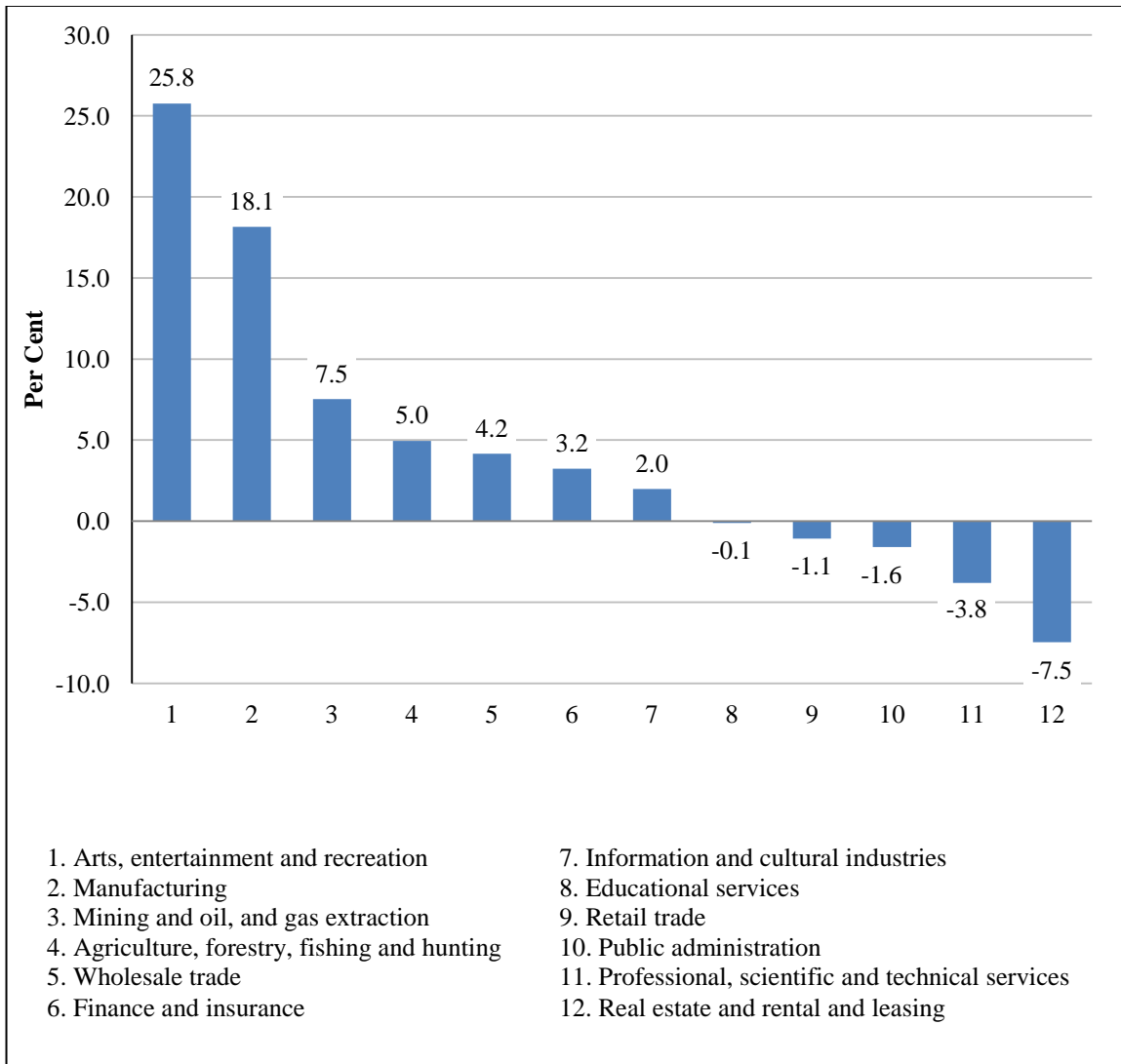
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

**Chart 5: Trends in ICT Investment by Component, 2000-2011,
Current Dollars (Indexed to 2000=100)**



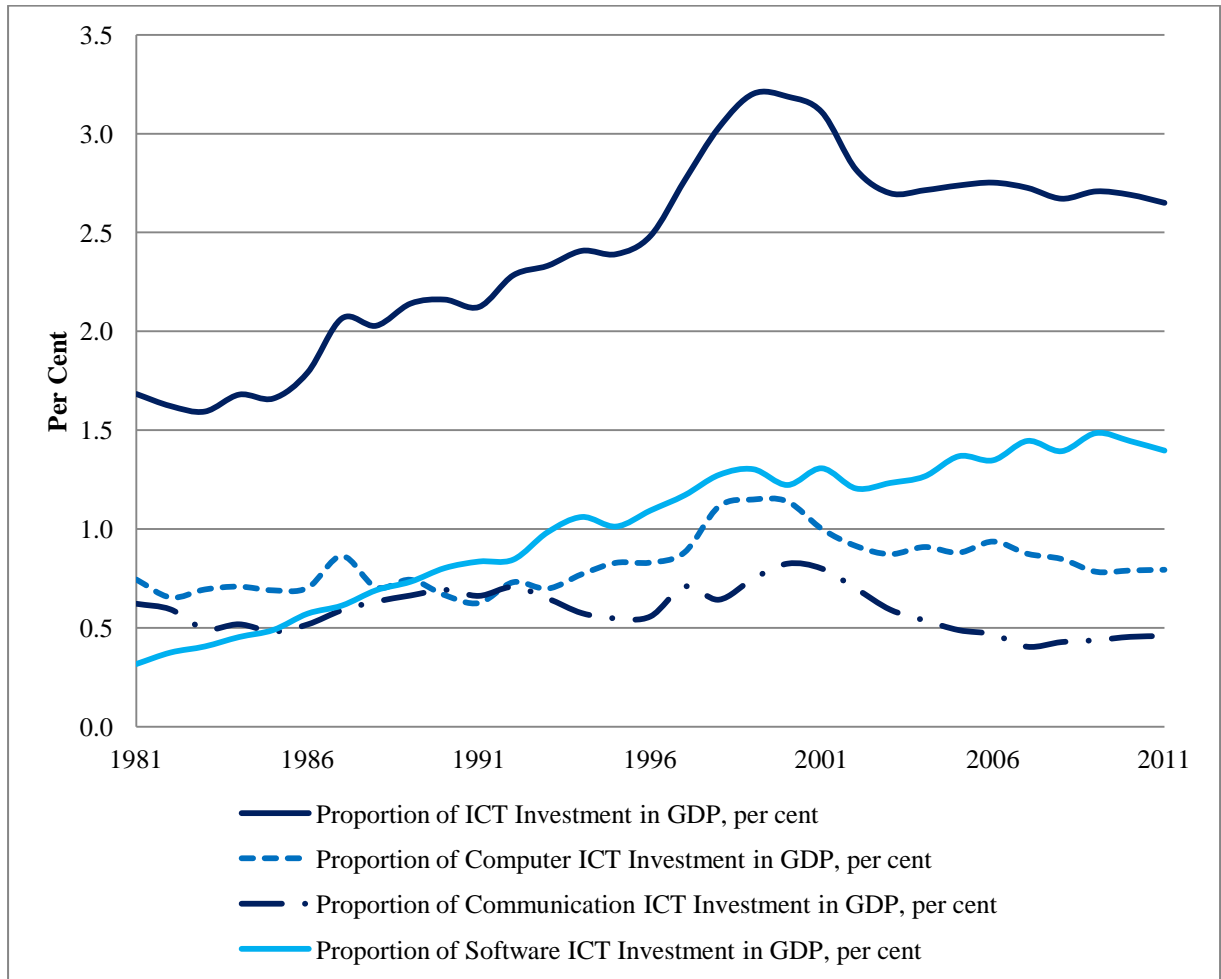
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 6: Total ICT Investment by Industry, 2011, Per Cent Change, Current Dollars



Source: CSLS ICT Database, which was built using Statistics Canada estimates.

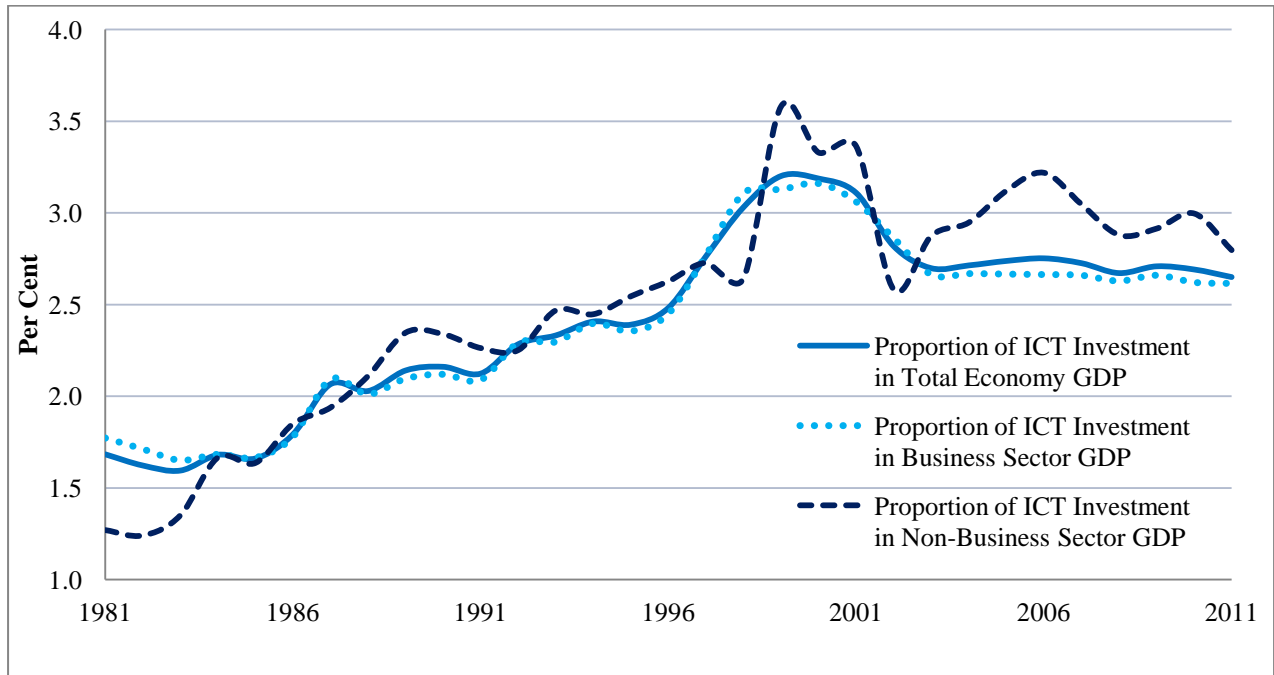
Chart 7: Trends in ICT Investment by Component as a Proportion of GDP, 1981-2011, Per Cent, Current Dollars



Note: GDP data for 2009 to 2011 are CSLS estimates.

Source: CSLS ICT Database, which was built using Statistics Canada estimates.

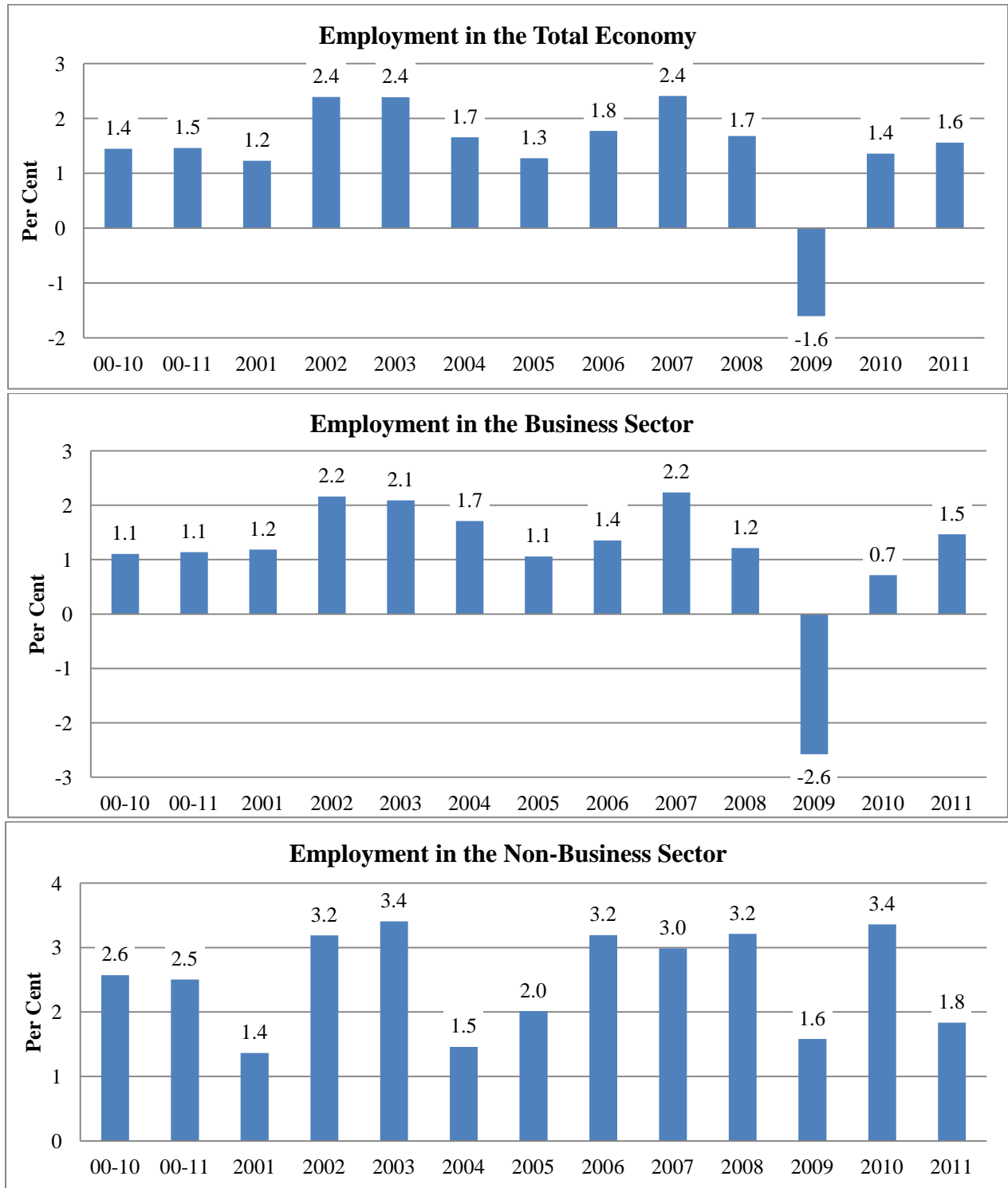
Chart 8: ICT Investment as a Proportion of GDP by Total Economy, Business Sector and Non-Business Sector, 1981-2011, Current Dollars



Note: GDP data for 2009 to 2011 are CSLS estimates.

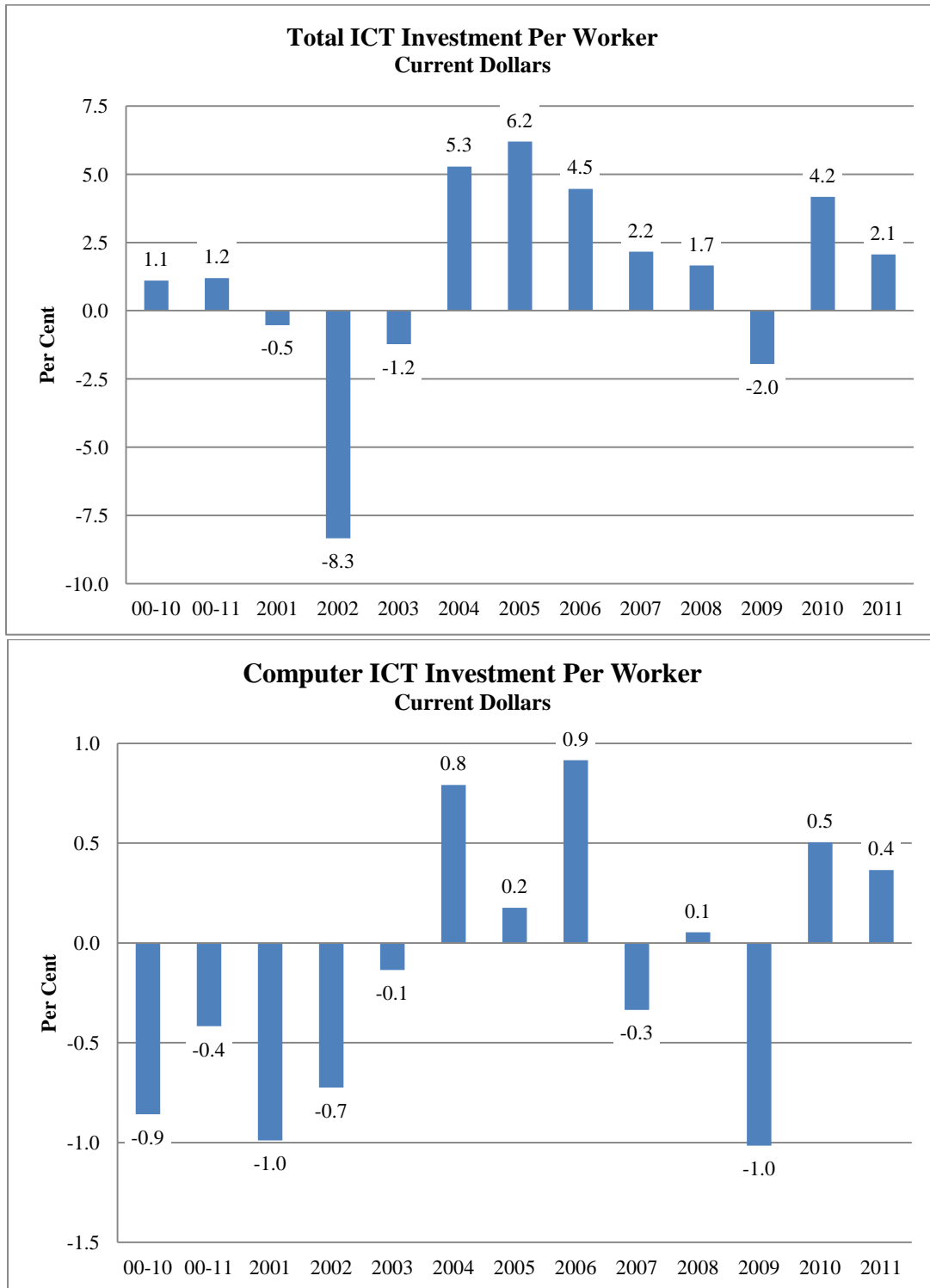
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 9: Number of Workers in the Total Economy, Business Sector, and Non-Business Sector, 2000-2011 (Annual Growth Rates, per cent)



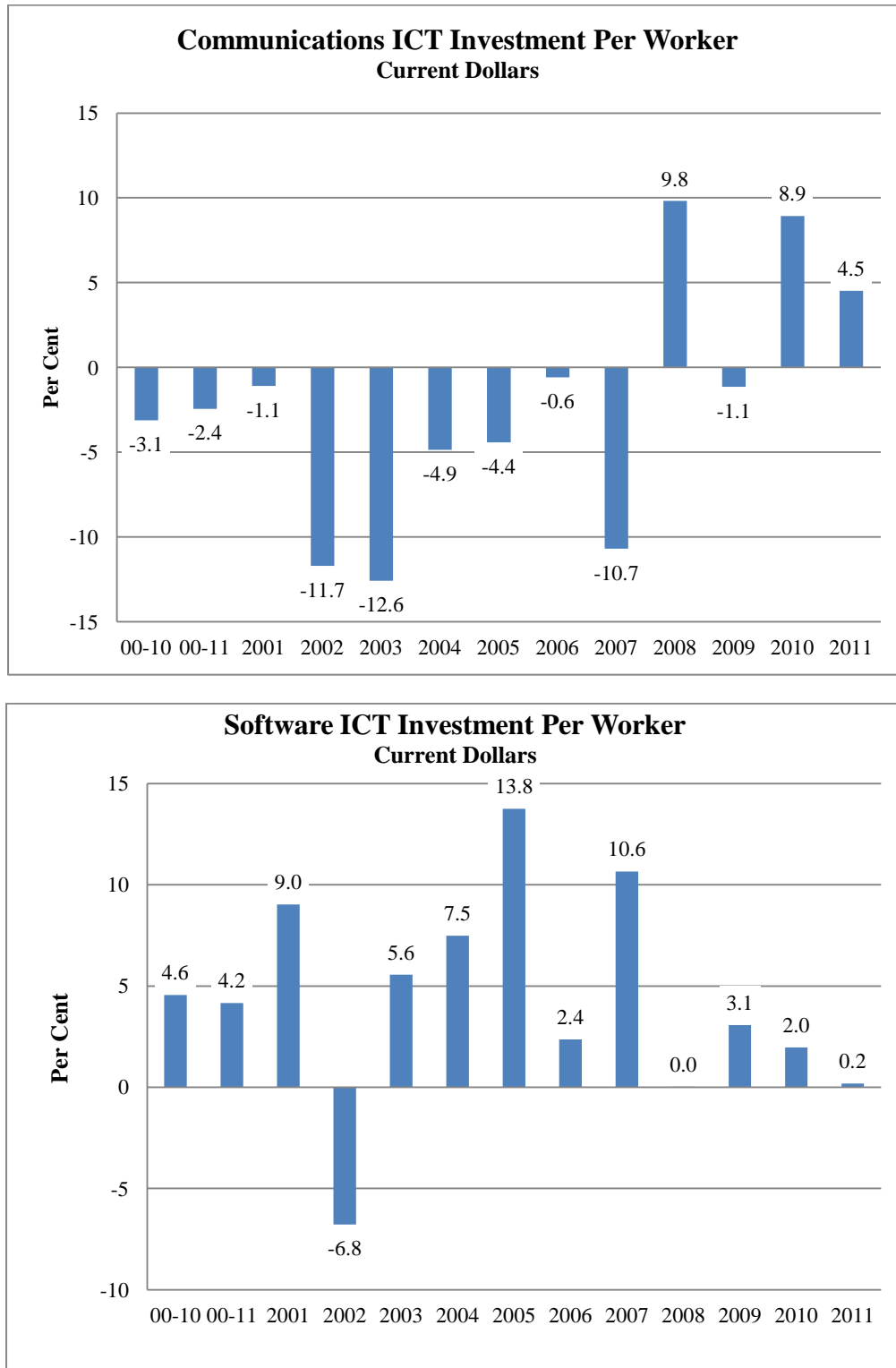
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 10: Trends in ICT Investment per Worker by Component, 2000-2011, Current Dollars (Average Annual and Annual Growth Rates, per cent)



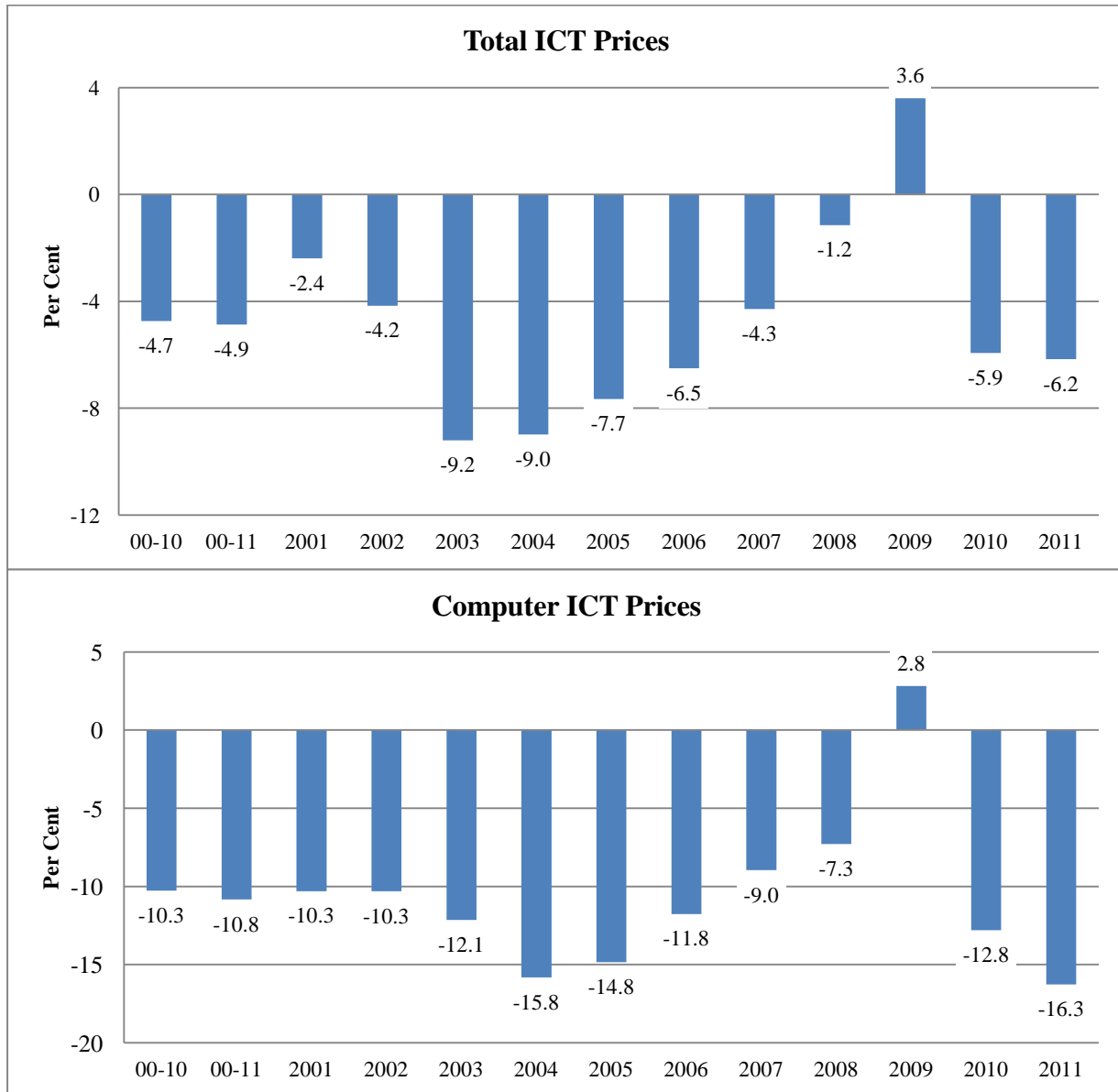
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 10 (Continued): Trends in ICT Investment per Worker by Component, 2000-2011, Current Dollars (Average Annual and Annual Growth Rates, per cent)



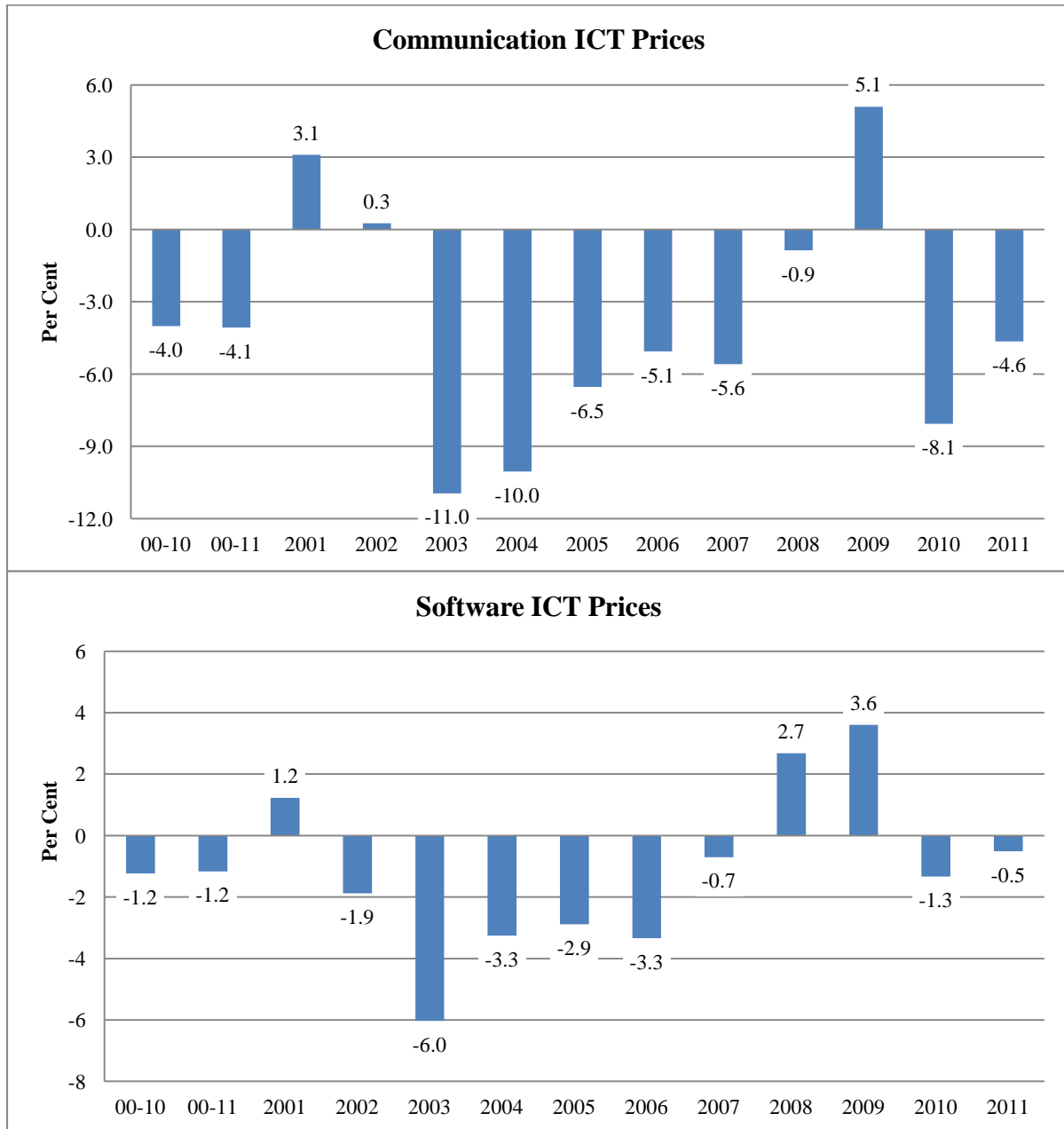
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 11: Trend in Price of ICT Goods by Component, 2000-2011, 2002 base year (Average Annual and Annual Growth Rates, per cent)



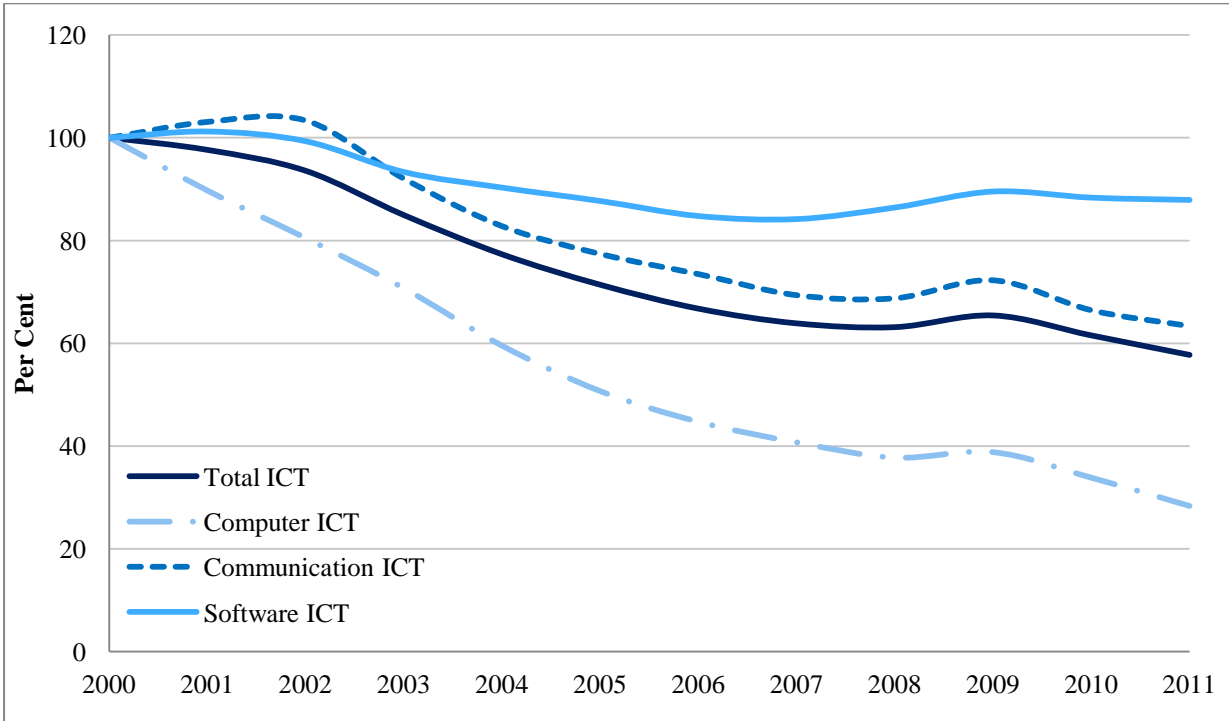
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 11 (Continued): Trend in Price of ICT Goods by Component, 2000-2011, 2002 base year (Average Annual and Annual Growth Rates, per cent)



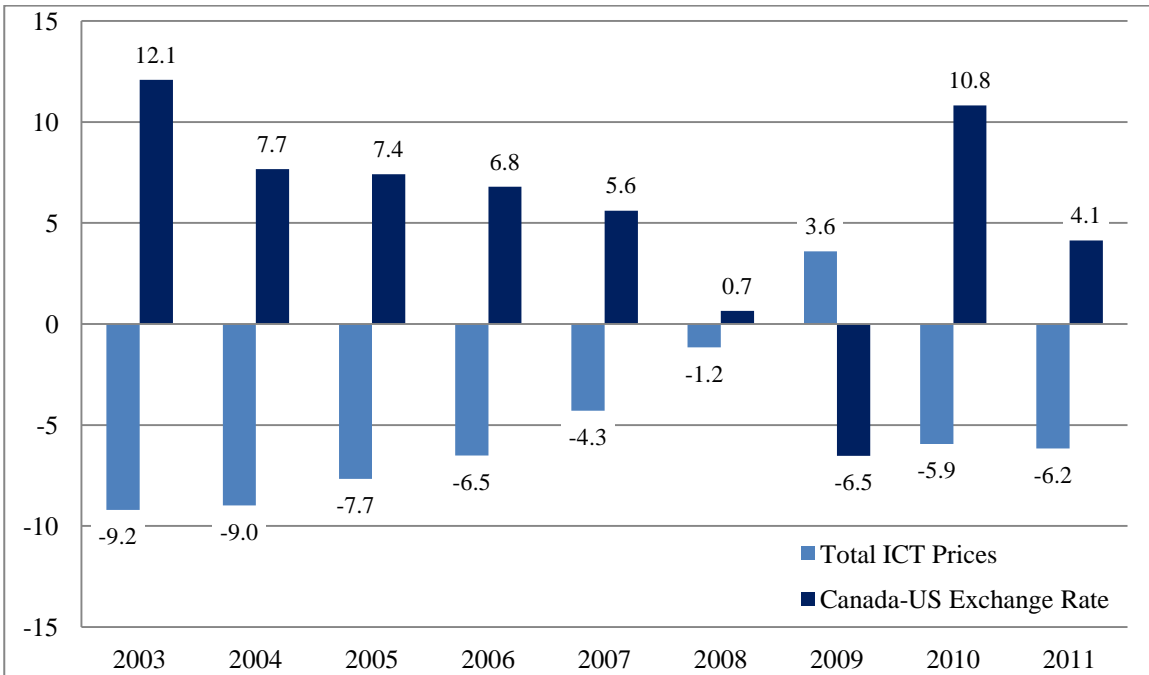
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 12: ICT Investment Prices by Component, 2000-2011, 2000 Base Year

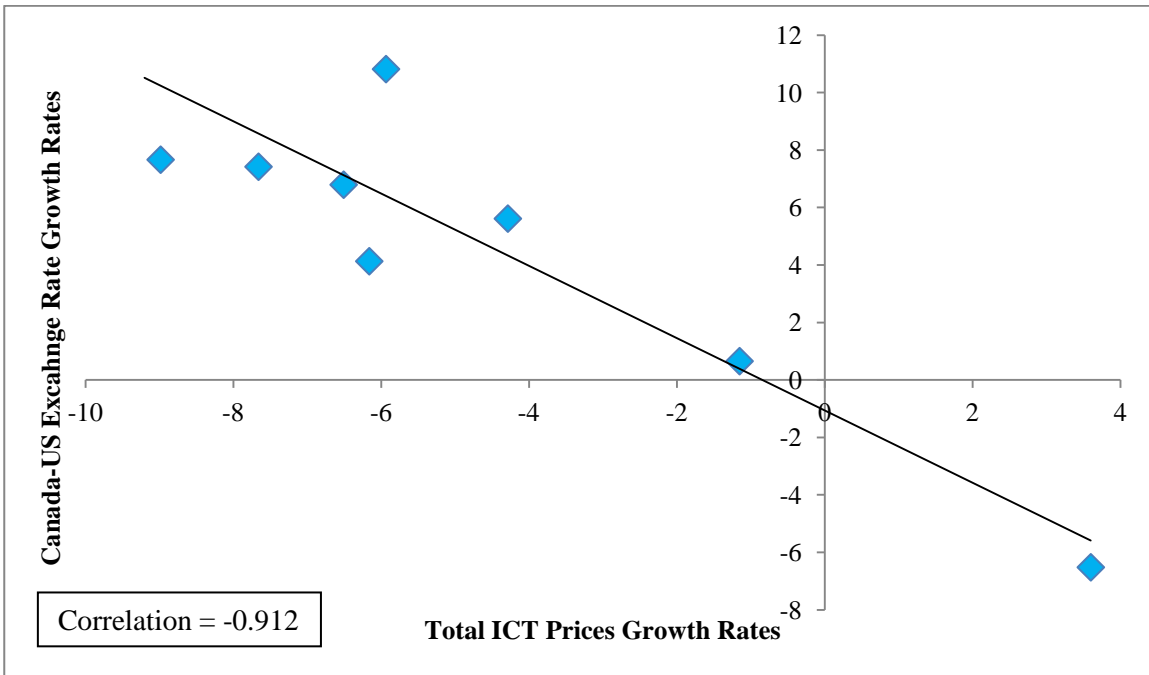


Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 13: Total ICT Prices (2002 base year) and Canada-US Exchange Rates (Canadian cents per US dollar), 2000-2011 (Annual Growth Rates, per cent)

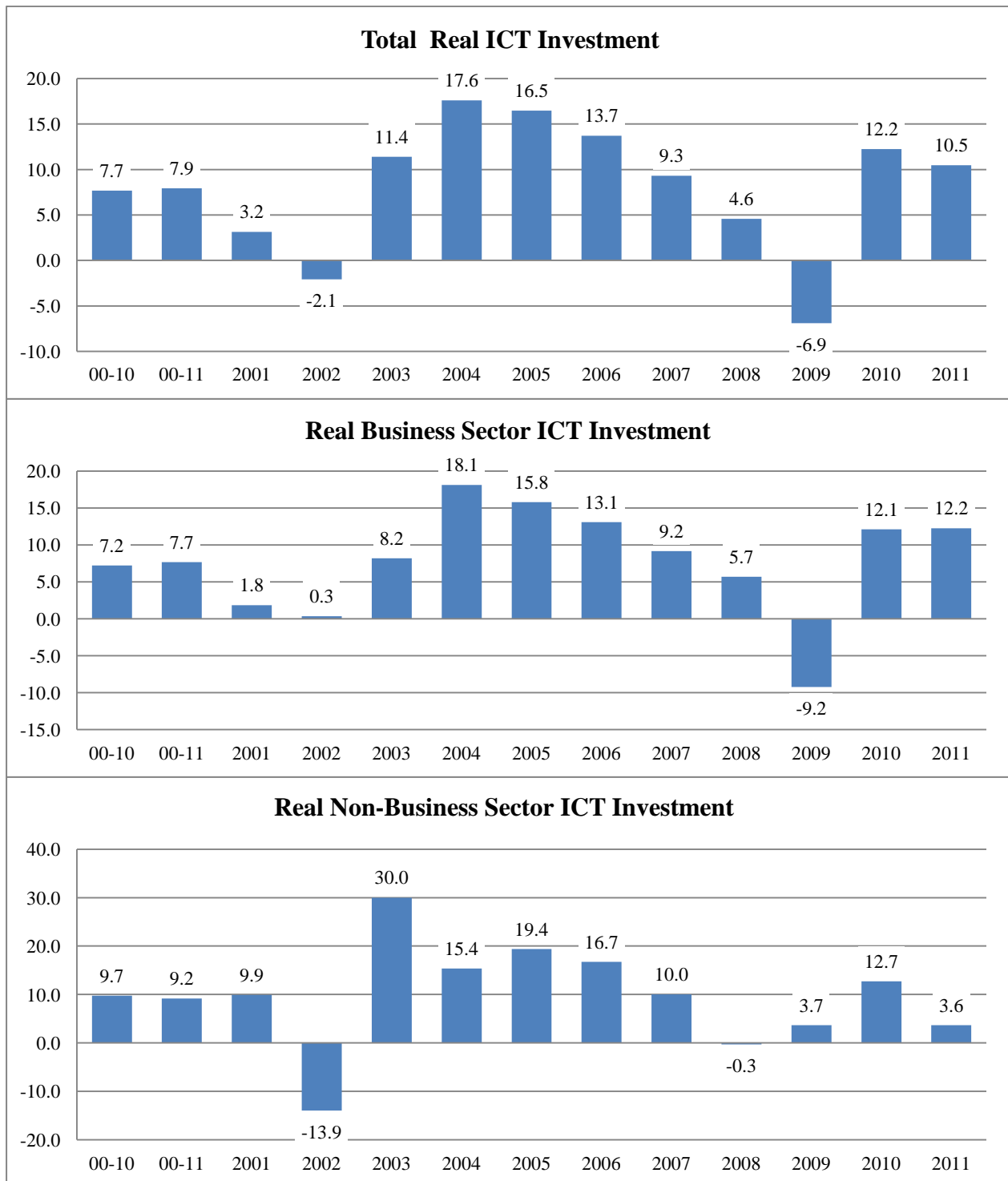


Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 14: Correlating Changes in Total ICT Price and Canada-US Exchange, 2003-2011

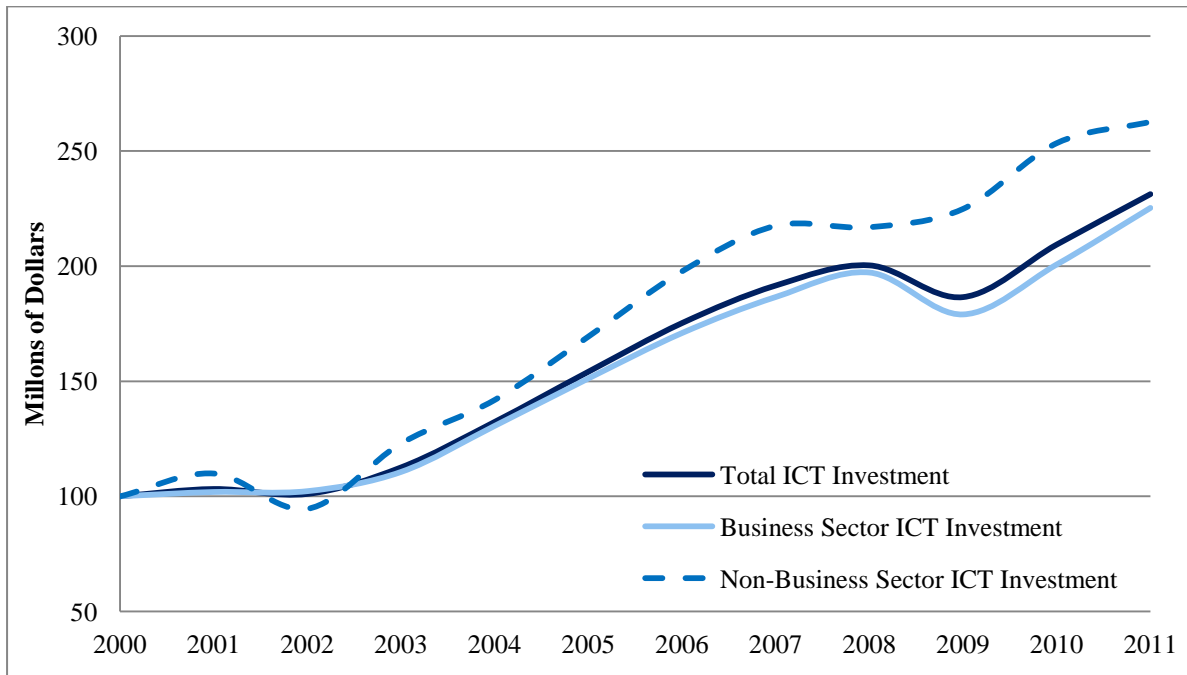
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

**Chart 15: Trends in Real ICT Investment by Sector, 2000-2011, 2002 Chained Dollars
(Average Annual and Annual Growth Rates, per cent)**

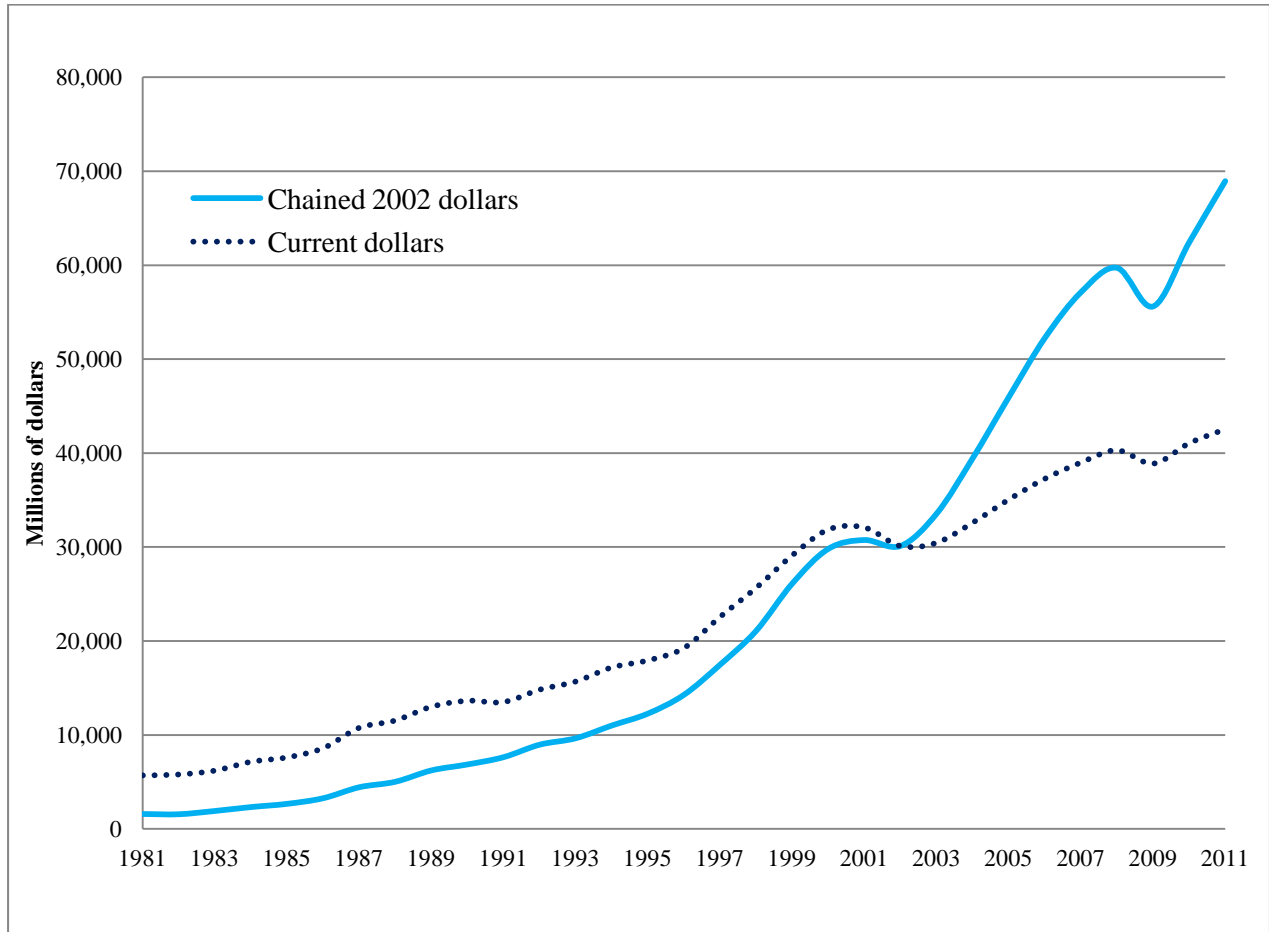


Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 16: Trends in Real ICT Investment by Sector, 2000-2011, Chained 2002 Dollars (Indexed to 2000=100)

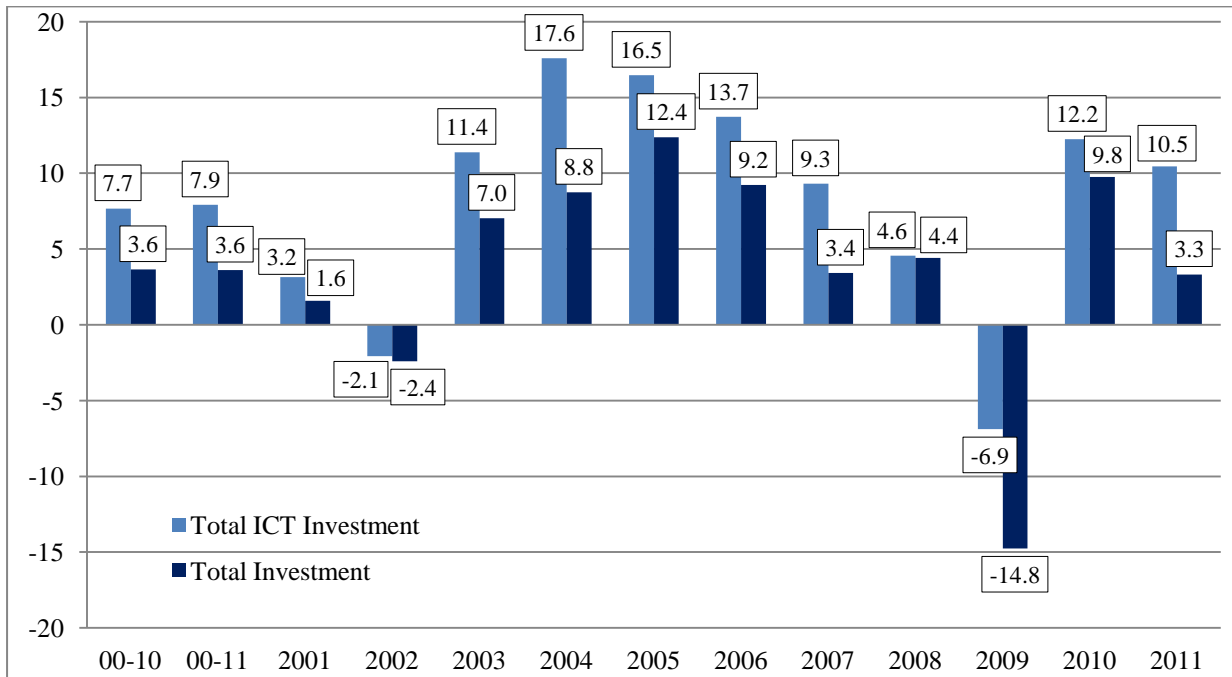


Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 17: Real and Nominal Total ICT Investment, 1981-2011

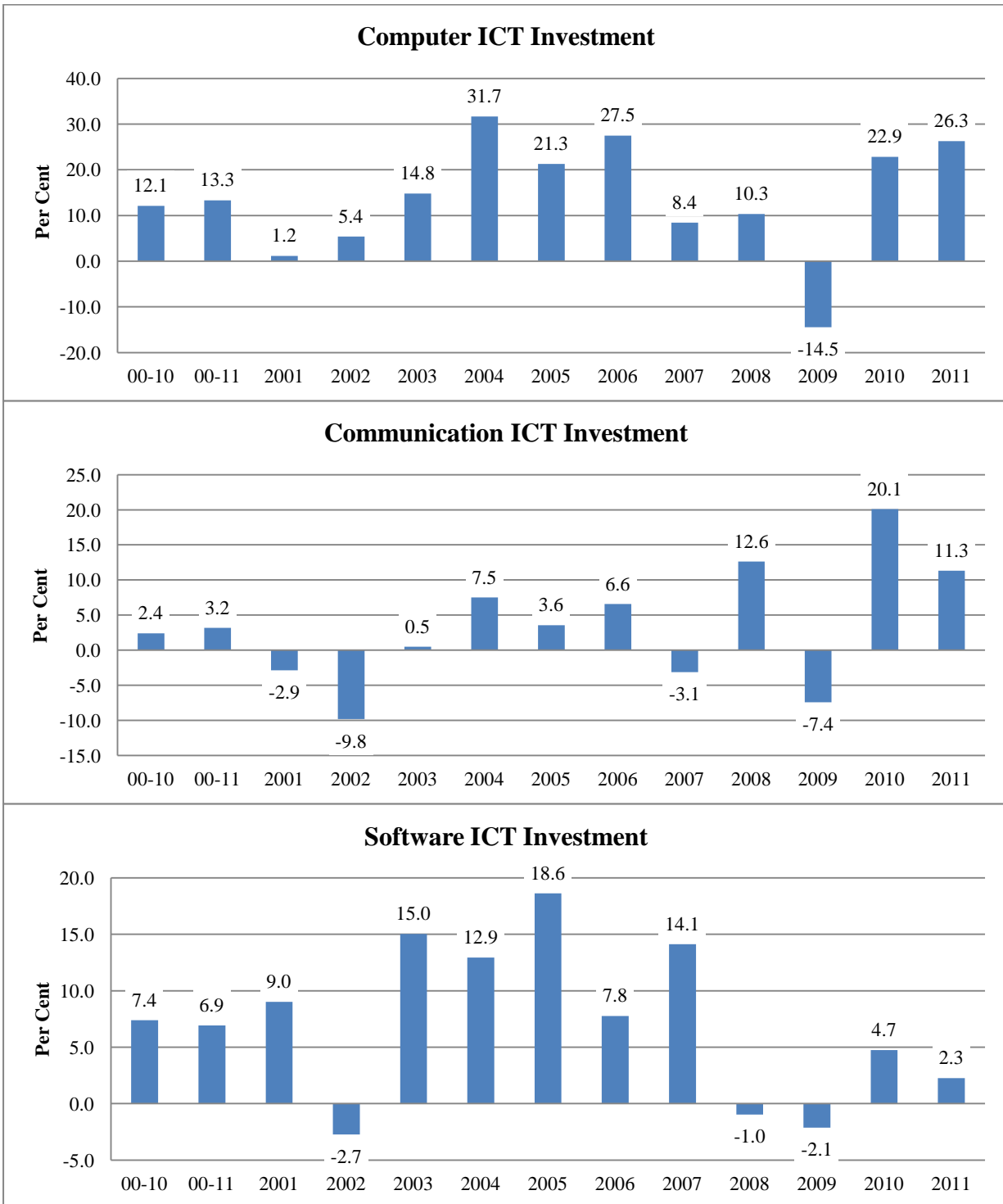
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 18: Total Economy Real ICT Investment and Total Economy Real Investment (Fixed, Non Residential), 2000-2011, 2002 Chained Dollars (Average Annual and Annual Growth Rates, per cent)



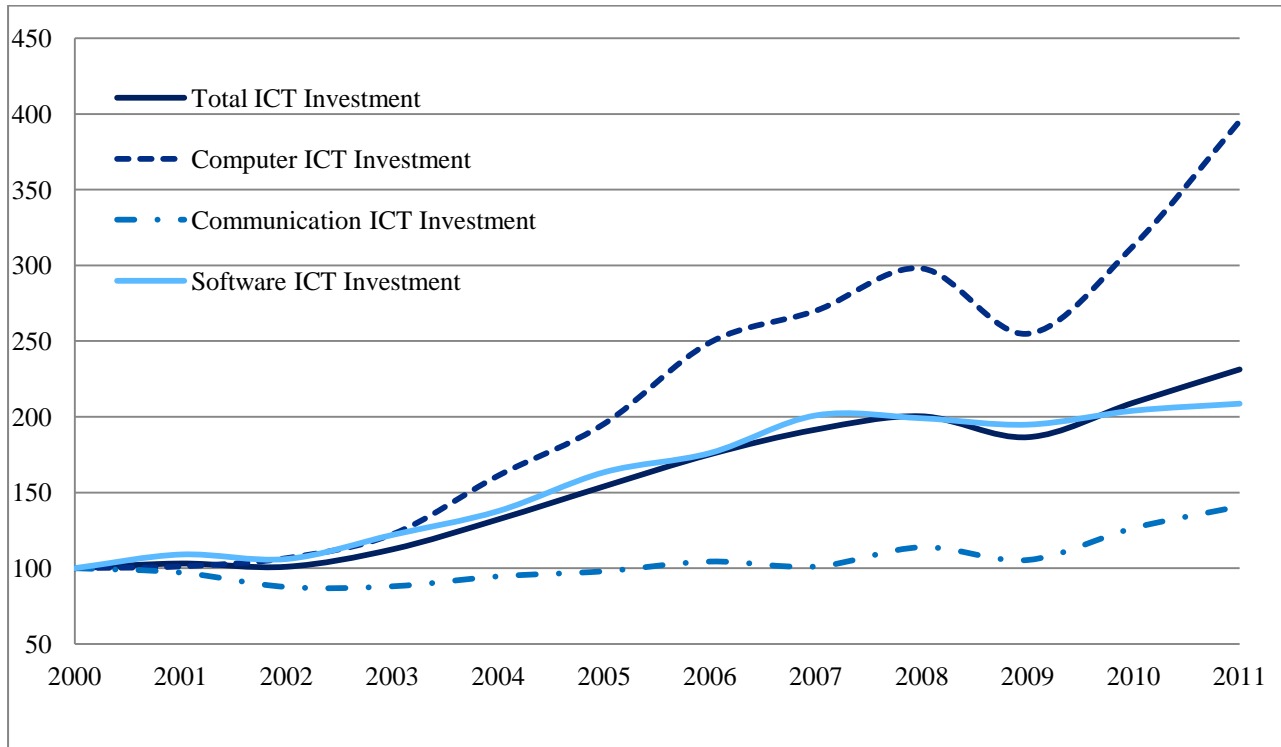
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 19: Trends in Real ICT Investment by Component, 2000-2011, 2002 Chained Dollars (Average Annual and Annual Growth Rates, per cent)



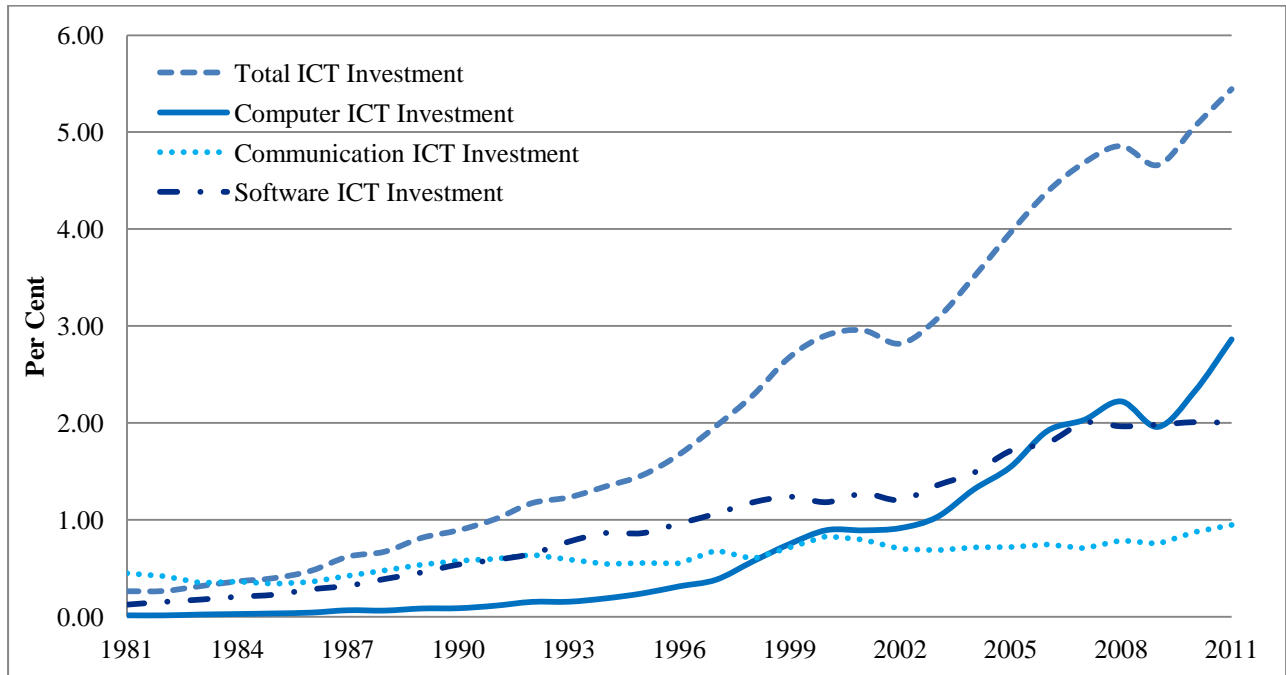
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 20: Trends in Real ICT Investment by Component, 2000-2011, Chained 2002 Dollars (Indexed to 2000=100)



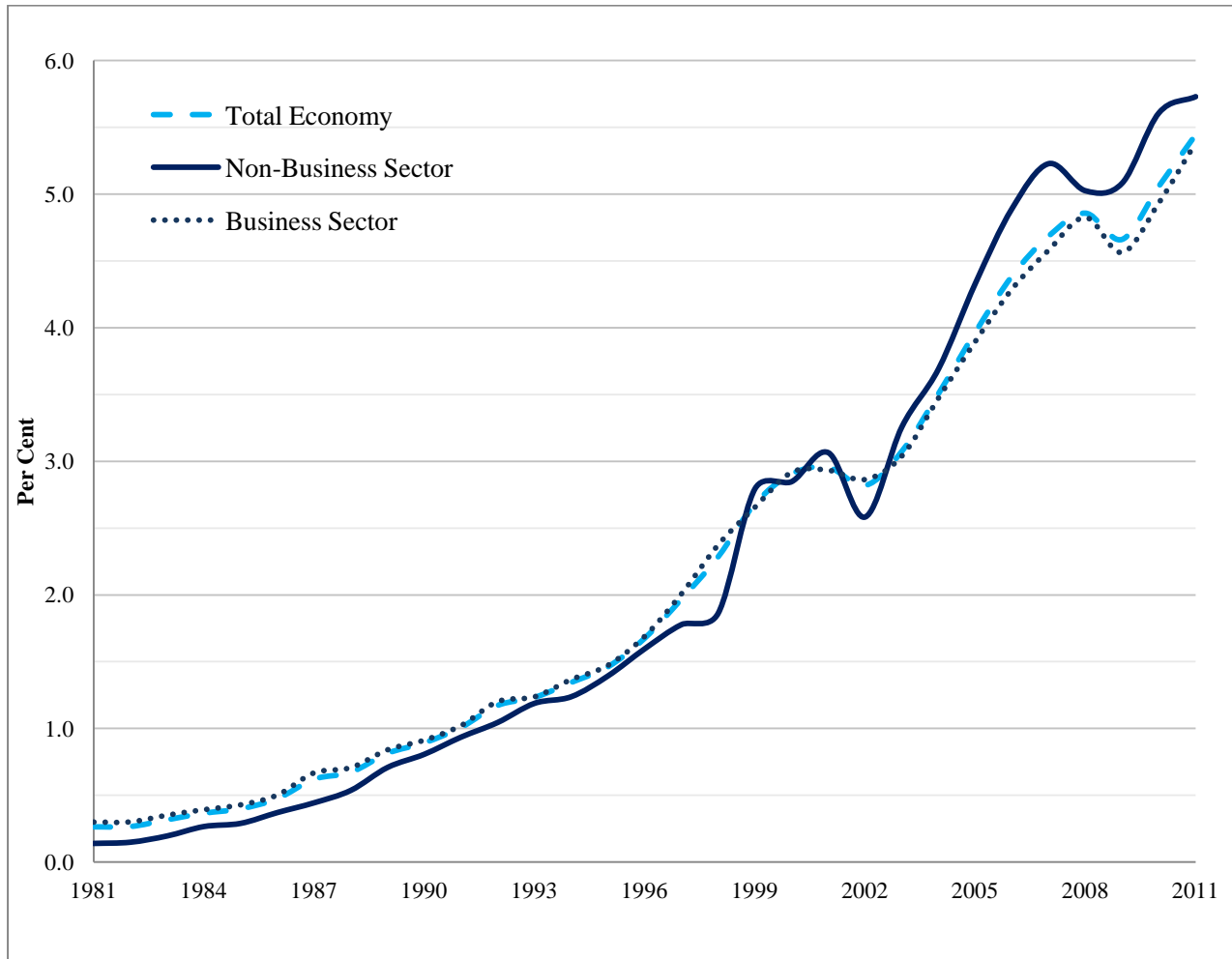
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 21: Trends in Real ICT Investment by Component as a Proportion of Real GDP, 1981-2011, Per Cent, 2002 Chained Dollars



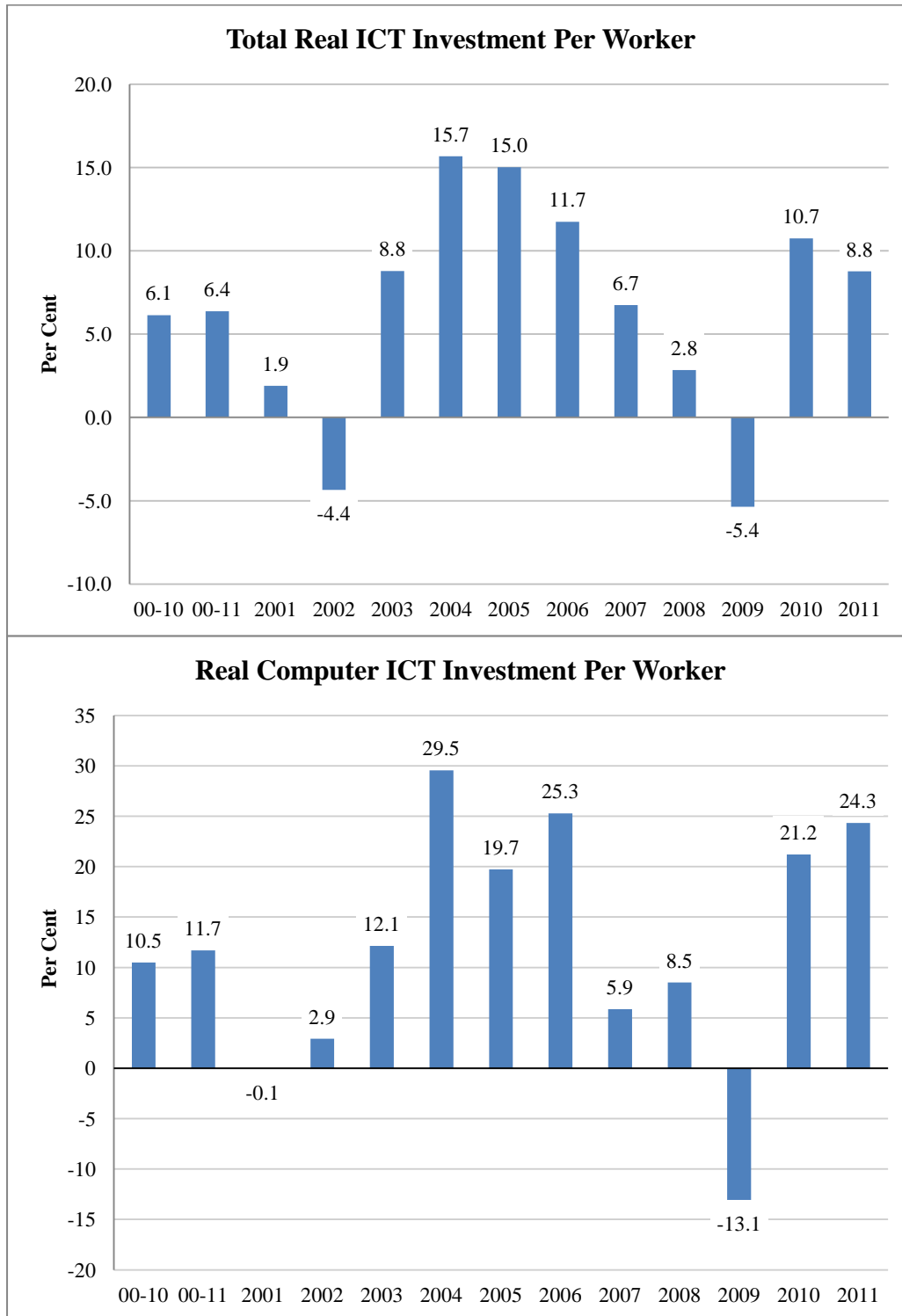
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 22: Real Total ICT Investment as a Proportion of Real GDP by Total Economy, Business Sector and Non-Business Sector, 1981-2011, Per Cent, Chained 2002 Dollars



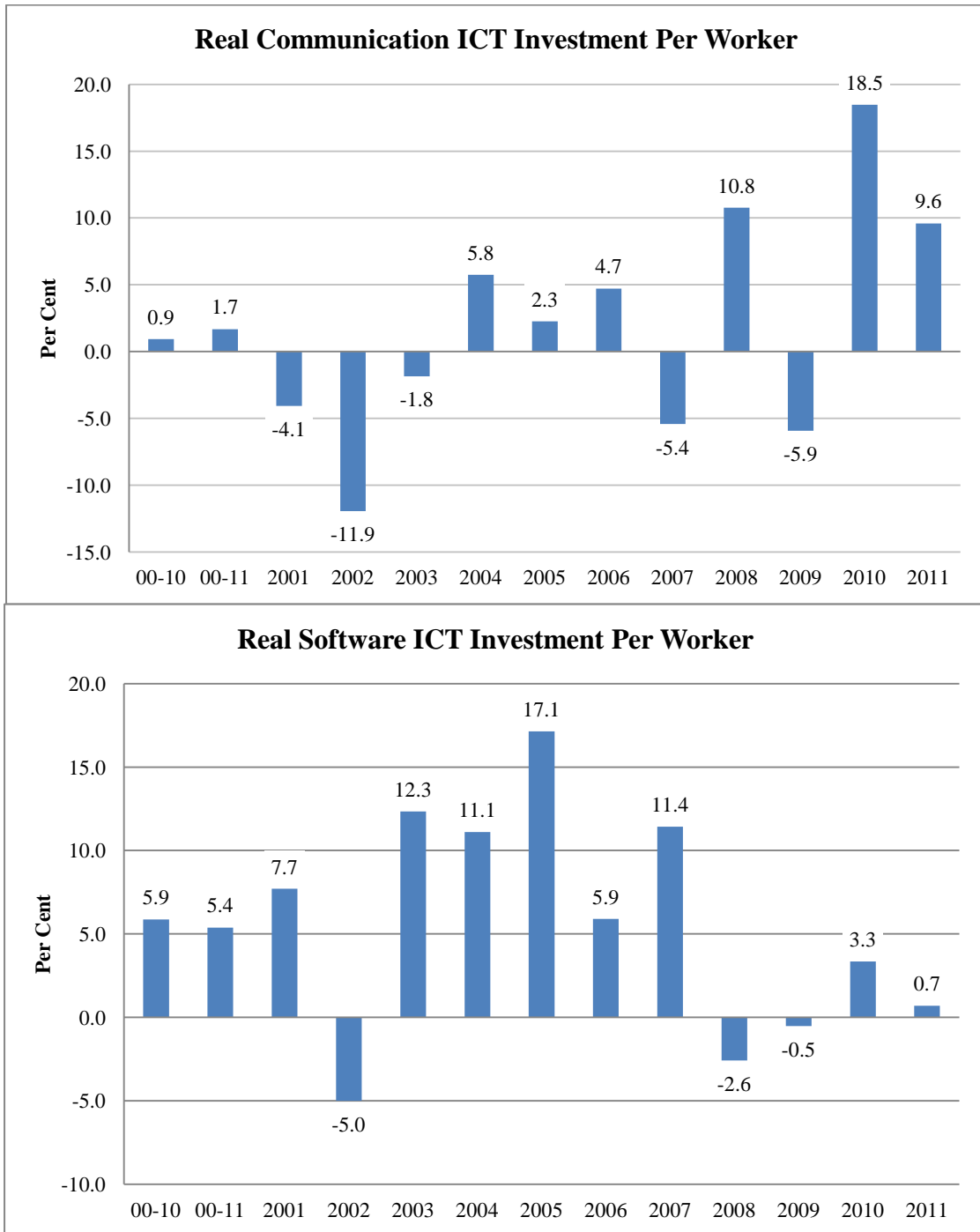
Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 23: Trends in Real ICT Investment per Worker by Component, 2000-2011, 2002 Chained Dollars (Average Annual and Annual Growth Rates, per cent)



Source: CSLS ICT Database, which was built using Statistics Canada estimates.

Chart 23 (Continued): Trends in Real ICT Investment per Worker by Component, 2000-2011, 2002 Chained Dollars (Average Annual and Annual Growth Rates, per cent)



Source: CSLS ICT Database, which was built using Statistics Canada estimates.