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Investment Intensity in Canada and the United States, 1990 to 2011

by John Baldwin, Wulong Gu and Huju Liu

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..	not available for a specific reference period
...	not applicable
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0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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John Baldwin, Wulong Gu and Huju Liu
Economic Analysis Division, Statistics Canada

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Abstract

This paper provides a comprehensive examination of investment intensity in fixed assets in Canada and the United States from 1990 through 2011 by examining nominal ratios of investment to gross domestic product (GDP), trends in the growth of the relative volume of investment and changes in relative prices, and finally, the impact of differences in industry structure in the two countries. During those two decades, investment intensity, measured by investment as a share of GDP for the total economy, followed a similar path in both countries despite differences in the economic environment in each country. Within the business sector, Canada had higher non-residential investment intensity than did the United States—especially in the period during the Great Recession. This was driven by more intensive investments in non-residential structures (buildings and engineering structures) in the Canadian business sector, especially after 2000. Canada had about the same investment intensity in machinery and equipment (M&E), but lower intensity in information and communications technology (ICT). The growth in the volume of M&E relative to the growth in output in Canada was less in the 1990s than in the United States but higher in the post-2000 period, a period when the Canada–United States exchange rate appreciated and made M&E relatively less expensive in Canada. A decomposition analysis was conducted to determine the industry sources of the Canada–United States investment difference. On average, the industry structure in Canada contributed to Canada's advantage in investments in structures. However, Canada's industry structure was less favourable to investments in ICT. After purging for differences in industrial structure, the gaps in within-industry investment intensity between Canada and the United States have declined post 2000 for the two asset types where the uncorrected averages were diverging—engineering and buildings, and ICT M&E.

Executive summary

This paper examines the investment performance of Canada and the United States, exploring similarities and differences in investments in fixed assets over the 1990-to-2011 period.

The comparison is primarily based on investment intensity, measured as the ratio of nominal dollar investment to nominal gross domestic product (GDP), but rates of growth of the volume of investment relative to the volume of GDP are also compared.

During the past 20 years, average investment intensity for the total economy was quite similar in Canada and the United States though there were periods when the individual country trajectories diverged from one another. Canada had relatively higher investment intensity in the early 1990s and more recently in the period of the Great Recession. Within the business sector, Canada had a higher intensity in nominal non-residential investments than did the United States. This reflected more intensive investment in structures (buildings, resource exploration, rail, pipelines), especially after 2000 in Canada—7% on average, compared with 4% in the United States. This was the period when the world resource boom benefited growth in Canada. By contrast, machinery and equipment (M&E) investment intensity in the two countries was similar for most of the period, averaging 10% for Canada and 11% for the United States. Within this category, both countries saw a pronounced shift to investments in information and communications technology (ICT) assets from non-ICT M&E assets. But Canada had a lower investment intensity in ICT assets—2.8% on average versus 4% for the United States, and the gap widened over time.

Underlying the movements in the investment intensities that capture the share of overall resources being devoted to investment are changes in the relative volumes of investment that are associated with changes in relative prices and differences in business cycles. During the 1990s, relative investment volume growth is more rapid in the United States in M&E—a period when relative prices favoured investment in the United States. In the period after 2000, the relative volume growth rate in Canada is greater: this corresponds to a period when movements in relative prices favoured investment in Canada, in part reflecting the sharp appreciation of the Canadian dollar after 2002 in response to the world-wide resource boom. Changes in relative investment intensities also reflected differences in business-cycle patterns in the two countries. Canadian M&E investment intensity peaked earlier at the end of the 1990s than it did in the United States and then grew more quickly post 2000.

Decomposition analyses were conducted at the industry level to determine if the difference in the level of investment intensity by asset type for the total business sector between Canada and the United States was mainly due to the difference in the industry structures of the two countries or to within-industry investment intensity differences, and how these factors contributed to changes over time in the overall Canada–United States investment intensity gap.

The ratio of Canada–United States levels of investment intensity depend on the relative level for individual industries and the relative importance of different industries in the economy—or to differences in industrial structure of the two countries. Canada's relatively larger investments in engineering structures and buildings is partially explained by its greater concentration on industries where the intensity of investment in these assets is higher—and this concentration increased over the period, which in turn was related to the world-wide resource boom. On average over the entire period, Canada's industry structure played a significant role in its higher investment intensity in engineering structures, which was largely driven by the mining and oil industry. In fact, by the end of the period, the differences in industrial structure account for almost all of the differences in the two countries in this asset class.

As well, Canada's industry structure contributed positively to differences in aggregate investment intensity in M&E in both countries—for both the ICT and non-ICT components. Differences in industry structure are increasingly responsible for differences in the aggregate ICT differences. Industries with more intensive ICT investment (finance, insurance and real estate; information; and professional services) were smaller, on average, in terms of their shares, in Canada than in the United States and grew less rapidly in Canada. Once these differences in structure are removed, differences across Canada and the United States in ICT investment have been falling.

Industry structural differences also matter for comparisons for the non-ICT component of M&E. Here industry structure is responsible for explaining much of Canada's greater investment intensity in non-ICT M&E. Indeed, once industry structure is considered, the difference disappears. But it is also clear that the difference in non-ICT M&E investment intensity, once corrections are made for industry structure, is highly sensitive to the time period chosen. The size of the within-industry disadvantage here widened considerably in the 1990s but narrowed in the post-2000 period—as changes in the Canada–United States exchange rate made investment in Canada relatively less expensive.

Canada's investment focus differs from that of the United States across asset types—investing more heavily in structures, about the same in M&E and less in ICT. The difference in performance in each of these areas has changed over time in response to structural changes in the economy and to changes in the relative prices of investment goods. After consideration of differences in industry structure, cross-country differences in industry investment intensity have declined in the period post 2000 in the case of all three assets—engineering and buildings, non-ICT and ICT M&E—a period that was associated with a resource boom and a rapidly appreciating Canadian dollar against the U.S. dollar that made imported M&E less expensive.

1 Introduction

Investment is defined as total expenditures on new assets or capital goods that are used in the production process and that last more than one year. Investment provides the source of residential housing that meets the accommodation needs of the population. Investment in machinery and equipment (M&E), buildings, and engineering structures such as rail and pipelines is also the source of physical capital for business production, and is often associated with adoption and diffusion of the latest technology. Investment is closely tied to economic growth, business innovation, and productivity.

The adequacy of M&E investment in Canada has been the subject of several studies (Baldwin and Gu 2007; Conference Board of Canada 2013; Macklem 2012; and Sharpe 2005). Investment in M&E, however, accounted for only about 40% of total non-residential investment in Canada in 2011. The other major type of investment in the business sector is structures (plants, buildings, bridges, highways, engineering facilities such as dams, pipelines, railway lines, etc), which accounted for about 60% of the total. In some cases, these structures are complementary to M&E. Assembling and production activities take place in buildings. The transportation industry needs not only trucks, trains and airplanes, but also highways, airport terminals and warehouses. In other cases, the building is an indispensable part of the product or service provided to consumers. For example, the retail industry uses stores, and the food and accommodation industry requires buildings for restaurants and hotels.

Focusing just on M&E provides only a partial assessment of the overall investment intensity in Canada. Unlike the other aforementioned studies that often just focus on investments in M&E or information and communications technology (ICT), this paper examines the performance of investments in all types of fixed assets (including both investments in M&E and structures) in Canada and the United States from 1990 to 2011. This period saw dramatic changes in the economic and technological landscape, with rapid advances in computer and communications technology, a growing oil and gas industry, the post-2000 world-wide resource boom and the associated appreciation of the Canadian dollar vis-à-vis its American counterpart, and the 2008 global financial crisis.

The paper asks whether overall investment intensity differs between Canada and the United States over this period; it examines the components (buildings, machinery and equipment) of total investment; it also asks how differences in investment intensity are affected by differences in industry composition.

Investment intensity is measured here as the ratio of nominal investment to nominal gross output (gross domestic product). The ratio captures the intensity of overall production that is devoted to investment. It is appropriate for answering questions on the nature of an economy's commitment to providing tangible long-lived assets to support production.[1] The nominal rather than the real ratio is used here because it measures resource use and production in the prices relevant to the time period in which quantities are being produced and because real ratios may not be invariant to the base year chosen for the comparison. The nominal ratio is also more precise in that the real ratio requires estimates of purchasing power relative prices (purchasing power parities [PPPs]) to convert nominal into real terms. These PPPs are generally either unavailable or not very accurate. Exchange rates can be used in their stead but are imperfect proxies for PPPs. Finally, a nominal ratio places the investment decision in the same units used to measure savings, which is the source of funds for investment.

1. Ratios of capital to labour are often used to answer other questions relating to the factors behind labour productivity. This is the topic of other studies (see Baldwin, Gu and Yan 2008)

Changes in a measure of investment intensity derived from nominal ratios can come either from changes in the volume of the underlying series or from prices. Investment intensity, when measured in nominal dollars, may remain constant but this can occur for different reasons—because the relative price of investment goods is declining and the quantity is increasing—or because both relative prices and quantities are unchanging. An examination of real or volume ratios allows the underlying forces behind changes in the nominal ratios to be isolated; doing so allows the relative change in investment quantities to be compared to the relative changes in prices in order to detect underlying relationships between the two. Since changes occurred over the period under study in the Canada–United States exchange rate and this would have influenced the relative price of imported investment goods, an investigation is conducted of the extent to which relative prices and relative volumes moved differentially.

Although Canada and the United States use similar methods to measure investment, comparability issues still remain (Baldwin et al. 2008; Sharpe 2005; Sharpe 2013).[2] For instance, Canadian investment data (both M&E and structures) are from Statistics Canada's Capital and Expenditure Survey (CAPEX), whereas U.S. data on investment in structures are obtained directly from construction industry sources. The full retail value of a new vehicle leased by the household sector is treated as personal consumption in Canada, but as a business investment in the United States. In both countries, investment in own-account software is based primarily on the labour costs of software developers, but the occupational categories used in the two countries are not the same. These measurement issues could affect the comparisons of investment intensity levels in Canada and the United States. Nonetheless, if the differences in methodology do not change very much over time; they should not affect the comparisons of trends in investment intensity in the two countries that are presented here.

Decomposition analyses at the industry level are used here to determine whether the difference in investment intensity by asset type between Canada and the United States is mainly due to the difference in the industry structures between the two countries or the within-industry intensity difference, and how their relative roles in explaining the Canada–United States investment intensity difference change over time.[3]

This study is organized as follows. Section 2 discusses the investment data for Canada and the United States, the measure of investment intensity used, and comparability issues. Section 3 compares investment intensity in the total economy between the two countries. Detailed investment intensities by asset type for the two counties are compared in Section 4. Section 5 presents decomposition analyses of the Canada–United States investment gap by asset type. Section 6 concludes.

2 Data and measurement

This section explains investment concepts and definitions, sources of investment data for Canada and the United States, the measure of investment intensity employed, and issues related to measuring investment in the two countries.

2. The comparability issue is discussed in more detail in Section 2.
3. Other factors that could contribute to Canada–United States investment differences, especially ICT investment, include differences in firm size, managerial ability and culture, and differences in relative costs of labour and capital (Baldwin et al. 2008; Sharpe 2005; and Conference Board of Canada 2013).

2.1 Investment data[4]

Investment is defined as total expenditures on new assets or capital goods that are used in the production process and that last more than one year. It excludes the purchase of financial assets or claims and the purchase of land. This study focuses on fixed investment, which excludes inventories.

Statistics Canada publishes annual data on investment in fixed assets by asset type and by detailed industry based on the North American Industry Classification System (NAICS).[5] Investment in fixed assets includes investment in residential capital (housing) and non-residential capital. Investment in non-residential capital can be disaggregated into investment in building assets, engineering assets and M&E assets, the last of which is further disaggregated into ICT-related (computers, telecommunications equipment, and software) and non-ICT-related investment. Investment in non-residential capital is available at a detailed NAICS industry level.

The U.S Bureau of Economic Analysis (BEA) also publishes investment data by asset type and by detailed industry level. However, the BEA combines investment in building and engineering as structures. To allow for consistent comparisons between the two countries, this analysis divides investment into residential and non-residential structures and non-residential M&E (ICT- and non-ICT-related).

2.2 Measure of investment intensity

Two measures of investment intensity are frequently used in the literature: investment per worker and investment as a share of gross domestic product (GDP). The former is widely used in studies of determinants of labour productivity, but international comparisons using this ratio are difficult because of a lack of price data for cross-country comparisons. Particularly, the PPP indexes needed to convert ratios of dollars of investment into ratios of the volume of investment are only available for total construction and total M&E. This creates difficulties if comparisons are made of more detailed asset types such as residential versus non-residential structures, and ICT versus non-ICT. Investment as a share of GDP captures the percentage of total output devoted to improving the productive capacity of the economy and does not need to correct for differences in price levels,[6] because both the numerator and denominator rely on domestic prices. In this study, the investment-to-GDP ratio is calculated within each country and then compared between countries.

2.3 Valuation of output

GDP estimates are generated using either or both of two different valuations—basic prices or market prices. GDP at market prices includes taxes and subsidies on the products themselves, such as sales taxes, fuel taxes, duties and taxes on imports, excise taxes on tobacco and alcohol products, and subsidies paid on agricultural commodities, transportation services and energy, etc. GDP at market prices is used here for calculating investment intensity (investment expenditure as percentage of GDP) because investment expenditure is measured at market prices.

4. Investment data by industry used in this paper for Canada and the United States were taken from Statistics Canada and Bureau of Economic Analysis web sites just before the historical revisions that took place in 2012 for Canada and 2013 for the United States.
5. These investment data are based on CAPEX and published by the Investment and Capital Stock Division (ICSD) of Statistics Canada. The data can be accessed from CANSIM, tables 030-0002 and 031-0002.
6. Sharpe (2005) calculates the Canada–United States gap in ICT investment in both measures. The gap is qualitatively significant by any measure.

Canadian and U.S. practices for reporting GDP differ. The U.S. BEA values industry output at market prices. Statistics Canada publishes GDP at market prices for the total economy, but reports industry output at basic prices. To convert Canadian industry GDP estimates using basic prices to estimates at market prices, it is assumed here that the ratio of GDP at market prices to GDP at basic prices at the industry level is the same as that for the total economy. Over the 1990-to-2008 period, Canadian GDP at market prices was 6% to 8% higher than GDP calculated at basic prices (Table 1). For each year in that period, GDP measured at basic prices is inflated to market prices using the ratios in Table 1 for each industry in scope for this analysis (NAICS 2-digit level).

Baldwin et al. (2008) derive a comparable GDP measure for the United States by converting the U.S. market-price GDP estimate to basic prices. The U.S. industry GDP shares based on market prices as used in this study are then compared with those based on basic prices derived in Baldwin et al. (2008) to determine if the valuation of GDP has an impact on estimates of industry shares, which are used in our decomposition analysis. The U.S. industry composition was largely similar when valued at market prices or basic prices. The largest differences (only 2% to 3%) occurred for wholesale, retail, and finance, insurance, real estate and rental and leasing industries. The U.S. industry GDP shares based on basic prices and market prices were very similar for the oil industry—an industry whose growth impacts primarily on the comparisons of investments in structures.[7]

7. See Subsection 5.3 for the results of decomposition analysis in detail.

Table 1
Total GDP, market price and basic price, Canada, 1990 to 2008

Year	Total GDP (market price)	Total GDP (basic price)	Column 1 divided by column 2
	Column 1	Column 2	Column 3
	millions of current dollars		ratio
1990	679,921	631,404	1.08
1991	685,367	636,082	1.08
1992	700,480	649,097	1.08
1993	727,184	672,835	1.08
1994	770,873	714,151	1.08
1995	810,426	750,663	1.08
1996	836,864	775,817	1.08
1997	882,733	816,755	1.08
1998	914,973	846,533	1.08
1999	982,441	909,691	1.08
2000	1,076,577	999,929	1.08
2001	1,108,048	1,032,172	1.07
2002	1,152,905	1,068,767	1.08
2003	1,213,175	1,128,797	1.07
2004	1,290,906	1,201,308	1.07
2005	1,373,845	1,280,547	1.07
2006	1,450,405	1,354,356	1.07
2007	1,529,589	1,430,771	1.07
2008	1,603,418	1,509,227	1.06

Note: GDP stands for "gross domestic product."

Sources: Statistics Canada, CANSIM tables 380-0016 and 379-0023.

2.4 Comparability issues relating to the measurement of investment

Although Canada and the United States use fundamentally the same methodology for collecting and deriving investment data, a number of differences exist.

First, Canada's investment data for buildings and structures are derived from a survey of firms' acquisition of assets, whereas U.S. data are mainly private-sector construction data that are collected at aggregate levels. Although investments are defined as expenditures made to acquire new assets in both countries, it may be difficult in Canada for a respondent firm to distinguish between a newly constructed asset (which are captured directly in the United States) and newly acquired assets that may include used assets. The Canadian survey data may include purchased used assets in the building estimate, and thereby generate higher building investment intensity than the United States.

Second, the treatment of new vehicles leased by the household sector differs in Canada and the United States. The full retail value of a new vehicle leased by the household sector is treated as personal consumption expenditure by Statistics Canada. The BEA records it as a business investment because vehicles are purchased from the dealer by a financial firm, although the down payment along with lease payments also appear in personal consumption expenditures. This would bias Canadian M&E investment intensity downward relative to the United States—by about 1 percentage point.[8]

Third, estimates of investment in own-account software in Canada and the United States are based primarily on the labour costs of software developers. However, the categorization of software developers differs—some occupations that the United States considers to be programmers are classified in non-programmer occupation categories in Canada. This may create a downward bias in the Canadian estimate relative to the United States. No correction for this difference is made here.

Fourth, investment data for Canada and the United States are not perfectly comparable at the industry level. Statistics Canada uses CAPEX (demand-side methodology) to measure investment by industry of ownership of the capital. Historically, the BEA used indirect supply-side methodology based on the occupational distribution of employment to allocate total investments to industry levels (Becker et al. 2006). Since 1993, the U.S. Census Bureau has collected capital stock and expenditures data on an economy-wide basis with a firm-level survey, the Annual Capital and Expenditure Survey (ACES). However, ACES collects data on capital expenditures by detailed asset class only every five years.

Differences stemming from these comparability issues may be reflected in the Canada–United States investment differences reported here. However, they are not expected to influence the analysis of trends over time, which is the primary focus of this study.

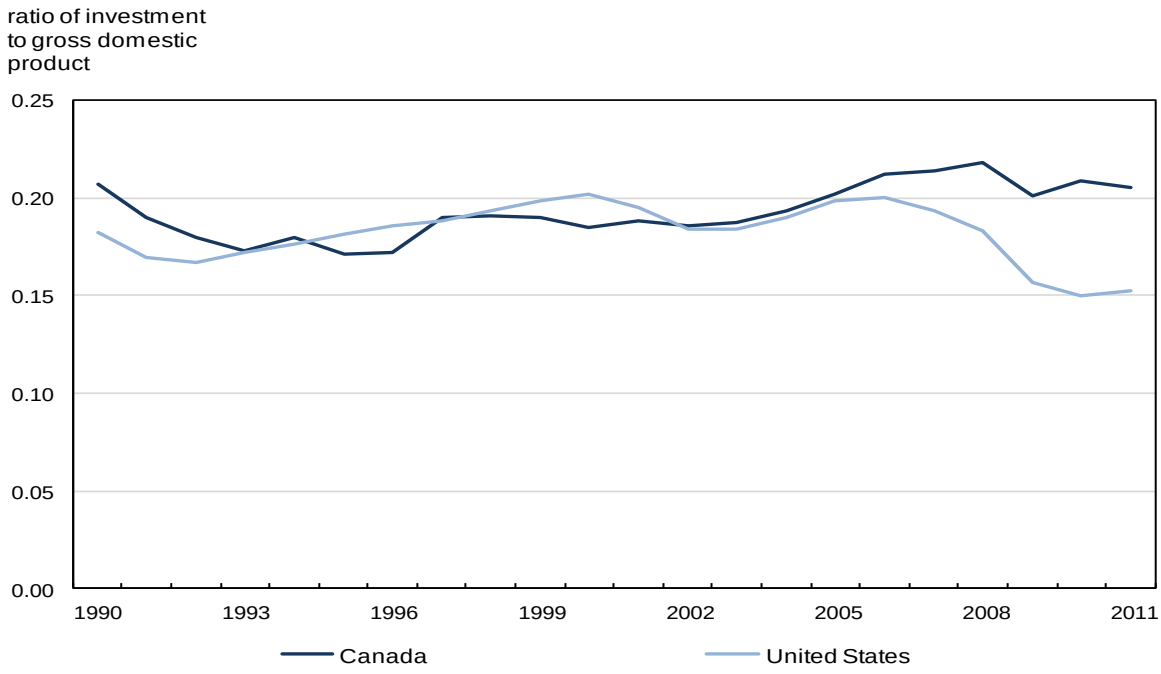
8. The value of leased new motor vehicles by households in Canada is large. It accounts for about 60% of total value of business investments in new motor vehicles on average from 1995 to 2012. Adding the total value of leased vehicles by households to the business investments in M&E in Canada roughly increases the nominal investment intensity by 1 percentage point. This increase is quite constant over time.

3 Trends in total investment intensity

This section examines trends in total investment intensity (residential and non-residential) in Canada and the United States from 1990 to 2011. This period covers the recession of the early 1990s, the decadal adjustment of the 1990s to free trade with the United States, the downturn in the early 2000 period that is felt more severely in the United States than in Canada, the world-wide resource boom of the post-2000 period that benefited the Canadian economy and the Great Recession late in the decade that also coincided with a collapse in U.S. real estate prices.

Despite differences in how the two economies responded to these events, over the past 20 years, total investment as a share of GDP in all asset types for the entire economy was similar in Canada and the United States (Chart 1 and Table 2). In 1990, Canada's total investment intensity was slightly higher than that of the United States—20% versus 18% of GDP. During the recession in the early 1990s, investment intensity declined in both countries, though more steeply in Canada, leaving Canada slightly behind the United States in 1995 (17% versus 18%). The late 1990s saw increases in both countries to 19% in 2001. After 2002, investment intensity in Canada increased while it decreased in the United States. Investment intensity in Canada surpassed that of the United States by 2006.

Chart 1
Total investment intensity (current dollars), Canada and the United States, 1990 to 2011



Note: Authors' calculations.

Sources: Statistics Canada, CANSIM tables 030-0002, 031-0002 and 379-0023; and U.S. Bureau of Economic Analysis, "Table 1.1.5. Gross Domestic Product," "Table 5.8.5. Gross Government Fixed Investment by Type," and "Table 5.3.5. Private Fixed Investment by Type."

Table 2
Non-residential and residential investment intensity (nominal), Canada and the United States, 1990 to 2011

Year	Total investments		Non-residential investments		Residential investments	
	Canada	United States	Canada	United States	Canada	United States
			ratio[1]			
1990	0.21	0.18	0.15	0.14	0.05	0.04
1991	0.19	0.17	0.14	0.13	0.05	0.04
1992	0.18	0.17	0.13	0.13	0.05	0.04
1993	0.17	0.17	0.13	0.13	0.05	0.04
1994	0.18	0.18	0.13	0.13	0.05	0.04
1995	0.17	0.18	0.13	0.14	0.04	0.04
1996	0.17	0.19	0.13	0.14	0.04	0.04
1997	0.19	0.19	0.15	0.14	0.04	0.04
1998	0.19	0.19	0.15	0.15	0.04	0.04
1999	0.19	0.20	0.15	0.15	0.04	0.05
2000	0.18	0.20	0.15	0.16	0.04	0.05
2001	0.19	0.19	0.15	0.15	0.04	0.05
2002	0.19	0.18	0.14	0.14	0.05	0.05
2003	0.19	0.18	0.14	0.13	0.05	0.05
2004	0.19	0.19	0.14	0.13	0.05	0.06
2005	0.20	0.20	0.15	0.14	0.05	0.06
2006	0.21	0.20	0.16	0.14	0.06	0.06
2007	0.21	0.19	0.16	0.15	0.06	0.05
2008	0.22	0.18	0.16	0.15	0.06	0.03
2009	0.20	0.16	0.15	0.13	0.05	0.03
2010	0.21	0.15	0.15	0.13	0.06	0.02
2011	0.20	0.15	0.15	0.13	0.06	0.02

1. Ratio of investment to gross domestic product.

Note: Authors' calculations.

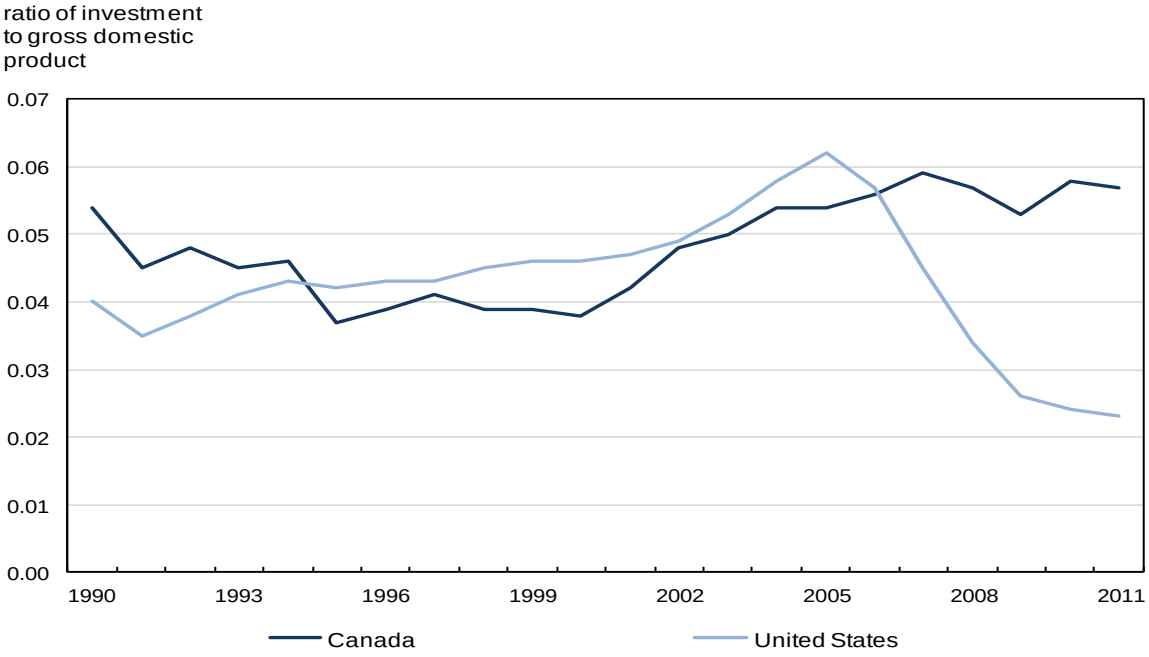
Sources: Statistics Canada, CANSIM tables 030-0002, 031-0002 and 379-0023; and U.S. Bureau of Economic Analysis, "Table 1.1.5. Gross Domestic Product," "Table 5.8.5. Gross Government Fixed Investment by Type," and "Table 5.3.5. Private Fixed Investment by Type."

After 2006, investment intensity increased in Canada until 2008, but declined in the United States. Both countries experienced a sharp drop in investment intensity after the 2008 global financial crisis. However, Canada's recovery was stronger, with the level of investment intensity in 2011 returning to 97% of the pre-2008 level (2006). By contrast, total investment intensity in 2011 in the United States did not regain its pre-2008 level. In 2011, investment intensity was 20% in Canada and only 15% in the United States.

Total investments consist of residential investments (single- and multiple-dwelling structures) and non-residential investments. In the early 1990s, Canadian residential investment intensity slightly exceeded that of the United States (Chart 2 and Table 2). Thereafter, residential investment in the United States rose until it reached a peak of 6% in 2005 and then dropped to 2% as a result of the U.S. housing price collapse during the Great Recession. In 2011, residential investment intensity in the United States was only half the level of 20 years earlier.

Canada's residential investment intensity lagged behind that of the United States in the 1990s, but continued to increase slowly after 2000, moving ahead of the United States as of 2007, and maintained a level around 6%. By 2011, the Canadian level was almost 3 times that of the United States.

Chart 2
Residential investment intensity (current dollars), Canada and the United States, 1990 to 2011

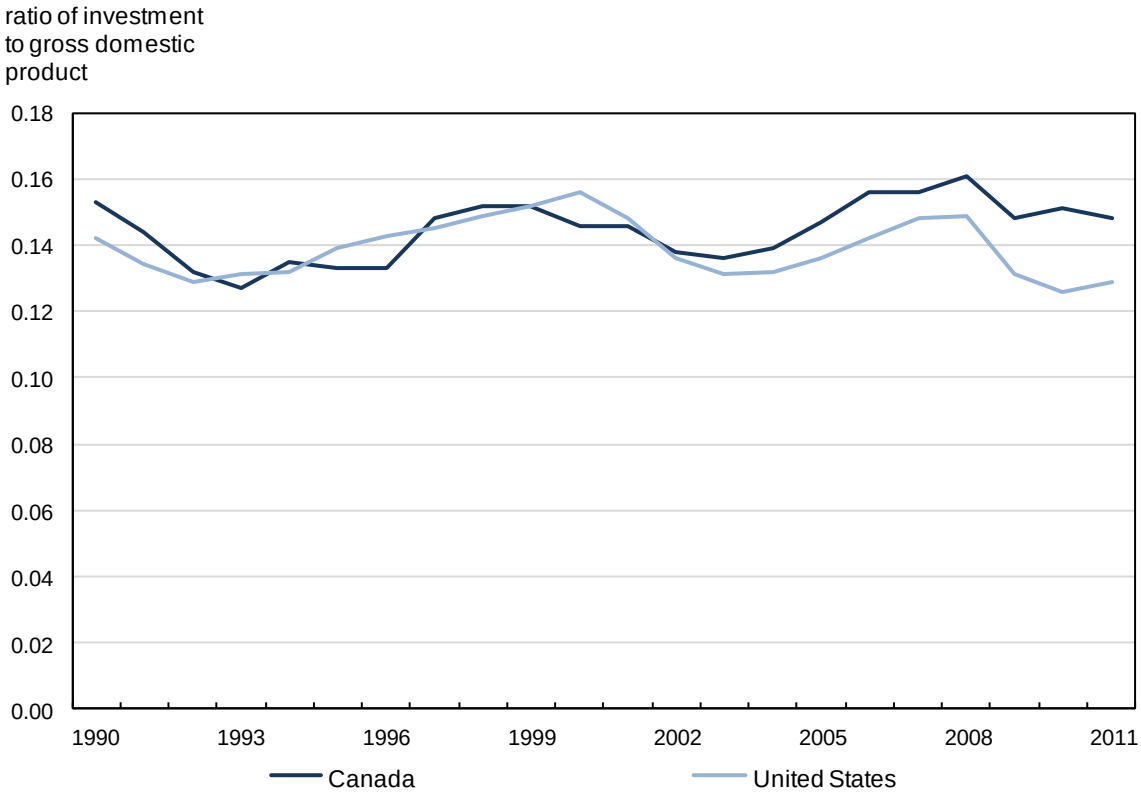


Note: Authors' calculations.
Sources: Statistics Canada, CANSIM tables 030-0902 and 379-0023; and U.S. Bureau of Economic Analysis, "Table 1.1.5. Gross Domestic product," "Table 5.8.5. Gross Government Fixed Investment by Type," and "Table 5.3.5. Private Fixed Investment by type."

Before 2002, Canada's ratio of non-residential investment to GDP was similar to that of the United States, with both countries maintaining levels of 13% to 15%; thereafter, Canada slightly outpaced the United States (Chart 3 and Table 2), moving about 1 percentage point above the United States during the middle part of the decade to 2 percentage points above the United States by the end of the decade during the Great Recession. Because non-residential investment constitutes the bulk of total investment, trends in non-residential investment in the two countries during the past 20 years were similar to those of total investment (Chart 1).[9]

9. The catch-up of Canadian investment in non-residential capital relative to the United States after 2000 is mainly attributable to Alberta, Saskatchewan, and Newfoundland and Labrador, which benefited from booming prices for fuel and non-fuel minerals (Bloskie et al. 2013; and Busby and Robson 2011).

Chart 3
Non-residential investment intensity (current dollars), Canada and the United States, 1990 to 2011



Note: Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0002 and 379-0023; and U.S. Bureau of Economic Analysis, "Table 1.1.5. Gross Domestic Product," "Table 5.8.5. Gross Government Fixed Investment by Type," and "Table 5.3.5. Private Fixed Investment by Type."

4 Trends in business sector non-residential investment intensity

Investments can be disaggregated by asset type into investments in structures (buildings, roads, bridges, etc.) and M&E (ICT and non-ICT). The similarity of trends in total investment intensity in Canada and the United States outlined in the previous section may not necessarily hold for each asset type. This section compares investment intensity in the Canadian and U.S. business sectors by asset type and by industry. Business sector non-residential investment is a major driver of economic growth and accounts for a large share of all investment, averaging 61% in Canada and 63% in the United States during the past 20 years.[10]

10. Residential investment consists mainly of a single asset type (structures) and is concentrated in a few industries (real estate and rental and leasing).

4.1 Definition of business sector

For this analysis, the business sector includes all industries except educational services, health care and social assistance, and public administration (NAICS 61, 62 and 91, respectively). It is often argued that the education and health sectors in Canada and the United States are not comparable. Most education and health services in Canada are provided by government, and so are classified as non-business activity. By contrast, in the United States, private and non-profit schools and hospitals are more common, and account for a much larger share of business activity. To correct for this intercountry difference, this study groups education and health with public administration for each country, and excludes them from the business sector.

Nonetheless, coverage of business sector industries is not completely the same. In Canada, the output and investment of government enterprises are included in the business sector. However, in the United States, the output of government enterprises is included in the output of the business sector, but investment by government enterprises is part of government investment. This should not greatly influence the conclusions derived here, because the investment and output shares of U.S. government enterprises are both fairly small.[11]

Because this section focuses on business non-residential investment, rents based on residential-related economic activity are excluded from estimates of business sector GDP for both Canada and the United States in the finance, insurance, real estate and rental and leasing (FIRE) sector. Both paid rents and imputed rents for owner-occupied housing are excluded from the analysis.

4.2 Business sector investment intensity, by asset type

Charts 4 and 5 and Table 3 present the ratios of non-residential investment by asset type to business-sector GDP in Canada and the United States over the 1990-to-2008 period.[12] Investment intensity trends in both structure and M&E assets were broadly similar in the two countries, even though levels differed.

11. In 2011, the investment of U.S. government enterprises accounted for about 6% of total business sector non-residential investment, and the GDP of U.S. government enterprises accounted for about 1% of total GDP in the U.S. business sector.
12. Because the historical revision of the Canadian System of National Accounts in 2012 only went back to 2009, GDP figures at the industry level data before and after 2009 are not fully comparable. Therefore, the analysis in this paper is restricted to the years before the 2009 revision.

Table 3
Business sector non-residential investment intensity (nominal), by asset type, Canada and the United States, 1990 to 2008

Year	Investments in structure		M&E investments		ICT investments		Non-ICT investment	
	Canada	United States	Canada	United States	Canada	United States	Canada	United States
	ratio[1]							
1990	0.08	0.05	0.10	0.09	0.02	0.03	0.08	0.06
1991	0.08	0.04	0.09	0.09	0.02	0.03	0.07	0.06
1992	0.06	0.03	0.09	0.09	0.03	0.03	0.07	0.06
1993	0.06	0.03	0.09	0.10	0.03	0.03	0.06	0.06
1994	0.07	0.03	0.09	0.10	0.03	0.03	0.07	0.07
1995	0.06	0.04	0.09	0.11	0.03	0.04	0.07	0.07
1996	0.06	0.04	0.09	0.11	0.03	0.04	0.07	0.07
1997	0.07	0.04	0.11	0.11	0.03	0.04	0.08	0.07
1998	0.07	0.04	0.11	0.12	0.03	0.05	0.08	0.07
1999	0.07	0.04	0.11	0.12	0.03	0.05	0.08	0.07
2000	0.06	0.04	0.11	0.13	0.03	0.06	0.07	0.07
2001	0.06	0.04	0.10	0.12	0.03	0.05	0.07	0.06
2002	0.06	0.03	0.10	0.10	0.03	0.04	0.07	0.06
2003	0.06	0.03	0.09	0.10	0.03	0.04	0.06	0.06
2004	0.07	0.03	0.09	0.10	0.03	0.04	0.06	0.06
2005	0.07	0.04	0.09	0.10	0.03	0.04	0.06	0.06
2006	0.08	0.04	0.09	0.10	0.03	0.04	0.07	0.06
2007	0.08	0.05	0.09	0.10	0.03	0.04	0.06	0.06
2008	0.09	0.05	0.09	0.10	0.03	0.04	0.06	0.06

1. Ratio of investment to gross domestic product.

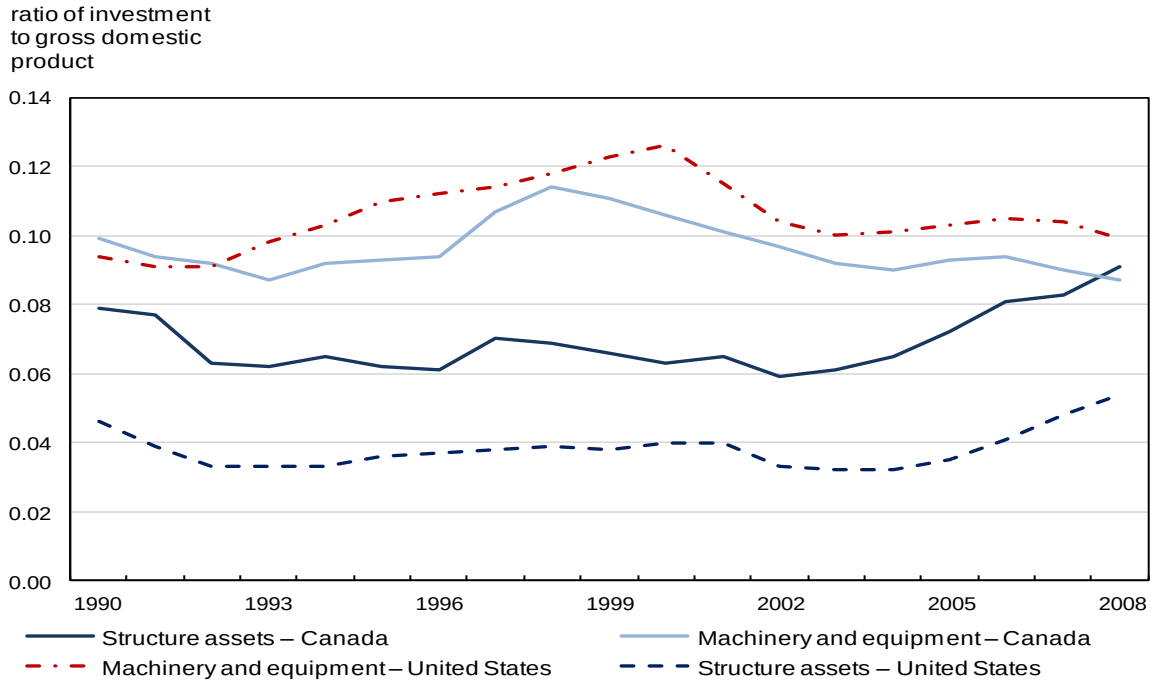
Notes: M&E stands for "machinery and equipment"; ICT stands for "information and communications technology." Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Over the 1990-to-2008 period, business sector investment intensity in structures averaged around 7% in Canada, compared with about 4% in the United States (Chart 4). The gap persisted over the entire period, and fluctuations in the two countries were broadly similar—the intensity of investment in structures declined in the early 1990s during the downturn; remained flat until the early 2000s; and then rose, although the increase in the latter period was greater in Canada during the resource boom. In 2008, investment in structures accounted for 50% of non-residential business sector investment in Canada, compared with only 35% in the United States. The more rapid increase in Canada during the latter part of the period stemmed partly from rapid growth of the mining and oil industries, which accounted for about half of all post-2000 investments on structures.

M&E investment intensity averaged 10% for Canada and 11% for the United States over the period. M&E intensity grew in Canada and the United States,[13] reaching a peak in the late 1990s and early 2000s in each of the two countries, respectively. This growth was more rapid in the United States than in Canada. The onset of the slowdown post 2000 was accompanied by a decline in both countries that was greater in the United States. By 2008, M&E investment intensity was close to the levels of the early 1990s.

Chart 4
Business sector non-residential investment intensity (current dollars), by asset type, Canada and the United States, 1990 to 2008



Note: Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

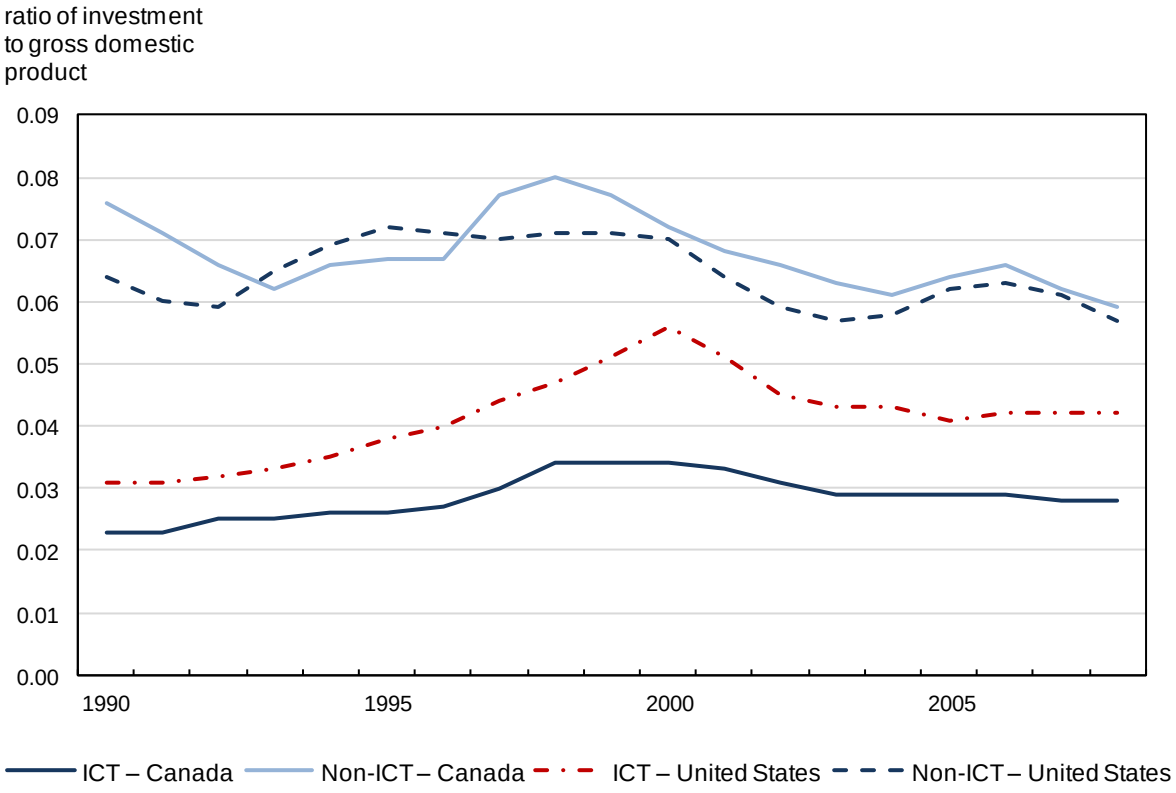
In both counties, investment intensity in M&E was generally higher than investment intensity in structures. However, the difference was much smaller in Canada than in the United States, especially after 2000. Despite the appreciation of the Canada–United States exchange rate that made imported machinery less expensive, this occurred because of the decline in manufacturing industries in Canada that accompanied this exchange rate appreciation. At the same time, investments in structures increased in Canada because of the booming mining and oil industries resulting from the world-wide resource boom. In fact, investments in structures overtook investments in M&E in Canada in 2008 as excess capacity in the manufacturing sector led to a decline in this sector's importance. By contrast, in the United States, the difference between investments in M&E and investments in structures was relatively constant.

Investments in M&E consist of investments in ICT-related and non-ICT-related assets. Canada had lower ICT investment intensity than did the United States throughout the period—2.8% of GDP, on average, compared with 4% in the United States (Chart 5). Both countries saw their ICT investment intensity increase during the 1990s and peak just after 2000 at the end of high-tech bubble. The subsequent economic slowdown and decline in the technology sector reduced ICT investment intensity in both countries.

13. The difference between the two countries is almost entirely due to the difference in treatment of automobiles.

The Canada–United States ICT investment gap was persistent and widened over the past 20 years.[14] As a percentage of the U.S. level, ICT investment intensity in Canada fell from about 76% in the early 1990s to a low of 60% in 2000. After 2000, the figure averaged around 67%.

Chart 5
Business sector M&E investment intensity (current dollars), by asset type, Canada and the United States, 1990 to 2008



Note: M&E stands for "machinery and equipment"; ICT stands for "information and communications technology." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Non-ICT investment intensity in Canada and the United States was much more similar over the period, averaging 7% and 6% of GDP, respectively (Chart 5). Both countries experienced a decline in the early 1990s, followed by an increase, and then another decline after 2000. In Canada, the increase in non-ICT investment from 1996 to the early years after 2000 was likely driven by depreciation of the Canadian dollar and greater integration of the manufacturing sector within the North American economy as a result of the implementation of the North American Free Trade Agreement (NAFTA).

Over the last 20 years, both countries saw a shift from non-ICT to ICT investments. The gaps between non-ICT and ICT investment intensity narrowed in both countries.

In summary, Canada was characterized by relatively higher total non-residential investment intensity than the United States over the 1990-to-2008 period. This was primarily driven by much higher investment intensity in structures. However, Canada had slightly lower investment intensity in M&E, though most of this difference was driven by the different treatment of

14. The widening ICT investment gap between Canada and the United States is documented in Baldwin et al. (2008), Sharpe (2005), and Sharpe and Andrews (2012).

automobiles. Canada had a higher ratio of non-ICT investment but a lower intensity of ICT-related assets than did the United States.

The current dollar investment ratios provide measures of the intensity of overall resource commitment to investment—but since they are calculated in nominal prices, they do not reveal whether part of the adjustment that takes place over time in the nominal ratios comes from changes in relative prices or outputs. In order to further investigate the underlying drivers of changes in the intensity measures presented previously, the ratio of the indices of the growth in real investment divided by the indices of growth in real GDP[15] was also computed for business sector non-residential investments for both Canada and the United States (see Appendix). Charts 11 to 14 in the Appendix provide a comparison of the extent to which volume estimates of investment and overall output grew differentially over time in the two countries and is based to 100 in 2002. Trends in the relative price ratios are also graphed in Charts 15 to 18 in order to provide information on whether changes in relative quantities were related to changes in relative prices.

The relative growth in the volume of investment in structures compared to the volume estimates of GDP in the two countries track one another very closely in the 1990s but diverge during the post-2002 Canadian resource boom. In both countries, the growth in investments in structures is below that for overall output. The relative price ratios also track one another in the 1990s and show an increase at the same time as the quantity increases are declining. In the post-2000 period, increases in the rate of growth of structures develop with the Canadian ratio turning upwards earlier than its U.S. counterpart. The relative price in the United States increases faster than it does in Canada later in period when the growth in U.S. investment intensity begins to lag that of Canada.

The relative growth in investment intensities in total M&E and in ICT-type M&E in both countries when measured as real ratios trended up over time. The volume of these investments was increasing more rapidly than overall output of all goods and services in the business sector. The increase was greater for the United States in the 1990s, but was higher for Canada post 2002. This change in the position of the two countries accorded with the movement in relative prices. The relative prices of total M&E to all goods fell over the period—but more so for the United States prior to 2002 than for Canada, while the reverse occurred after 2002 when the Canadian dollar appreciated relative to the United States, making imported M&E relative less expensive in Canada. Relative intensity changes, when measured in volume terms, were inversely relative to changes in the movements of relative prices of investment as opposed to all goods for total M&E.

The relative-volume ICT component of M&E follows the same trajectory as overall M&E and is responsible for the trend in total M&E. The increase in ICT intensity was driven by higher growth rates in ICT than overall output growth in both countries. The growth in the relative indices is quite substantial. The ratio of ICT to GDP grows equally rapidly in both Canada and the United States in the 1990s but more quickly in Canada post 2002. Once again, this pattern is the inverse of the changes in the relative price ratios. These broad differences in relative quantities of ICT investment reflected differences in the movement of relative prices of ICT investment goods versus all goods in the two countries.

For non-ICT M&E, Canadian relative volume indices trend downward over the 1990s but then reversed in the post-2002 period. This was accompanied by an increase in relative prices of non-ICT M&E investment to all prices in the 1990s but a decline after 2002 when the Canadian dollar appreciated vis-à-vis the U.S. dollar making imported equipment less expensive. In the United States, there is less of a trend in both relative volume and in relative price movements.

15. The indices are calculated using the base year 2002.

In summary, the broad trends revealed by the current dollar ratios were the result of underlying changes in volumes and prices. Increases in M&E intensity measures derived in current dollars resulted both from increasing relative volumes and by declining relative prices. The relative constancy in the structures current dollar intensity are the result of two opposing forces—a slow decline in the 1990s in the relative real growth of investment compared to GDP and a slow increase in the relative prices of structures compared to that of GDP. Post 2000, structures increase in both nominal and real terms as the resource economy begins to affect both countries. The increase in the relative structures price after 2000 along with the relative growth in the volume of structures together creates the upward increase in the nominal share of investment in structure assets. The relative volume changes are greatest for ICT assets. These are accompanied by large declines in the relative prices of these assets. Together, these dramatic differences (decreases in relative prices and increases in relative volumes) translate into increases of about 1 or 2 percentage points in the current dollar investment intensity of this asset (Table 3). For the non-ICT M&E component, the upward movement in Canada in the late 1990s was the product of declining volumes but increasing prices. The decline after 2000 was the result of the reverse as relative prices reversed direction after the Canada–United States exchange rate began to appreciate.

The next section examines another factor underlying changes in the intensity of investment—that of differences in industry structure and changes therein. Decomposition analyses of current dollar investment intensity at more detailed industry levels are used to examine the contribution of differences in industrial structure to the Canada–United States gaps in investment intensity at the aggregate level. Aggregate levels of investment intensity depend on the level of investment intensity in individual industries and the relative importance of different industries. Therefore, differences in industrial structure may affect differences in aggregate investment intensity. Using aggregate measures to assess the underlying strength or capabilities of the economy with regards to the resources devoted to investment is inappropriate if Canada simply specializes in a different set of industries than the United States and those industries are less investment intensive.

5 Decomposition of the investment intensity difference between Canada and the United States

This section presents a set of decomposition analyses for differences in Canada–United States investment intensities by asset type and over time.

5.1 Methodology

The Canada–United States investment intensity difference for a given type of asset can be expressed as

$$\ln(I^m / Y)^c - \ln(I^m / Y)^u = \ln(I^{m,c} / I^{m,u}) - \ln(Y^c / Y^u), \quad (1)$$

where I^m is the nominal investment for asset type m (total, structure, ICT-related M&E, or non-ICT-related M&E); Y is the nominal business sector GDP; and c, u are country indexes for Canada and the United States, respectively. The log difference in Canada–United States investment intensity is calculated as the log difference in investment minus the log difference in output between the two countries. The log difference in investment between Canada and the United States for asset type m and the log difference in output between Canada and the United States can be expressed as

$$\ln(I^{m,c} / I^{m,u}) = \sum_j \overline{v}_j^m \ln(I_j^{m,c} / I_j^{m,u}), \tag{2}$$

$$\ln(Y^c / Y^u) = \sum_j \overline{s}_j \ln(Y_j^c / Y_j^u), \tag{3}$$

where

$$v_j^{m,i} = \frac{I_j^{m,i}}{\sum_j I_j^{m,i}}; s_j^i = \frac{Y_j^i}{\sum_j Y_j^i}, i = c, u$$

$$\overline{v}_j^m = \frac{v_j^{m,c} + v_j^{m,u}}{2}; \overline{s}_j = \frac{s_j^c + s_j^u}{2}, \qquad j,$$

And $v_j^{m,i}$ is the investment share of industry j for asset type m and country i (Canada or the United States); $\overline{v}_j^m$ is the average investment share of industry j for asset type m between Canada and the United States; $I_j^{m,i}$ is the investment of type m for country i and industry j; Y_j^i is the GDP for industry and country i; s_j^i is the GDP share of industry j in country i (Canada and the United States); and $\overline{s}_j$ is the average GDP share of industry j between Canada and the United States.

Combining Equations (1), (2) and (3), Canada–United States investment intensity differences can be decomposed into the contributions of individual industries.

$$\begin{aligned} \ln(I^m / Y)^c - \ln(I^m / Y)^u &= \sum_j \overline{v}_j^m \ln(I_j^{m,c} / I_j^{m,u}) - \sum_j \overline{s}_j \ln(Y_j^c / Y_j^u) \\ &= \sum_j \frac{1}{2}(\overline{v}_j^m + \overline{s}_j)\left(\ln\left(\frac{I_j^{m,c}}{Y_j^c}\right) - \ln\left(\frac{I_j^{m,u}}{Y_j^u}\right)\right) \\ &\quad + \sum_j \frac{1}{2}(\overline{v}_j^m - \overline{s}_j)\left(\ln\left(\frac{I_j^{m,c}}{I_j^{m,u}}\right) + \ln\left(\frac{Y_j^c}{Y_j^u}\right)\right). \end{aligned} \tag{4}$$

As in Equation (4), the Canada–United States investment intensity difference in the business sector becomes the sum of two components—the within-industry investment intensity difference (the first term on the right) and the difference due to the industry structure of the country (the second term).

The former holds the shares (investment and GDP shares) constant between Canada and the United States for a given industry and compares the investment intensity difference within a given industry between the two countries. As a result, the former is a weighted sum of all within-industry investment intensity differences between Canada and the United States. Industries with a larger investment or GDP share, or with a larger investment share of GDP in one country relative to the other country, will make a larger contribution to the aggregate Canada–United States investment intensity difference.

The latter holds the sum of the investment difference and the GDP difference for a given industry constant between Canada and the United States, and compares the difference between investment share and GDP share for a given industry. The term $\overline{v}_j^m - \overline{s}_j$ measures how intensive the investment in industry j is relative to its output. The term $\ln(I_j^{m,c} / I_j^{m,u}) + \ln(Y_j^c / Y_j^u)$ measures the size of Canadian industry j relative to its U.S. counterpart in terms of investment and output.

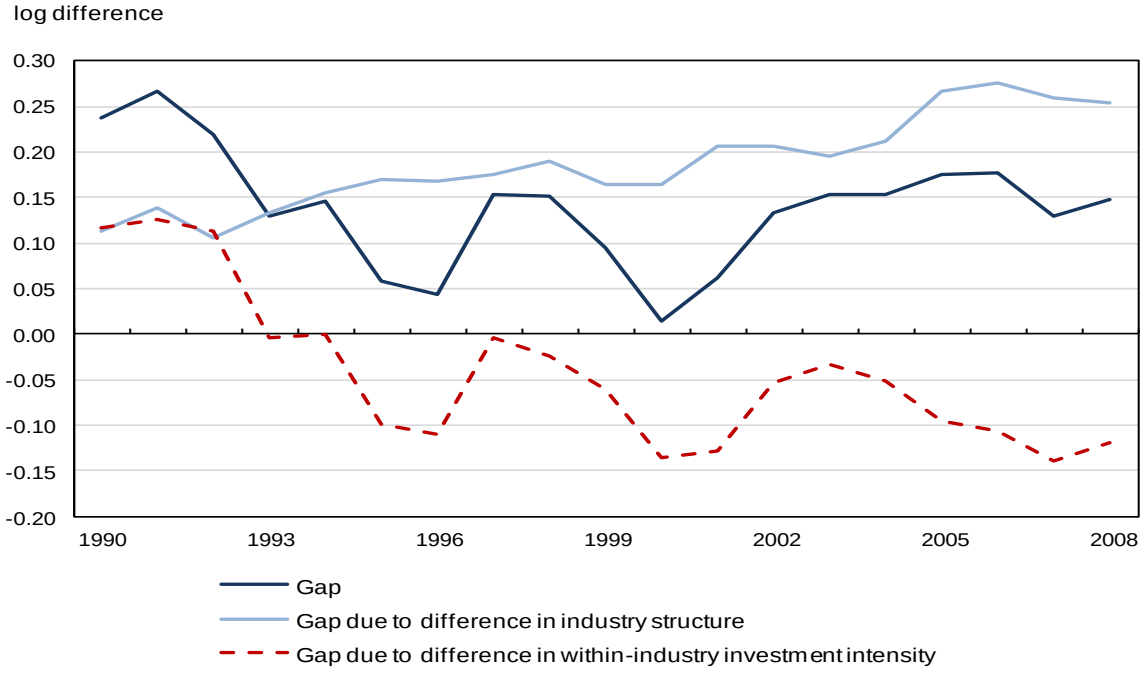
5.2 Decomposition of the Canada–United States investment intensity difference by asset type

The results of decomposing the Canada-United States difference in total business sector non-residential investment intensity over the 1990-to-2008 period are illustrated in Chart 6 and Table 4.

Over the two decades, Canada had higher total non-residential business investment intensity than did the United States. Over the entire period, Canada's total non-residential business investment intensity was, on average, about 15% higher than that of the United States, but fluctuations in relative intensity were substantial. It was about 30% higher in the early 1990s; almost disappeared by 2000; and then, increased after 2000.

The differences in industry structure between Canada and the United States contributed to Canada's higher investment intensity, and its role increased over time. The within-industry investment intensity differences between Canada and the United States were negative for most of the period, meaning that once corrected for differences in industry structure, Canada tended to be have a lower overall investment intensity.

Chart 6
Decomposition of the Canada–United States difference in non-residential investment intensity (current dollars), business sector, 1990 to 2008



Note: Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Table 4
Decomposition of the gap in non-residential investment intensity between Canada and the United States, business sector, 1990 to 2008

Year	Total gap	Gap due to within-industry investment intensity difference	Gap due to difference in industry structures	Residual (column 1, minus column 2, minus column 3)
	Column 1	Column 2	Column 3	Column 4
		percent		
1990	26.8	12.3	12.0	2.5
1991	30.6	13.3	14.9	2.4
1992	24.5	12.0	11.2	1.3
1993	13.9	-0.4	14.3	-0.1
1994	15.6	0.0	16.7	-1.1
1995	6.1	-9.4	18.4	-2.9
1996	4.4	-10.4	18.2	-3.4
1997	16.6	-0.4	19.3	-2.3
1998	16.4	-2.5	20.8	-1.9
1999	9.9	-5.9	18.0	-2.2
2000	1.5	-12.6	18.0	-3.9
2001	6.3	-12.0	22.9	-4.6
2002	14.2	-5.2	22.8	-3.4
2003	16.6	-3.3	21.5	-1.6
2004	16.7	-5.0	23.6	-1.9
2005	19.2	-9.1	30.6	-2.3
2006	19.4	-10.0	31.6	-2.2
2007	13.9	-13.1	29.7	-2.7
2008	15.8	-11.3	28.8	-1.6

Notes: The gap is measured as the percentage difference between Canada and the United States. The residual contribution arises from the discrepancy after taking the exponential of log differences. Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

The within-industry investment intensity difference fell from being positive at the beginning of the period to negative at the end. Across industries, on average, total investment intensity in Canada was about 12% higher than in the United States in the early 1990s, but then dropped below the United States, and by 2008, was 11% lower. Thus, across industries, Canada invested more intensively than did the United States only in the early 1990s, and less intensively for most of the 1990-to-2008 period. This reduced Canada's advantage over the United States in total business non-residential investment intensity. Canada's utilities, transportation and warehouse, and the FIRE industries were the only industries that invested more intensively in total assets than did their U.S. counterparts over the entire period (Table 5).

Table 5
Average non-residential investment intensity and average GDP share, business sector, Canada and the United States, 1990 to 2008

Industry	Average investment intensity		Average industry GDP share	
	Canada	United States	Canada	United States
	ratio (percent)[1]			
Agriculture	18.40	24.50	3.40	1.70
Mining and oil	44.60	44.60	7.70	1.90
Utilities	39.00	31.40	4.10	2.90
Construction	5.60	6.40	8.00	6.20
Manufacturing	11.50	12.80	22.50	20.40
Wholesale	6.40	8.50	7.30	8.60
Retail	9.30	9.20	7.70	9.80
Transportation and warehousing	22.00	19.80	6.60	4.30
Information	25.10	25.80	4.80	6.30
Finance, insurance, real estate	26.80	19.90	11.30	16.00
Professional services	6.40	7.50	5.50	9.10
Administrative services	4.00	8.50	3.10	3.70
Arts	11.30	13.80	1.20	1.30
Accommodation and food	7.30	10.60	3.40	4.00
Other services	5.10	8.70	3.20	3.80

1. Ratio of investment to GDP.

Notes: GDP stands for "gross domestic product." Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Canada's industry structure relative to that of the United States contributed substantially to higher total investment intensity. Over the 1990-to-2008 period, Canada had a relatively larger mining, utilities, and transportation and warehouse sectors, measured in terms of industry GDP share, than did the United States (Table 5). On average, these industries were also more investment-intensive in Canada. As well, the role of the difference in industry structure between Canada and the United States increased over time. In the early 1990s, differences in industry structure and within-industry investment intensity each accounted for about half of the total investment intensity difference between Canada and the United States. During the rest of the period, the positive contribution of the difference in industry structure offset the negative contribution of within-industry investment intensity differences.

The results of the decomposition for different asset types are shown in Charts 7 to 10 and Tables 6 to 13. Chart 7 and Table 6 contain the results for investments in structures. During the 1990-to-2008 period, differences in the industry structure between Canada and the United States contributed positively to Canada's higher investment intensity in structures and their influence increased over time. By contrast, the contribution of the within-industry investment intensity difference declined and became negative in 2007.

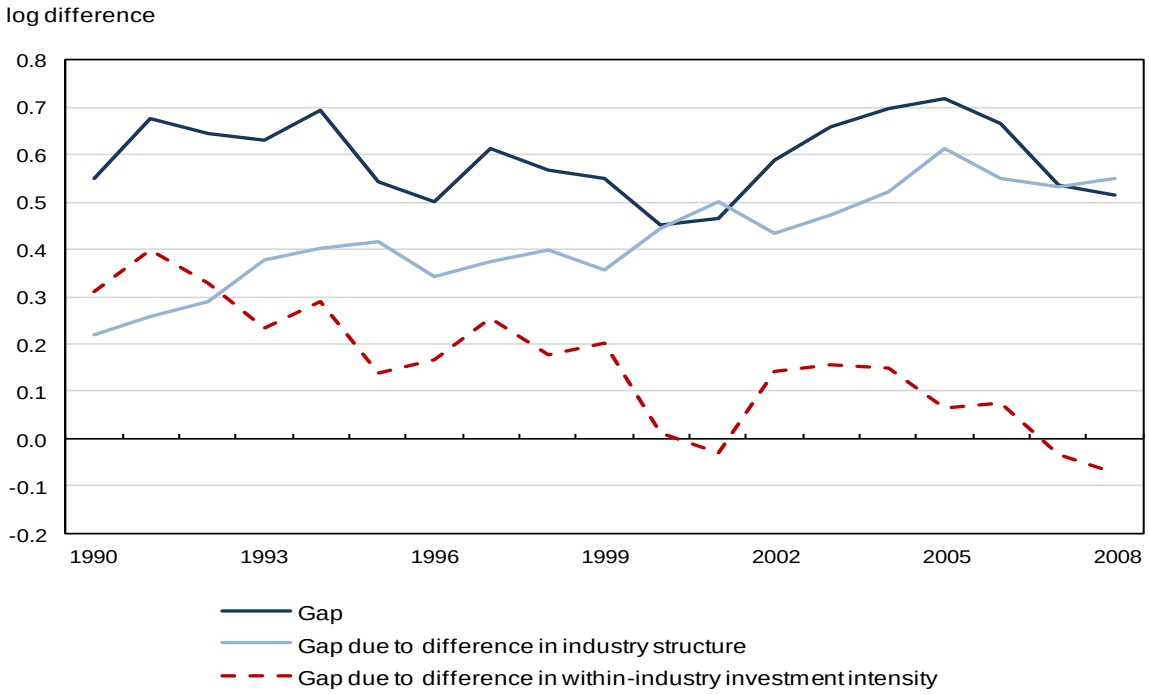
Table 6
Decomposition of the gap in structure asset investment intensity between Canada and the United States, business sector, 1990 to 2008

Year	Total gap	Gap due to the within-industry investment intensity difference	Gap due to the difference in industry structures	Residual (column 1, minus column 2, minus column 3)
	Column 1	Column 2	Column 3	Column 4
		percent		
1990	73.3	36.1	24.4	12.7
1991	96.6	48.7	29.4	18.5
1992	90.6	39.1	33.7	17.8
1993	88.0	26.2	46.0	15.8
1994	100.3	33.6	49.4	17.3
1995	72.2	14.8	51.5	5.9
1996	65.1	18.0	41.0	6.1
1997	84.7	29.2	45.6	9.9
1998	76.5	19.5	48.8	8.2
1999	73.0	22.3	42.8	7.9
2000	56.9	1.3	56.1	-0.5
2001	59.6	-2.9	65.2	-2.8
2002	80.3	15.1	54.1	11.0
2003	93.3	16.8	60.4	16.1
2004	101.1	15.9	68.7	16.5
2005	104.7	6.5	84.7	13.6
2006	94.2	7.8	73.5	12.9
2007	71.0	-3.2	70.1	4.2
2008	67.6	-6.8	73.2	1.2

Notes: The gap is measured as the percentage difference between Canada and the United States. The residual contribution arises from the discrepancy after taking the exponential of log differences. Authors'

Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Chart 7
Decomposition of the Canada-United States difference in structure asset investment intensity (current dollars), 1990 to 2008



Note: Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Canada had a substantially higher investment intensity in structures than did the United States during the entire 1990-to-2008 period (Chart 7). On average, investment intensity in structures in Canada was about 80% higher than in the United States. Both higher within-industry investment intensity and industry structure in Canada made positive contributions to Canada's advantage in structures. In the early 1990s, Canada's within-industry investment intensity in structures was about 40% higher than that in the United States. Over time, the difference narrowed, and by the end of the period, industries in both countries were investing almost the same percentage of GDP in structures. For about two-thirds of the industries in Canada, average investment intensities in structures were higher than those of their U.S. counterparts over the period (Table 7).

Table 7
Average structure asset investment intensity and average GDP share, by industry, business sector, Canada and the United States, 1990 to 2008

Industry	Average investment intensity		Average industry GDP share	
	Canada	United States	Canada	United States
	ratio (percent)[1]			
Agriculture	6.0	3.6	3.4	1.7
Mining and oil	37.7	31.9	7.7	1.9
Utilities	25.8	13.7	4.1	2.9
Construction	0.7	0.5	8.0	6.2
Manufacturing	2.0	1.7	22.5	20.4
Wholesale	1.4	1.1	7.3	8.6
Retail	3.8	3.8	7.7	9.8
Transportation and warehousing	8.9	4.2	6.6	4.3
Information	7.2	5.6	4.8	6.3
Finance, insurance, real estate	6.1	5.1	11.3	16.0
Professional services	0.7	0.7	5.5	9.1
Administrative services	0.8	1.2	3.1	3.7
Arts	5.9	7.6	1.2	1.3
Accommodation and food	4.1	5.0	3.4	4.0
Other services	1.5	4.2	3.2	3.8

1. Ratio of investment to GDP.

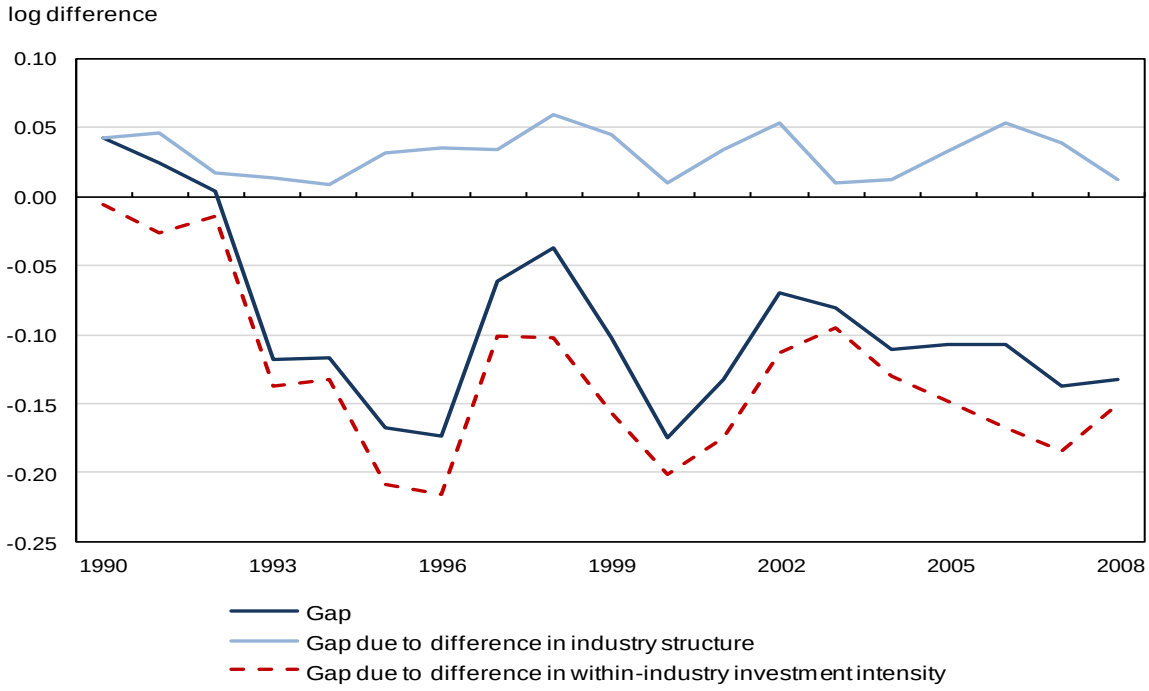
Notes: GDP stands for "gross domestic product." Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

The contribution of differences in industry composition to Canada's advantage in structure investments increased over time (Chart 7). In 1990, the difference in industry composition accounted for about a third of the Canada–United States difference in the intensity of investment in structures, but it accounted for almost the entire difference at the end of the period. Mining and utilities contributed the most. For example, the mining industry in Canada accounted for an average of about 40% of total investment in non-residential structures over the past 20 years. Moreover, mining's share of total GDP rose from about 6% in 1990 to 14% in 2008. By contrast, the United States mining industry accounted for about 16% of total business sector non-residential investment in structures over the past 20 years, and its share of total GDP averaged 2%.

No clear trend emerged for investments in M&E, and volatility in terms of relative investment intensity was considerable (Chart 8 and Table 8). Except in the early 1990s, Canada had a lower investment intensity in M&E than did the United States (Chart 8). On average, Canada's investment intensity in M&E was about 10% lower than that of the United States, though much of that was accounted for by the different treatment of automobile investment. The Canada–United States investment intensity gap in M&E narrowed briefly in 1998, when Canada's investment intensity in M&E was only about 4% lower than that in the United States. This largely reflected growth of the manufacturing and transportation industries in Canada, which was driven by increased foreign demand in the 1990s as a result of the depreciation of the Canadian dollar and more integrated North American markets owing to the implementation of NAFTA. After 1999, the Canada–United States investment intensity gap in M&E widened again.

Chart 8
Decomposition of the Canada-United States difference in M&E investment intensity (current dollars), 1990 to 2008



Notes: M&E stands for "machinery and equipment." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Table 8
Decomposition of the gap in M&E investment intensity between Canada and the United States, 1990 to 2008

	Total gap	Gap due to the within-industry investment intensity difference	Gap due to the difference in industry structures	Residual (column 1, minus column 2, minus column 3)
	Column 1	Column 2	Column 3	Column 4
		percent		
1990	4.3	-0.6	4.2	0.7
1991	2.4	-2.6	4.7	0.2
1992	0.4	-1.4	1.7	0.1
1993	-11.1	-12.8	1.4	0.2
1994	-11.0	-12.4	0.9	0.5
1995	-15.4	-18.7	3.2	0.1
1996	-15.9	-19.5	3.6	0.0
1997	-5.9	-9.6	3.4	0.3
1998	-3.6	-9.7	6.1	0.0
1999	-9.7	-14.5	4.6	0.2
2000	-16.1	-18.2	1.0	1.1
2001	-12.4	-16.1	3.5	0.2
2002	-6.8	-10.7	5.4	-1.5
2003	-7.7	-9.1	1.0	0.4
2004	-10.5	-12.2	1.3	0.4
2005	-10.1	-13.8	3.3	0.3
2006	-10.1	-15.4	5.5	-0.2
2007	-12.8	-16.8	4.0	0.1
2008	-12.4	-14.0	1.2	0.5

Notes: The gap is measured as the percentage difference between Canada and the United States. The residual contribution arises from the discrepancy after taking the exponential of log differences. M&E stands for "machinery and equipment." Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

The overall Canada–United States gap in M&E investment intensity was driven by the within-industry investment intensity difference between the two countries. Over the period, within-industry M&E investment intensity was, on average, about 13% lower in Canada (Chart 8) than in the United States. Except for FIRE, all industries in Canada invested proportionally less in M&E than did their U.S. counterparts (Table 9). Moreover, the FIRE industry, which had more intensive M&E investment, was relatively smaller in terms of GDP share in Canada than in the United States—11% versus 16%. Although it was favourable to Canada, the difference in industry structure between the two countries had little influence on the Canada–United States intensity gap in M&E investment.

Table 9
Average M&E investment intensity and average GDP share, by industry, business sector, Canada and the United States, 1990 to 2008

Industry	Average investment intensity		Average industry GDP share	
	Canada	United States	Canada	United States
	ratio (percent)[1]			
Agriculture	12.4	20.9	3.4	1.7
Mining and oil	6.9	12.7	7.7	1.9
Utilities	13.2	17.8	4.1	2.9
Construction	5.0	6.0	8.0	6.2
Manufacturing	9.6	11.1	22.5	20.4
Wholesale	5.0	7.4	7.3	8.6
Retail	5.4	5.5	7.7	9.8
Transportation and warehousing	13.1	15.7	6.6	4.3
Information	17.9	20.1	4.8	6.3
Finance, insurance, real estate	20.7	14.8	11.3	16.0
Professional services	5.8	6.7	5.5	9.1
Administrative services	3.3	7.3	3.1	3.7
Arts	5.4	6.2	1.2	1.3
Accommodation and food	3.1	5.6	3.4	4.0
Other services	3.6	4.5	3.2	3.8

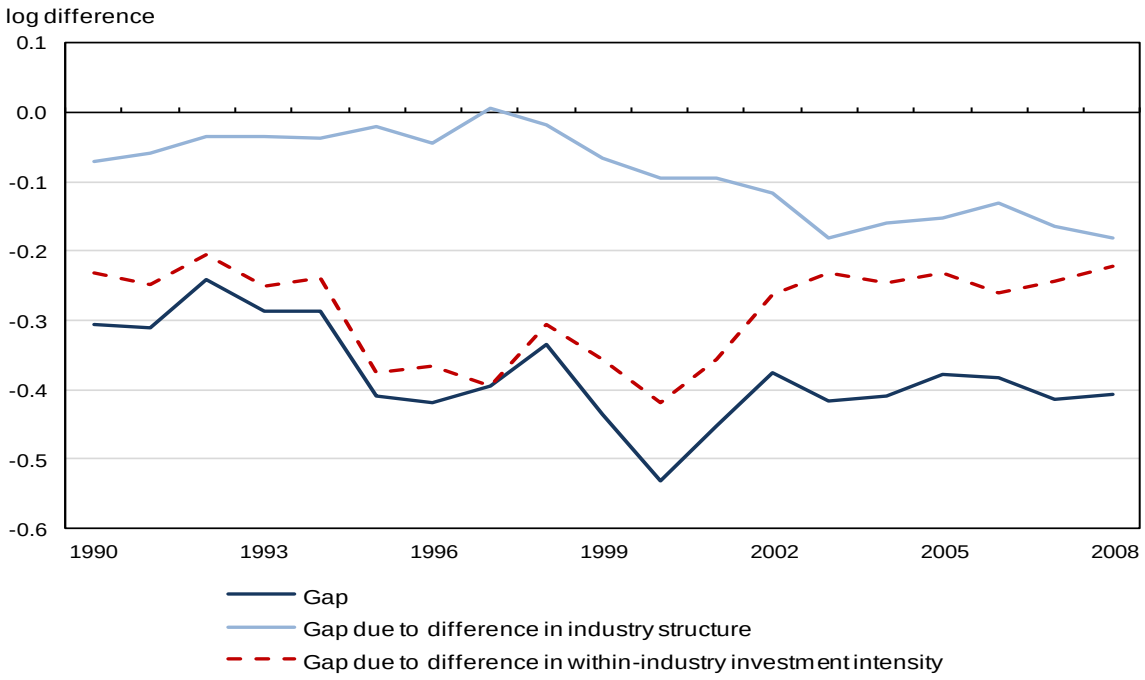
1. Ratio of investment to GDP.

Notes: M&E stands for "machinery and equipment"; GDP stands for "gross domestic product." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Canada had a lower ICT investment intensity than did the United States over the entire period and the size of the gap generally widened (Chart 9 and Table 10).

The within-industry investment intensity difference explained almost all the overall Canada–United States gap in ICT investment in the 1990s (Chart 9). The within-industry investment intensity difference increased in the 1990s, and the gap reached its widest point in 2000 (Table 10). The largest contribution came from manufacturing. In 2000, within-industry ICT investment intensity in Canadian manufacturing was 35% of the United States, which translates into about 40% of the within-industry investment intensity difference that year, after accounting for manufacturing industries' relative shares of investment and GDP in the two countries (Table 11). After 2000, the gap diminished, so that by 2008, within-industry ICT investment intensity in Canada was about 80% of the United States. This occurred because many industries in Canada either invested more intensively in ICT assets than did their U.S. counterparts (agriculture, utilities, transportation, and accommodation) or reduced the gaps with their U.S. counterparts (mining, construction, manufacturing, wholesale, and FIRE).

Chart 9
Decomposition of the Canada–United States difference in ICT investment intensity (current dollars), business sector, 1990 to 2008



Note: ICT stands for "information and communications technology." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Table 10
Decomposition of the gap in ICT investment intensity between Canada and the United States, business sector, 1990 to 2008

Year	Total gap	Gap due to within-industry investment intensity difference	Gap due to difference in industry structures	Residual (column 1, minus column 2, minus column 3)
	Column 1	Column 2	Column 3	Column 4
		percent		
1990	-26.4	-20.6	-6.9	1.2
1991	-26.8	-22.0	-5.8	1.0
1992	-21.5	-18.6	-3.4	0.5
1993	-24.9	-22.1	-3.4	0.6
1994	-24.9	-21.2	-3.7	0.0
1995	-33.6	-31.3	-2.2	-0.1
1996	-34.3	-30.6	-4.3	0.6
1997	-32.7	-32.6	0.5	-0.6
1998	-28.4	-26.4	-1.8	-0.2
1999	-35.3	-29.9	-6.4	1.0
2000	-41.3	-34.2	-8.9	1.9
2001	-36.3	-29.9	-9.1	2.7
2002	-31.4	-23.1	-11.1	2.7
2003	-34.1	-20.8	-16.5	3.3
2004	-33.6	-21.9	-14.7	3.0
2005	-31.5	-20.7	-14.1	3.4
2006	-31.8	-22.9	-12.2	3.3
2007	-34.0	-21.6	-15.2	2.8
2008	-33.5	-19.9	-16.7	3.1

Notes: The gap is measured as the percentage difference between Canada and the United States. The residual contribution arises from the discrepancy after taking the exponential of log differences. ICT stands for "information and communications technology." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

The difference in industry structure between Canada and the United States played a minimal role in the Canada–United States ICT investment intensity gap in the 1990s. However, it was more important after 2000, when its effect changed from being positive to negative. Industries with more intensive ICT investments (information, FIRE, professional) grew more slowly in Canada, and those which were less intensive with respect to ICT investments (mining, construction, manufacturing) were relatively larger in Canada (Table 11).

Table 11
Average investment intensity for ICT investments and industry GDP share, by industry, business sector, Canada and the United States, 1990 to 2008

Industry	Average investment intensity		Average industry GDP share	
	Canada	United States	Canada	United States
	ratio (percent)[1]			
Agriculture	0.4	0.4	3.4	1.7
Mining and oil	0.3	1.9	7.7	1.9
Utilities	2.6	2.7	4.1	2.9
Construction	0.3	0.9	8.0	6.2
Manufacturing	1.3	2.7	22.5	20.4
Wholesale	2.6	2.8	7.3	8.6
Retail	1.9	1.7	7.7	9.8
Transportation and warehousing	2.2	4.3	6.6	4.3
Information	16.9	17.1	4.8	6.3
Finance, insurance, real estate	5.9	6.7	11.3	16.0
Professional services	4.6	4.7	5.5	9.1
Administrative services	1.8	3.7	3.1	3.7
Arts	2.5	1.1	1.2	1.3
Accommodation and food	0.6	0.5	3.4	4.0
Other services	1.7	1.4	3.2	3.8

1. Ratio of investment to GDP.

Notes: ICT stands for "information and communications technology"; GDP stands for "gross domestic product." Authors' calculations.

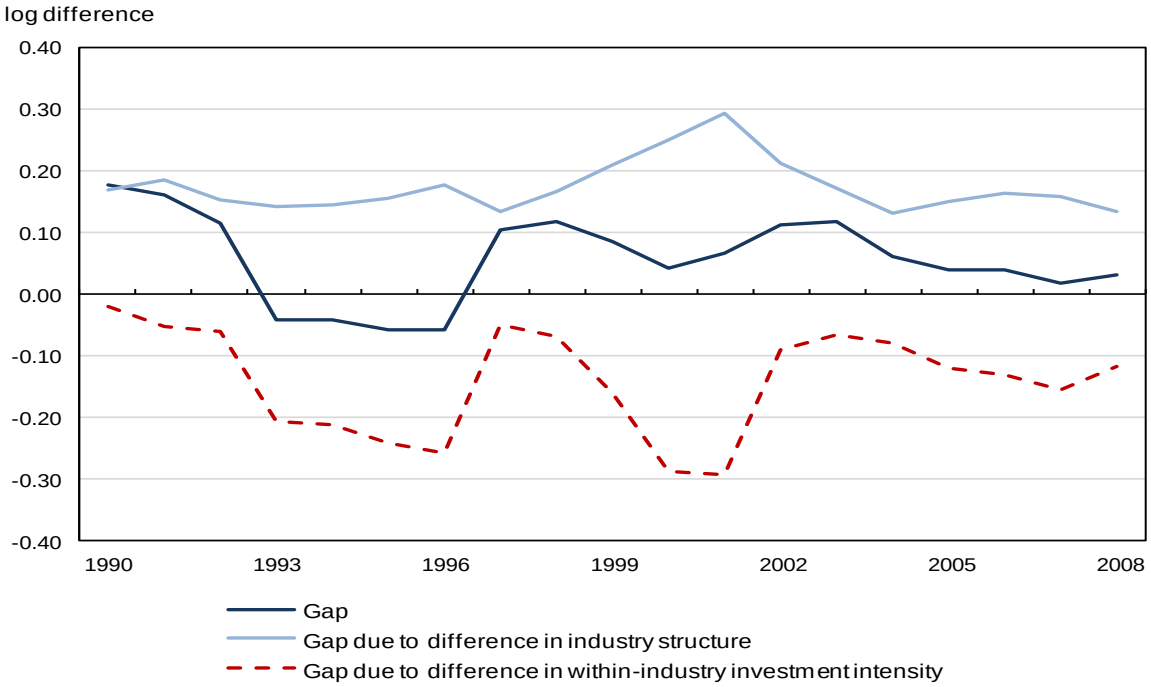
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

The results of the decomposition for the Canada–United States intensity gap in non-ICT investments are illustrated in Chart 10 and Table 12. The gap in non-ICT investment intensity was relatively constant throughout the 1990-to-2008 period. The contribution of industry structure was positive and relatively flat, but the within-industry difference in investment intensity was negative and more volatile.

On average, over the 1990-to-2008 period, Canada's non-ICT investment intensity was about 6% higher than that of the United States (Chart 10). However, the gap narrowed quickly from 20% in 1990 and became negative in the mid-1990s. Thereafter, the gap widened, becoming positive again. But by 2008, Canada's non-ICT investment intensity had decreased to being only about 3% higher than that of the United States (Table 12).

Once differences in industry structure are accounted for, Canada's industries invested less intensively in non-ICT M&E assets than did their U.S. counterparts throughout the period. The within-industry investment intensity difference was only 2% in 1990, but widened steadily until 1996, mostly because of the more severe impact of the early 1990s recession on the Canadian economy. The within-industry intensity difference was about 25% in 2001, but then narrowed. Over the entire period, the within-industry intensity difference contributed negatively to the Canada–United States non-ICT investment gap. Large within-industry investment intensity differences between Canada and the United States are evident for many industries—agriculture, mining and oil, utilities, wholesale, information, professional service, administrative service, and accommodation and food service (Table 13). The only Canadian industry that invested more intensively in non-ICT M&E assets, on average, than did its U.S. counterpart was FIRE.

Chart 10
Decomposition of the Canada–United States difference in non-ICT investment intensity (current dollars), business sector, 1990 to 2008



Notes: ICT stands for "information and communications technology." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Table 12
Decomposition of the gap in non-ICT investment intensity between Canada and the United States, 1990 to 2008

Year	Total gap	Gap due to within-industry investment intensity difference	Gap due to the difference in industry structures	Residual (column 1, minus column 2, minus column 3)
	Column 1	Column 2	Column 3	Column 4
		percent		
1990	19.2	-2.0	18.5	2.7
1991	17.3	-5.1	20.3	2.1
1992	12.2	-5.9	16.4	1.7
1993	-4.1	-18.6	15.2	-0.7
1994	-4.1	-19.2	15.6	-0.5
1995	-5.8	-21.5	16.9	-1.2
1996	-5.6	-22.8	19.2	-2.0
1997	11.0	-4.9	14.3	1.6
1998	12.5	-6.7	18.2	1.1
1999	8.8	-14.7	23.2	0.4
2000	4.2	-24.9	28.3	0.8
2001	6.7	-25.3	33.9	-1.8
2002	11.8	-8.7	23.5	-3.0
2003	12.4	-6.5	18.6	0.3
2004	6.4	-7.7	13.9	0.1
2005	4.1	-11.3	16.2	-0.8
2006	4.1	-12.2	17.7	-1.4
2007	1.8	-14.4	17.1	-1.0
2008	3.1	-11.1	14.3	-0.1

Notes: The gap is measured as the percentage difference between Canada and the United States. The residual contribution arises from the discrepancy after taking the exponential of log differences. ICT stands for "information and communications technology." Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

Table 13
Average non-ICT investment intensity and average GDP share, by industry, business sector, Canada and the United States, 1990 to 2008

Industry	Average investment intensity		Average industry GDP share	
	Canada	United States	Canada	United States
	ratio (percent)[1]			
Agriculture	12.0	20.5	3.4	1.7
Mining and oil	6.6	10.8	7.7	1.9
Utilities	10.6	15.0	4.1	2.9
Construction	4.6	5.1	8.0	6.2
Manufacturing	8.3	8.4	22.5	20.4
Wholesale	2.4	4.7	7.3	8.6
Retail	3.5	3.8	7.7	9.8
Transportation and warehousing	10.9	11.3	6.6	4.3
Information	1.0	3.1	4.8	6.3
Finance, insurance, real estate	14.9	8.1	11.3	16.0
Professional services	1.2	2.0	5.5	9.1
Administrative services	1.5	3.6	3.1	3.7
Arts	2.9	5.1	1.2	1.3
Accommodation and food	2.5	5.1	3.4	4.0
Other services	1.9	3.1	3.2	3.8

1. Ratio of investment to GDP.
Notes: ICT stands for "information and communications technology"; GDP stands for "gross domestic product." Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 379-0023; and U.S. Bureau of Economic Analysis, "Value Added by Industry" table and "Non-residential Detailed Estimates for Investment" table.

The difference in industry structure contributed positively to the Canada–United States non-ICT M&E investment gap (Chart 10), which more than offset the negative impact of the within-industry investment intensity difference. Canada's industry structure advantage was mainly attributable to mining and oil, utilities, manufacturing and transportation, whose non-ICT M&E investment intensity was greater, and whose GDP shares were relatively larger than those in the United States (Table 13). The increase in the late 1990s and the spike in the gap in 2001 due to the difference in industry structure mostly reflected faster growth of the mining, oil and manufacturing industries in Canada than in the United States. After 2000, growth of all the Canadian industries with more intensive non-ICT investments, except mining and oil, slowed relative to their U.S. counterparts. This reduced the contribution of the difference in industry structure to the overall Canada–United States investment intensity gap in non-ICT assets.

6 Conclusion

From 1990 to 2011, average investment intensity measured as the percentage of GDP output devoted to investment in Canada and the United States was similar for the total economy, although differences in the magnitude of business cycles caused the two countries to change positions over the time period. Canada had relatively higher total investment intensity than did the United States in the early 1990s and again at the end of the period. Residential investment held up better in Canada than in the United States during the period post 2000.

Within the business sector, Canada's investment intensity in non-residential investments was higher than the United States. This was driven by more intensive investment in structures (buildings and engineering structures) in Canada, especially after 2000. In Canada, there was a greater shift from investments in M&E to investments in structures than in the United States.

Overall, there were only small differences in investment intensity in the M&E category which consists of both ICT and non-ICT categories. Most of this came from differences in measurement methodology. Within the M&E category, both countries saw a shift from investments in non-ICT-related assets to ICT-related assets, Canada's investment intensity in ICT-related M&E, was below that of the United States—but this was offset by a slightly higher non-ICT M&E intensity. While M&E in total differed little, the Canada–United States gap in ICT investment intensity widened over time.

Underlying the movements in the investment intensities that capture the share of overall resources being devoted to investment are changes in the relative volumes of investment that are due to changes in relative prices and differences in the magnitude of the effect of business cycles.

There is a slowdown in the relative volume growth in structures compared to GDP in the 1990s but this is partially offset by a relative increase in the prices of structures. Post 2000, the demand for the structures assets increases in Canada more than it does in the United States.

During the 1990s, the relative volume growth in M&E is more rapid in the United States. This was a period when the movement of relative prices favours investment in the United States. In the period after 2000, the relative volume growth rate in Canada is greater and this corresponds to a period when relative prices favour investment in Canada. Investment intensities also reflect differences in the business cycle. Canadian M&E investment intensity peaks earlier at the end of the 1990s than it did in the United States and then grows more quickly coming out of the post-2000 downturn.

Aggregate levels of investment intensity between two countries depend on the relative level for individual industries and the relative importance of different industries, that is, differences in the industrial structure of the two countries. Canada's advantage in investments in engineering structures and buildings is partially explained by its greater concentration of industries where the intensity of investment in these assets is higher—and this concentration increased over the period. Canada's industry composition played a significant role in accounting for its higher investment intensity in structures, which was largely driven by the booming mining and oil industry. In fact, by the end of the period, the differences in industrial structure account for almost all of the differences between the two countries in this asset class. Canada started the period under study with considerably greater investment intensity at the industry level in structures but relinquished that advantage over the period.

As well, Canada's industry structure contributed positively to differences in investment intensity with respect to M&E—both the ICT and non-ICT components. Differences in industry structure are increasingly responsible for differences in the aggregate ICT differences. Industries with

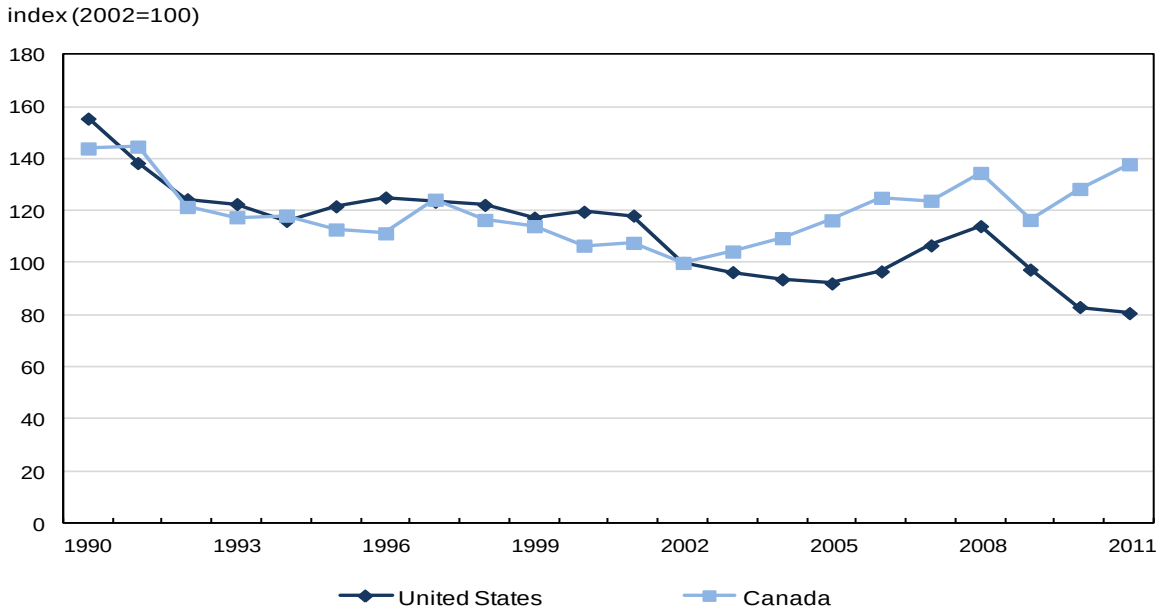
more intensive ICT investment (FIRE, information, and professional) were smaller, on average, in terms of their GDP shares, in Canada than in the United States. Once these differences in structure are removed, differences in ICT investment have been falling.

Industry structural differences also matter for comparisons for the non-ICT component of M&E. Here industry structure is responsible for explaining much of Canada's greater investment intensity. Indeed, once differences in industry composition are considered, it disappears completely. But it is also clear that the difference, once corrected for industry structure, is highly sensitive to the time period chosen. The size of the within-industry disadvantage here widened considerably in the 1990s but narrowed in the post-2000 period.

Canada's investment focus differs from that of the United States across asset types—investing more heavily in structures, about the same in non-ICT M&E and less in ICT. The difference in performance in each of these areas has changed over time along with structural changes in the economy and with changes in the prices of investment goods relative to all goods in general. After consideration of differences in industry structures, differences in industry investment intensity between Canada and the United States have declined in the period post 2000 in the case of all three assets—engineering and buildings, non-ICT and ICT M&E.

7 Appendix

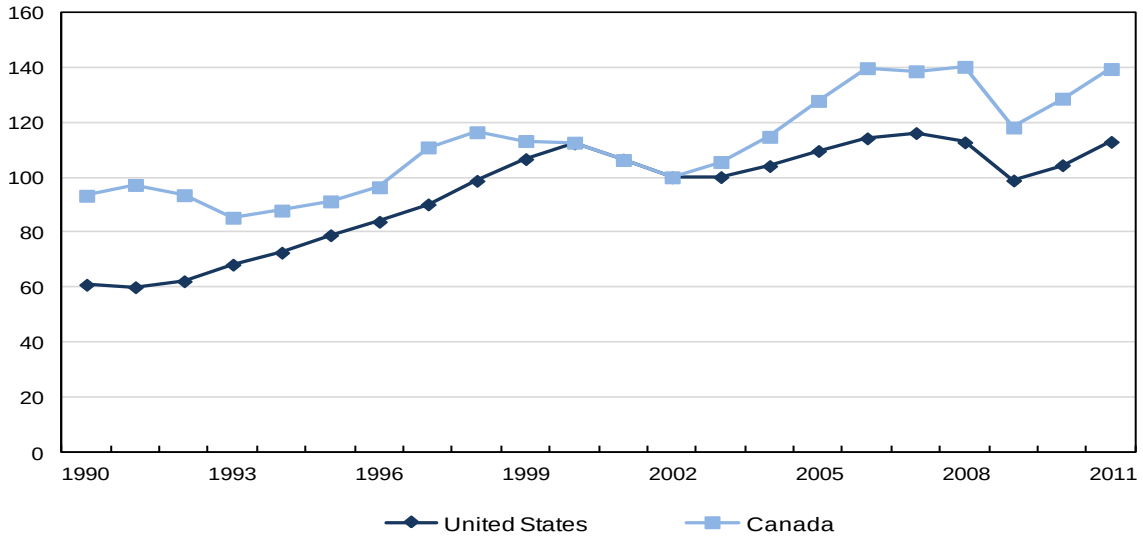
Chart 11
Relative quantity index for structure investments in Canada and the United States



Notes: The relative quantity index for investments in structure is calculated as the quantity index for investments in structure divided by the quantity index for gross domestic product in the business sector, and then multiplied by 100. Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

Chart 12
Relative quantity index for M&E investments in Canada and the United States

index (2002=100)

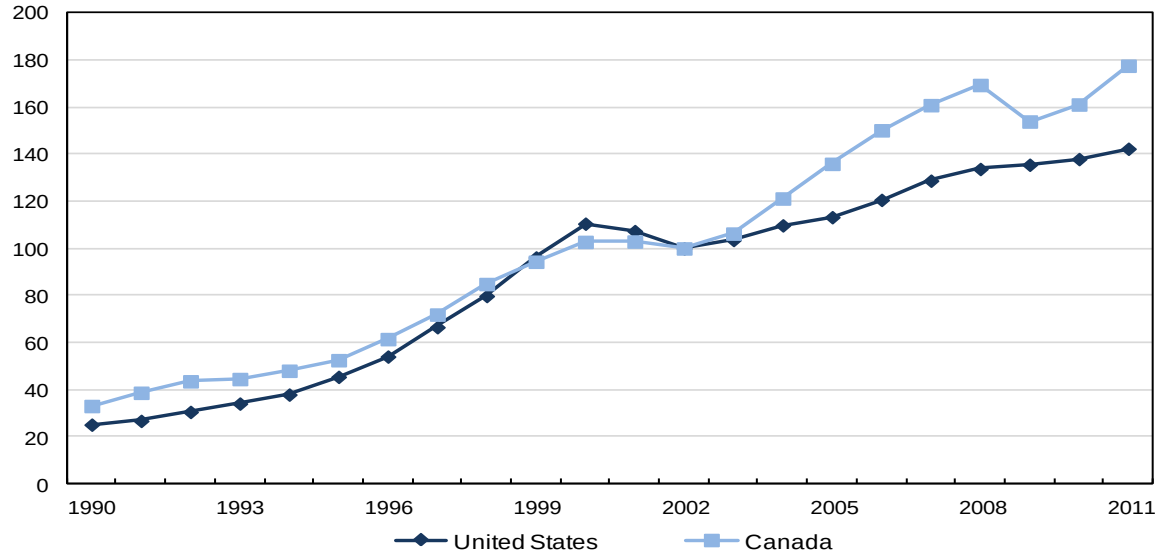


Notes: M&E stands for "machinery and equipment." The relative quantity index for investments in M&E is calculated as the quantity index for investments in M&E divided by the quantity index for gross domestic product in the business sector, and then multiplied by 100. Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

Chart 13
Relative quantity index for ICT M&E in Canada and the United States

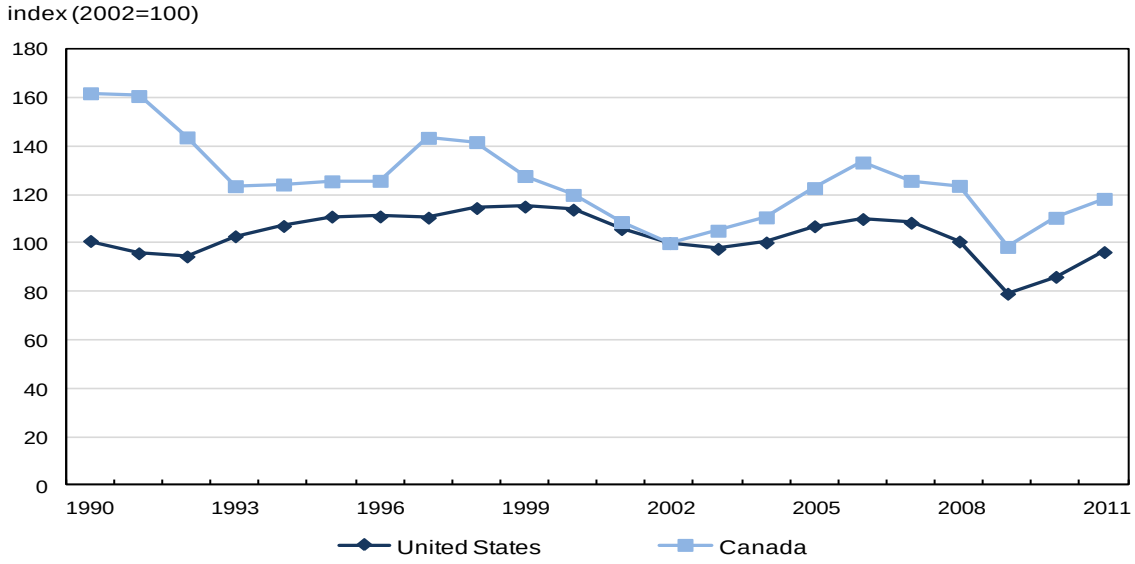
index (2002=100)



Notes: ICT stands for "information and communications technology"; M&E stands for "material and equipment." The relative quantity index for investments in ICT M&E is calculated as the quantity index for investments in ICT M&E divided by the quantity index for gross domestic product in the business sector, and then multiplied by 100. Authors' calculations.

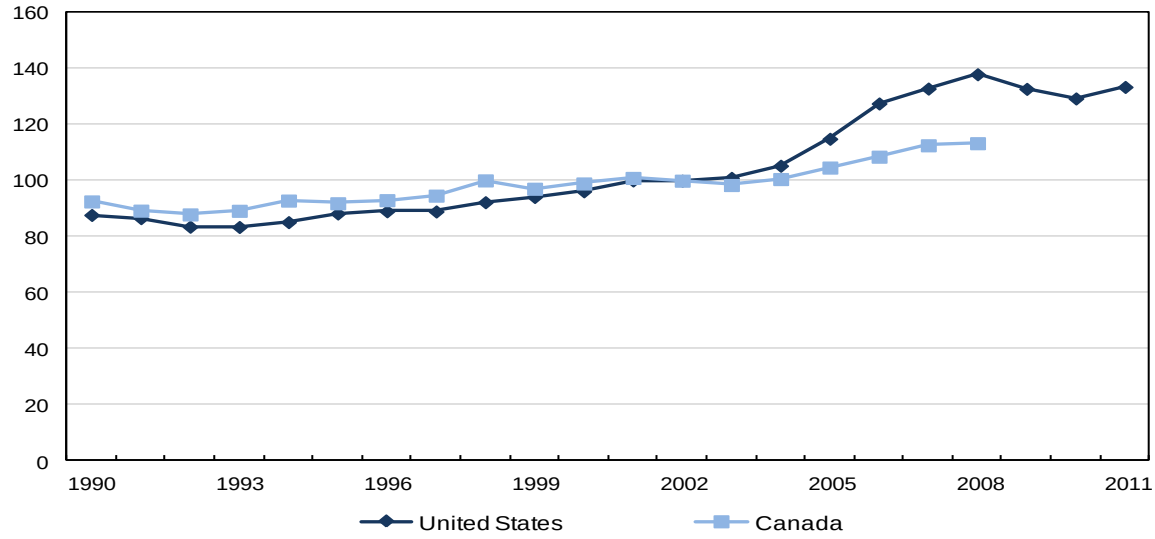
Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4 Price Indexes for Gross Domestic Product."

Chart 14
Relative quantity index for non-ICT M&E in Canada and the United States



Notes: ICT stands for "information and communications technology"; M&E stands for "machinery and equipment." The relative quantity index for investments in non-ICT M&E is calculated as the quantity index for investments in non-ICT M&E divided by the quantity index for gross domestic product in the business sector, and then multiplied by 100. Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

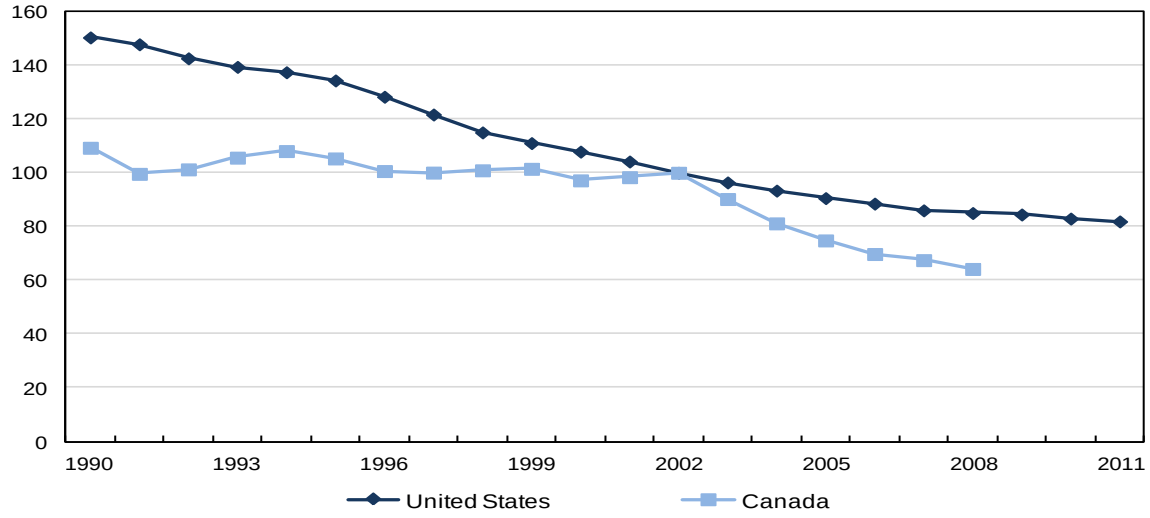
Chart 15
Relative price index for strucure investments in Canada and the United States



Notes: The relative price index for investments in structure is calculated as the price index for investments in structure divided by the price index for gross domestic product (GDP) in the business sector, and then multiplied by 100. The relative price index for Canada is available only up until 2008, as the nominal business sector GDP for Canada is only available until 2008. Authors' calculations.
Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

Chart 16
Relative price index for M&E investments in Canada and the United States

index (2002=100)

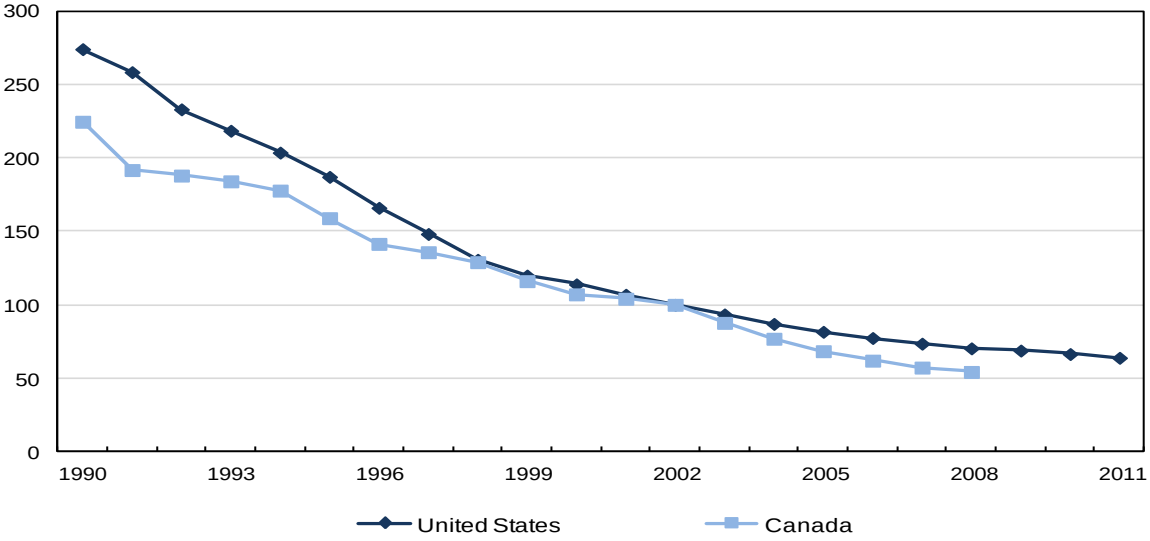


Notes: M&E stands for "machinery and equipment." The relative price index for investments in M&E is calculated as the price index for investments in M&E divided by the price index for gross domestic product (GDP) in the business sector, and then multiplied by 100. The relative price index for Canada is only available up until 2008, as the nominal business sector GDP for Canada is only available until 2008. Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

Chart 17
Relative price index for ICT investments in Canada and the United States

index (2002=100)

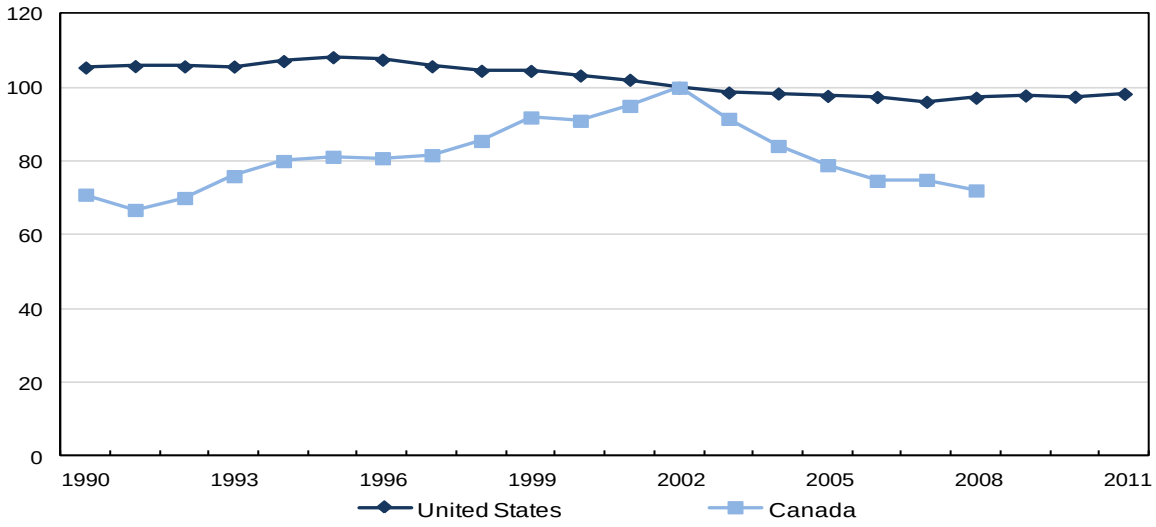


Notes: ICT stands for "information and communications technology." The relative price index for investments in ICT is calculated as the price index for investments in ICT divided by the price index for gross domestic product (GDP) in the business sector, and then multiplied by 100. The relative price index for Canada is only available up until 2008, as the nominal business sector GDP for Canada is only available until 2008. Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

Chart 18
Relative price index for non-ICT investments in Canada and the United States

index (2002=100)



Notes: ICT stands for "information and communications technology." The relative price index for investments in non-ICT is calculated as the price index for investments in non-ICT divided by the price index for gross domestic product (GDP) in the business sector, and then multiplied by 100. The relative price index for Canada is available only up until 2008, as the nominal business sector GDP for Canada is only available until 2008. Authors' calculations.

Sources: Statistics Canada, CANSIM tables 031-0003 and 383-0021; and U.S. Bureau of Economic Analysis, "Table 5.3.3. Real Private Investment by Type, Quantity Indexes," "Table 5.3.4. Prices Indexes for Private Fixed Investment by Type," "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," and "Table 1.1.4. Price Indexes for Gross Domestic Product."

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