

A Critical Juncture: Assessing Canada’s Productivity Performance and Future Prospects

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Abstract

It is widely acknowledged that Canada has faced long-standing issues with productivity growth, both in comparison to its past performance and relative to other advanced economies. Additionally, it is recognized that as the transformation brought on by population aging continues, improvements in the living standards of Canadians will increasingly depend on productivity growth. This situation arises at a time when Canada, along with the global economy, is at the forefront of major structural transformations, including the green transition, the realignment of global trade, and the increasing digitization and use of AI. The necessity to adapt to the scale and scope of these transformations will create pressures for all economic actors to make renewed efforts to address Canada’s longstanding productivity challenges. To better understand the direction of Canada’s future productivity growth, this article chronicles Canada’s productivity growth over recent decades and highlights key structural factors that have likely constrained Canada’s productivity performance. We then explore how these factors might shape the trajectory of productivity growth in the context of these impending structural transformations and identify areas where further research should be prioritized.

Over the long-term, economic growth can drive significant GDP growth—and is driven by two factors, increases in the labour force and increases in labour productivity. Although population growth indeed it has for several decades in Canada—growth in GDP per capita, which is more closely aligned to living standards,

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is primarily driven by improvements to either employment rates or productivity.

As a modern economy facing long-term demographic challenges of population ageing, there is limited room for Canada to increase its working-age participation rate. The labour force participation rate in Canada is higher than the OECD average and the United States and has increased by almost 15 percentage points since 1976, driven mainly by improvements in women's participation.² Although further improvements can and should be made (e.g., women's participation rates),³ the potential gains to GDP per capita from further increases in labour force participation rates are estimated to be similar in size to the gains from just a few years of labour productivity growth, even at the low average pace of labour productivity growth seen in the years leading into the pandemic. As prospects for improved growth in GDP per capita through increases in labour force participation run thinner, the imperative of confronting Canada's productivity challenges has clearly increased.⁴

The latest OECD projection for GDP per capita growth (Guillemette and Turner, 2021) highlights the potential consequences of Canada's productivity challenge. According to the OECD, Canada could see the slowest growth in real GDP per

capita of any advanced economy from 2020 to 2060. This projected outcome stems largely from a poor productivity performance as measured by labour efficiency (i.e., labour-augmenting technological progress) and capital per worker, which were both projected to trail every other OECD country over the 2020-2060 period. Although Canada's standing in the OECD on demographic fundamentals (i.e. labour force and employment rate growth) are slightly better, they are not projected to be sufficient to offset Canada's low standing on productivity fundamentals that weigh on its future GDP per capita growth.

This projected outcome does not need to become a reality. Even modest improvements in Canada's productivity growth, as defined by labour efficiency and capital per worker, can make a notable improvement in terms of Canada's GDP per capita ranking in 2060. For instance, if Canada's labour productivity were to grow at the average rate projected for the other G7 members, rather than the weakest growth in the G7, real GDP per capita in Canada would improve from the 23rd to the 15th highest level in the OECD by 2060 (Chart 1).⁵ This would leave Canada's rank largely unchanged from 2019 (i.e., Canada would decline from 14th in 2019 to 15th in 2060) and behind only the United States and Ger-

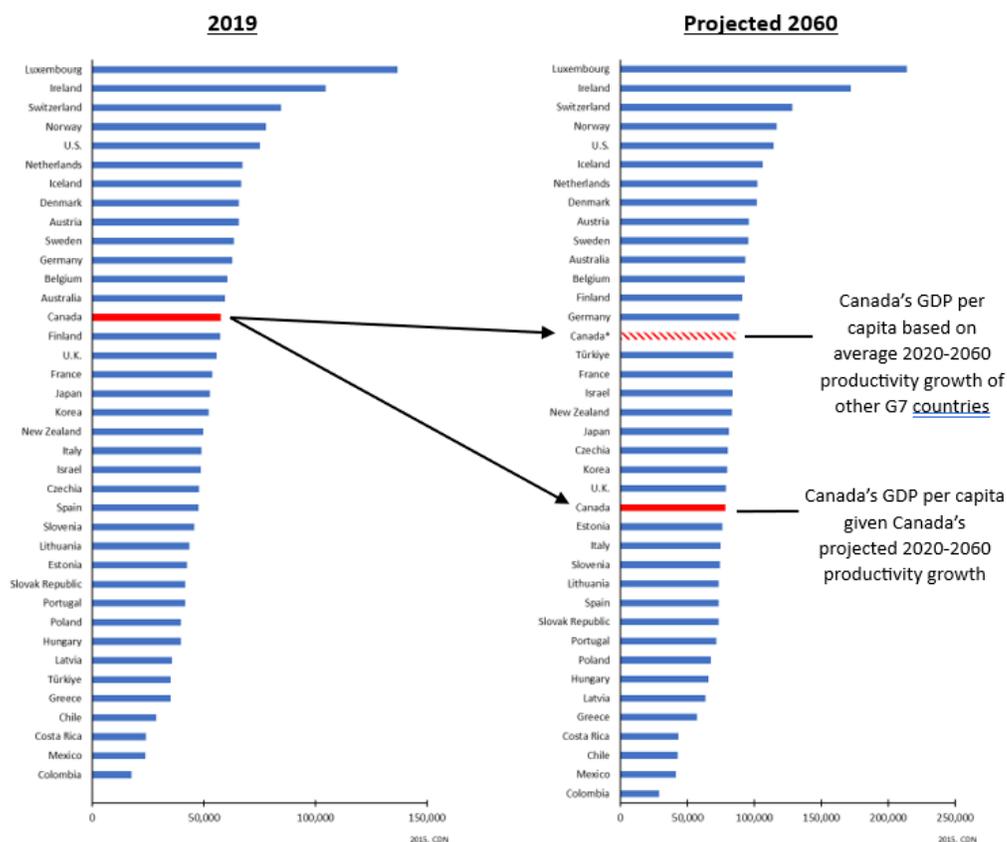
2 Sources: <https://data.oecd.org/emp/labour-force-participation-rate.htm>, <https://www150.statcan.gc.ca/t1/tbl1/en/cv.actionpid=1410001701>

3 For example, some improvement is possible with respect to women in their prime working years, Indigenous people, persons with disabilities, and older Canadians.

4 In this article, productivity is defined as labour productivity unless noted otherwise.

5 The projected range in GDP per capita growth over the 2020-2060 period within the G7 is estimated to be about 0.4 percentage points. If Canada were to have the average growth of other G7 countries over this period, Canadian growth would rise by nearly 0.25 percentage points.

Chart 1 : GDP per Capita in OECD countries, 2019 and 2060 (OECD projection), Real 2015 C\$)



Source: OECD Productivity and ULC – Annual, Total Economy database and Guillemette and Turner (2021). Authors’ calculations.

Note: 2060 projections reflect 2019 GDP per capita after compounding for 40 years GDP per capita growth rates inferred from Guillemette and Turner (2021). *This projection is compounded after adjusting the Canadian GDP per capita growth rate to reflect the average productivity (i.e., labour efficiency and capital per worker) growth of the other G7 countries over the 2020-2060 period.

many in the G7 in 2060.

In this article, Section 1 presents a broad overview of Canada’s productivity performance, including recent developments since COVID-19, Section 2 explores the role of business investment in driving Canada’s weak productivity growth. Section 3 examines the potential factors that may hinder Canada’s investment and productivity performance. We conclude by looking ahead and explore areas for future research that could help us better understand how the key structural forces of population ageing, the green transition, the reshaping of

global trade and the continuing expansion of the digital economy and AI may shape Canada’s productivity challenges, in what is now no longer a far away long-term horizon but increasingly a near term reality.

Trends in Productivity Growth in Canada

In this section, we take stock of Canada’s productivity growth in the past four decades. We begin by looking at the long-term trends, and how productivity growth can be sorted into within-sector growth or

sectoral shifts. We then more closely examine the productivity challenges since the pandemic, including large swings in labour and its implications for recent productivity dynamics. To round out our comparative assessment, we also provide international perspectives on Canada’s productivity performance.

Long-term trends in productivity growth – Within-sector growth versus. sectoral shifts

Canada’s productivity performance has been a source of concern spanning several decades. Business sector productivity was strong during the 1960s, 1970s, and early 1980s, with an average rate of 2.8 per cent from 1961 to 1985. Following this period of strong growth, a discernible slowdown began to emerge, with productivity growth averaging 1.4 per cent leading up to the Financial Crisis. This rate of growth further decelerated to 1.0 per cent following the 2008 Financial Crisis, through to the 2014-2015 commodity prices shock. This period saw Canada’s economy subjected to the negative impact of declining commodity prices, with productivity growth declining further to an average of 0.7 per cent leading up to the pandemic (Table 1).⁶

Although a complex set of factors are behind these long-term dynamics of Canada’s productivity growth, a sectoral decomposition provides interesting per-

spectives for how productivity at the sectoral level shapes aggregate productivity growth. Several methods exist for the constructing decompositions. For example, De Avillez (2012) employs three different versions to untangle the sectoral contributions to Canadian growth over the 2000-2010 period and finds these methods provide complementing rather than competing views. For this exercise, this article uses a method developed by Almon and Tang (2011) that break apart productivity growth into within-sector effects and effects driven by changes in the “economic significance” of sectors (also referred to as “shift effects”, they are size changes in terms of resource use and output valuation). Changes in the economic significance, capture traditional real-value-based reallocation effects as well as changes in the sector’s importance due to its output becoming relatively more (or less) valuable. In this respect, the Almon and Tang (2011) method differs from more traditional decomposition approaches by incorporating the role of nominal price shocks in shaping productivity growth. Extended discussions on how these differences in methodology affect the sectoral decomposition is beyond the scope of this article. For more details on various decomposition approaches.⁷

Table 1 parcels-out business sector productivity growth based on 15 2-digit NAICS sectors. It also tracks growth across various time spans; while the earliest pe-

⁶ The decline in commodity prices can cause the influence of the resource sector in aggregate productivity to decline. Given that this sector has relatively higher productivity levels, the resulting compositional change would drag aggregate growth even as growth in the sector rises as lower productivity opportunities in the sector shutdown.

⁷ See De Avillez (2012) and and Reinsdorf (2015).

Table 1: Decomposition of Labour Productivity Growth, Business Sector, 1961-2019

	Average annual percentage-point contribution to the labour productivity growth rate			
	1961-1985	1985-2007	2007-2014	2014-2019
Within-sector effects	2.6	1.4	1.0	1.1
Shift effects	0.2	-0.0	0.1	-0.5
Total	2.8	1.4	1.0	0.7

Source: Statistics Canada Table 36-10-0208-01. Authors' calculations.

Notes: Decomposition based on the methodology from Almon and Tang (2011). Annual average calculated by performing the decomposition for each year and averaging over the period. Totals may not add up due to rounding .

riod summarizes a span with growth considered high by today's standards, later periods are punctuated by notable years such as 2007 (the peak before the Great Recession), 2014 (roughly the turning point in resource prices), and 2019 (the year prior to the start of the COVID-19 pandemic). Overall, for most periods, aggregate growth is driven by the growth within each sector while shift effects generally play a minor role. In other words, the decline in overall productivity growth in Canada over time has been mainly due to the decline in productivity growth within each sector. For instance, the within-sector effects declined significantly from 2.6 per cent in the 1961-1985 period to around 1.0 per cent by 2007-2014 while aggregate productivity growth in the business sector fell from 2.8 per cent to 1.0 per cent between the two periods.

However more recently, over 2014-2019, shift-effects have become a much more significant factor behind aggregate productivity growth. In particular, within-sector effects were slightly higher in 2014-2019 than in 2007-2014 (1.1 per cent versus 1.0 per cent), however, due to sizable negative shift-effects (-0.5 per cent versus 0.1 per cent), the overall average annual productivity growth over 2014-2019 was below that of 2007-2014. This negative shift-effect was mainly driven by the resource

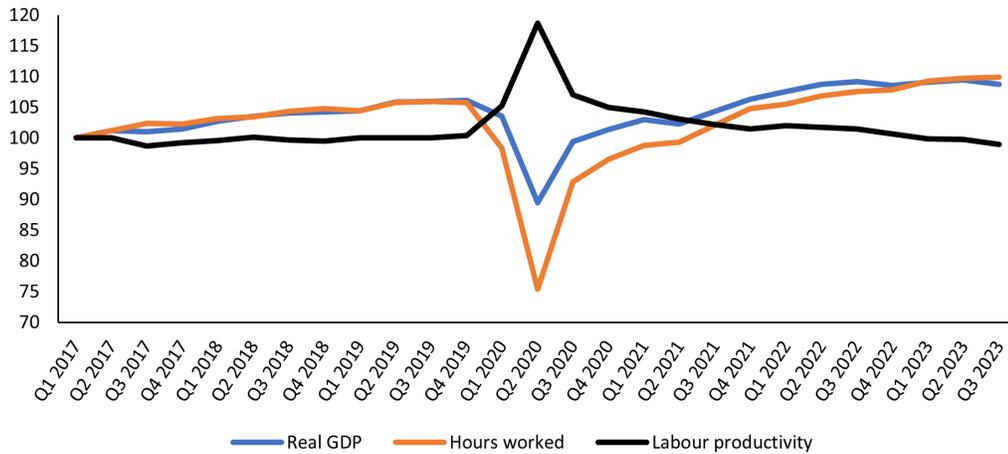
sector, which experienced a significant negative price shock over the period. A more detailed breakdown of the decomposition is located in Appendix Table 1.

The experience over 2014-2019 could hold lessons for the future productivity growth in Canada. If the global economy becomes more volatile, inflicting various nominal price shocks on a small open economy such as Canada's, shift-effects could become an increasingly important influence on the aggregate productivity growth. Nevertheless, given aggregate productivity growth continues to be influenced relatively less by from shift effects, improving within-sector performance remains crucial. In Section 3, we explore some of the economic trends that could be a source of shocks to Canada's economy. More research around these trends will help us better understand the prospect for Canada's future productivity growth.

Post-COVID-19 Trends in Productivity Growth for Canada

More recently, during the COVID-19 Pandemic, Canada experienced significant productivity fluctuations. Year-over-year business sector productivity growth in 2020 spiked at 8.6 per cent (7.8 per cent for the total economy) before subsequently declining by 5.8 (5.1) and 1.5 (1.0)

Chart 2 : Real GDP, Hours Worked, and Labour Productivity, Business Sector, 2017Q1 to 2023Q3, 2017Q1=100)



Source: Statistics Canada Table 36-10-0206-01. Authors' calculations.,

per cent respectively in 2021 and 2022. This was driven by disruptions caused by COVID-19, which led to sharp changes in hours worked, which were a more important driver of productivity growth than changes in value-added (Chart 2). Labour productivity growth has continued its decline from the COVID-19 high and is now lower than its pre-COVID level. By the third quarter of 2023, Canada's productivity in the business sector had fallen to a level not seen since 2017 (2018 for the total economy). Since the trough of the pandemic in the second quarter of 2020, total hours worked have increased faster than growth in real GDP highlighting the driving role growth in hours has played in driving the declining trend in Canada's labour productivity growth.

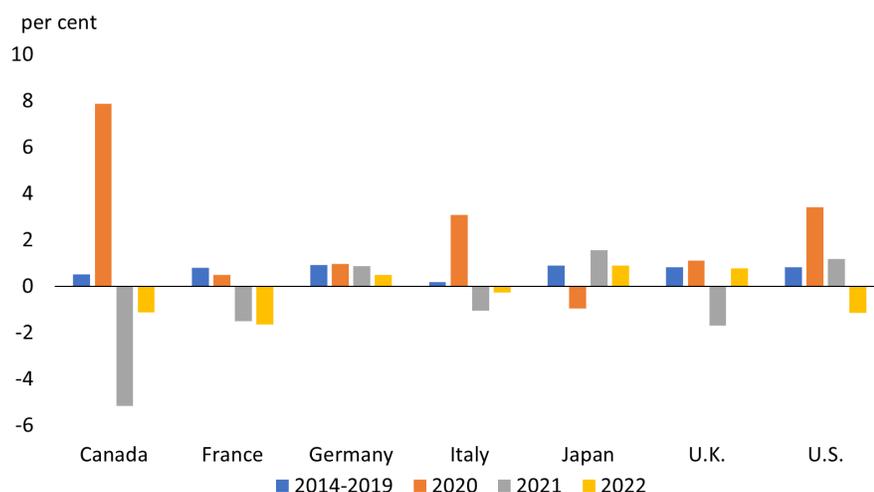
This general pattern is seen in other advanced economies to varying degrees (Chart 3). In Canada as in the United States, this initially seems to have been related to the disruptions from compositional effects from COVID. COVID-19 initially affected relatively more workers

in non-essential activities (e.g., hospitality and personal services) that also tend to be less productive than essential activities, and Wang (2021) shows that that this composition change helped drive the spike in Canada. A similar story is suggested by Stewart (2022) for the United States in that the increase in productivity was due to labour quality increases arising from initial steep job losses focused on lower-wage industries.

More broadly, COVID's disruptions in hours worked would not only have influenced productivity growth through compositional effects on labour quality. It would have also affected growth if it disproportionately affected workers in less capital-intensive jobs. In Canada, the effects are seen in the recent contributions to productivity growth from labour composition and capital deepening.

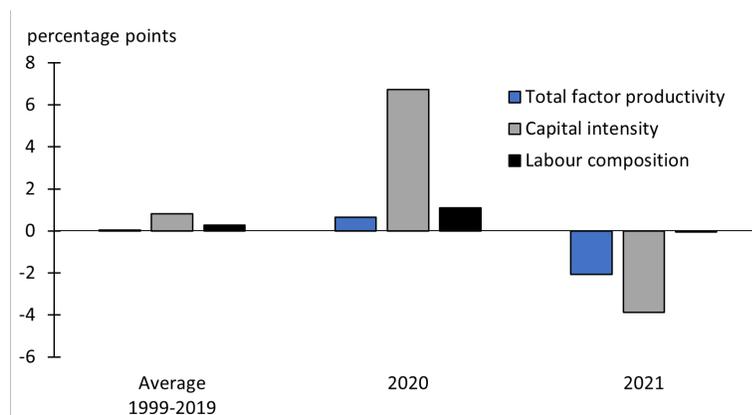
Generally, national statistical agencies decompose drivers of labour productivity growth, which are typically sorted into growth in labour quality (or composition), capital intensity and changes in total factor

Chart 3 :Annual Labour Productivity Growth, Total Economy – G7 Countries)



Source: OECD Productivity and ULC – Annual, Total Economy database, Authors’ calculations
 Note: Labour productivity reflects GDP per hour worked in the total economy. Annual growth rates reflect the geometric average over the 2015-2019 period or the year-over-year percentage change in productivity.

Chart 4 :Percentage Point Contribution to Average Annual Labour Productivity Growth by Factor for Canada, Business Sector, 1999-2021



Source: Statistics Canada Table 36-10-0208-01. Authors’ calculations.
 Note: The sum of contributions from each factor (i.e., TFP, capital intensity, and labour composition) equal annual average labour productivity growth.

productivity (TFP). Labour quality refers to the distribution of education and skills of the workforce, capital intensity refers to the ratio between capital and labour, and TFP is essentially what is left after accounting for measurable capital deepening and changes in labour quality—generally assumed to capture technological (potentially including those embedded in capital) and process advancement.

While labour composition contributed around 0.3 percentage points on average to labour productivity growth in Canada’s business sector over the 1999-2019 period, this rose to 1.1 percentage points in 2020. More starkly, capital deepening saw its contribution increase from 0.8 percentage points between 1999 and 2019 to 6.7 percentage points in 2020 (Chart 4). Part of this increased contribution in capital inten-

sity could have come mechanically as the decline in hours left fewer workers with the same stock of capital. However, the hours drop-off could also have had a compositional effect like that suggested by Wang (2021) and Stewart (2020) with respect to the type of labour that continued working. If the loss of hours disproportionately applied to occupations or industries with low capital intensity then, this compositional effect would have further raised capital intensity and productivity across the industries that were still operating smoothly .

The continued strong rise in hours worked post-COVID, due to potential factors such as labour hoarding, highlights capital deepening's sizable contribution to productivity at the onset of the pandemic followed by the sharp negative contribution in 2021 as these increases in labour inputs reduced capital intensity. For instance, the current tight labour market may be prompting firms to hire and retain more skilled labour than needed to ensure they have a sufficient supply of workers in the future (i.e., labour hoarding). Recent media reports suggest that the practice of labour hoarding is occurring in Canada as well as in other advanced economies ⁸. While hoarding could improve the resilience of firms and their productivity in the long-run by preserving firm-specific human capital and avoiding future hiring costs, in the short-run it can negatively impact productivity if demand does not keep pace.

More research is needed to determine if labour hoarding is happening and dampen-

ing productivity growth but sectoral data since the onset of COVID may already provide some evidence for this (Table 2). Sectors where skill shortages seem the most acute, thus the most compelling case for labour hoarding, have seen some of the highest labour gains but without commensurate increases in output. For example, from 2019Q4 to 2023Q3, professional services, and information and cultural industries saw respective annualized growth of 6.8 and 3.3 per cent in employment and 6.8 and 2.6 per cent in total hours. However, these sectors saw some of the greatest declines in productivity as real GDP growth was much lower than employment and hours growth. That said, the output gains in these sectors are also some of the highest, suggesting the strong employment growth was not purely driven by labour hoarding, but also by the strong growth of these sectors.

The labour market has played a large role in labour productivity growth post-COVID and may continue to do so over the near-term. However, labour market developments may only have temporary impacts and, with sufficient time to adjust, there is no fundamental barrier to productivity growth as a result of the growth in employment. Over the long run, capital and innovation assume a more important role in determining productivity. In this context, the usefulness of Canada's recent experience for setting expectations about medium term productivity growth is questionable. It remains uncertain when the

⁸ For example, for Canada see: Lord, 2020; Olive, 2023; for the United States: Weiss, 2022; Wallace, 2023; Kemp, 2023; Aeppel, 2023

Table 2: Annualized Quarterly Labour Productivity Growth, 2019Q4 – 2023Q3

Per cent	Real GDP	Employment	Hours	Labour Productivity
Total economy	1.1	1.3	1.2	-0.1
Business Sector	0.6	1.2	1	-0.4
Goods	-0.1	0.8	0.6	-0.7
Agriculture, forestry, fishing and hunting	-3	-3.2	-4.5	1.6
Mining and oil and gas extraction	1.8	1.1	0.8	0.9
Utilities	-1.4	1.8	0.7	-2.1
Construction	0.4	1.8	1.8	-1.4
Manufacturing	-0.5	0.6	0.5	-1
Services	0.8	1.3	1.2	-0.4
Wholesale trade	0.7	1.3	1.1	-0.4
Retail trade	1.7	-0.3	-0.3	2
Transportation and warehousing	-2.3	0.3	-0.3	-2
Information and cultural industries	0.9	3.3	2.6	-1.7
Finance and insurance, and holding companies	1.7	1	0.7	1
Real estate and rental and leasing	-0.4	-2.3	-2.1	1.7
Professional, scientific, and technical services	3.3	6.8	6.8	-3.2
Administrative, waste and remediation	-1.9	0.8	0.9	-2.7
Arts, entertainment, and recreation	-2.3	0.8	0.1	-2.4
Accommodation and food services	-2.1	-0.9	-1.1	-1
Other business services	1.9	2.1	1.8	0.1
Non-business sector and others	2.3	1.7	1.9	0.4

Source: Statistics Canada Table 36-10-0206-01 and 36-10-0207-01. Authors' calculations.

Note: Labour productivity defined on a per-hour basis.

current trend will reverse and how long it will take to recoup the declines in productivity levels that have been experienced. Naturally, the longer this process takes, the more important it becomes to consider whether structural factors are impeding the recovery of productivity.

International Comparison of Long-run Productivity Growth

In addition to the slowing productivity growth over the decades, Canada's productivity has been lagging many of its G7 peers. At the total economy level,⁹ Canada's productivity growth over the 1994-2022 period averaged 1.0 per cent, ahead of Italy and France. Canada's

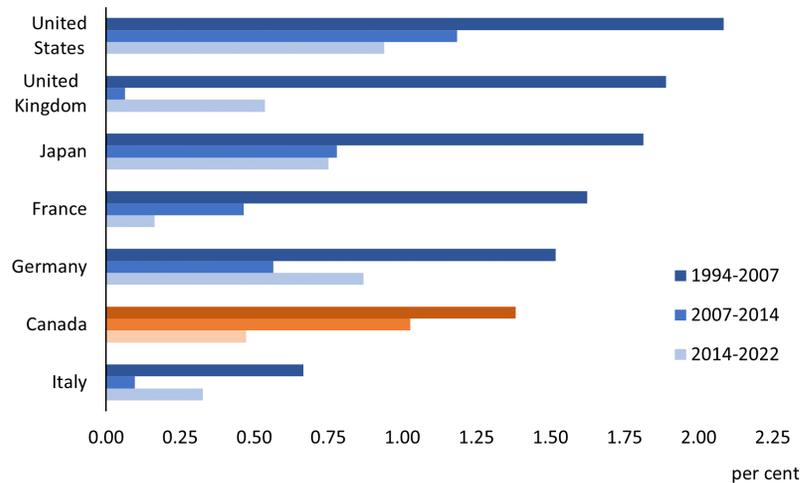
growth was particularly weak in comparison to the United States which experienced annual growth of 1.5 per cent.

However, this long-term view masks periods of relative strength and weakness. From 1994 to just before the Great Recession, Canada's productivity growth ranked second last in the G7, averaging 1.4 per cent per year (Chart 5). Between 2007 and 2014, this growth deteriorated to just 1.0 per cent per year. This decline was broadly experienced by all of Canada's G7 peers and felt by some as early as 2000. And, though no factor can be identified as the cause, some think that it may be due to recent technological advancements not having the same punch to boost productivity as those introduced earlier in the post-

⁹ International comparisons must be made at the total economy level as the OECD data does not have complete coverage of the business sector and the availability of business sector productivity data for Canada in OECD datasets is limited to the period from 2008 to 2019.

¹⁰ This is the technological pessimist opinion most associated with Gordon (2012).

Chart 5 :Labour Productivity Growth, Total Economy – G7 Countries (Average Annual Rate of Change)



Source: OECD Productivity and ULC – Annual, Total Economy database, Authors’ calculations
 Note: Labour productivity reflects GDP per hour worked in the total economy. Growth rates reflect the average geometric growth rate over the three different periods. The base year for these calculations is the first year shown in each label.

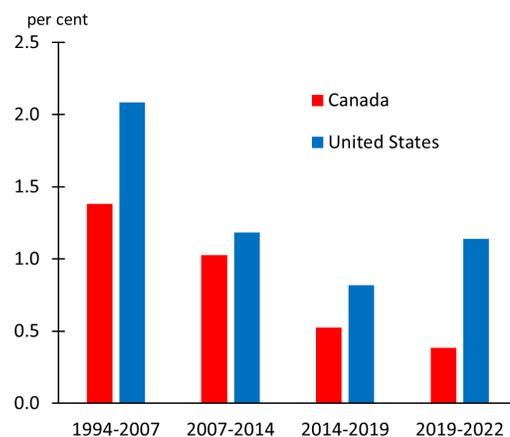
war era.¹⁰ Yet, what is key to understand Canada’s relative performance is that its decline was small, allowing its performance to improve to second in the G7 during the 2007-2014 period.

Canada’s relative improvement in productivity growth after the 2008-09 Financial Crisis was notable enough that it led some to anoint Canada as one of the leaders among G7 countries (Tang and Wang, 2020). However, this was short lived. The relatively stronger productivity growth in Canada that followed the Financial crisis soon slowed in 2014, partly as a result of an economic shock due to the sharp decline in commodity prices, and continued until the beginning of the pandemic. Although productivity in Canada surged during the first year of the pandemic, it then normalized as hours worked rebounded faster than output. But well after the initial economic recovery, labour productivity continued to trend downwards, contracting over the last

few quarters. All in all, Canada’s productivity growth over 2014-2022 has declined to 0.5 per cent and ranks fifth in the G7 over this period, only ahead of Italy and France.

A similar trend is seen when comparing Canada to the United States (Chart 6). From 1994 up to the Financial Crisis, U.S. productivity growth was about 0.7 percentage points higher than in Canada. Between 2007 and 2014, while Canada’s productivity growth declined modestly, the United States experienced a larger deceleration in productivity growth which narrowed the Canada-United States gap. However, in the wake of falling commodity prices in 2014-2015, Canada’s performance relative to the United States was on the decline again, similar to how it performed relative to other advanced economies (Chart 5). This gap has continued to widen over the pandemic and subsequent recovery with the percentage-point gap over 2019-2022

Chart 6 :Labour Productivity Growth, Total Economy – Canada and the United States (Average Annual Rate of Change)



Source: OECD Productivity and ULC – Annual, Total Economy database, Authors’ calculations.
 Note: Labour productivity reflects GDP per hour worked.

reaching back to the level last seen over 1994-2007.

As a result, productivity levels compared to the United States have deteriorated significantly over time. Chart 7 shows that Canada’s productivity relative to the United States has declined 16 percentage-points from the mid-1980s, when Canadian productivity was just shy of 90 per cent of the U.S. level, to 2022, where it stood at 72 per cent. Canada’s relative productivity dipped to a low of 71 per cent in 2010 but plateaued around 74 per cent from 2015 to just before the pandemic.

Investment and Productivity Growth

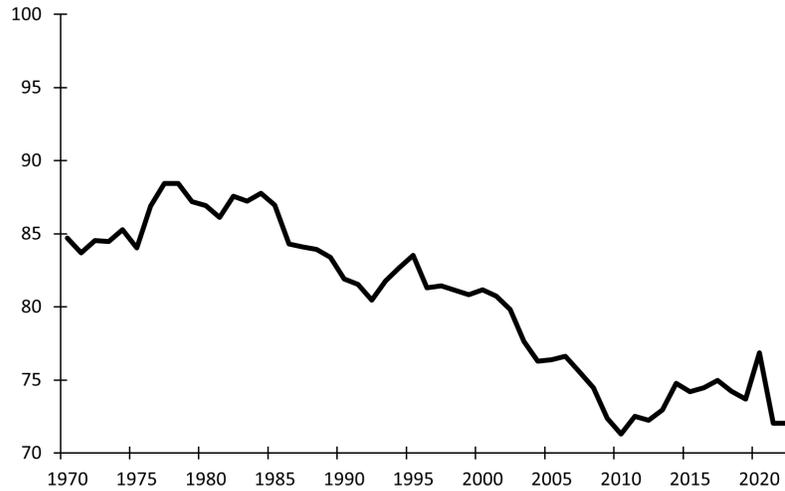
A lack of investment in Canada is often cited as a key driver of its poor productivity performance vis-à-vis other advanced economies. The story is complex and there is a tendency for commentators to place excess focus on the objective of boosting investment for the sake of boosting in-

vestment. For example, many would be surprised that the contribution of productivity growth from capital deepening was about the same in Canada as in the United States between 1999 and 2019 with only 0.06 percentage-point difference on average (Chart 8). The contribution of TFP to labour productivity growth was, however, much weaker in Canada with a 0.76 percentage point gap compared to the United States over the period. Although difficult to estimate, some of this is due to weaker investments in Canada in the types of capital (such as Information and Communications Technologies, ICT) that would have the capacity of boosting TFP and how well capital investments are exploited by Canadian businesses.

International Comparison of Long-run Productivity Growth

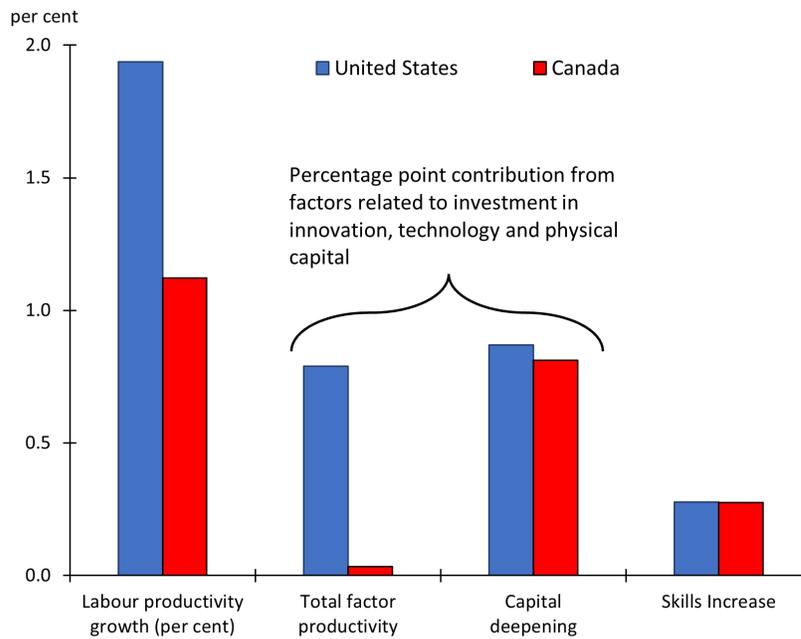
A major shortcoming in Canada’s investment performance has been lagging investments in productivity-enhancing tech-

Chart 7: Canada-United States Relative Labour Productivity Level, Total Economy, 1970-2022 (United States = 100)



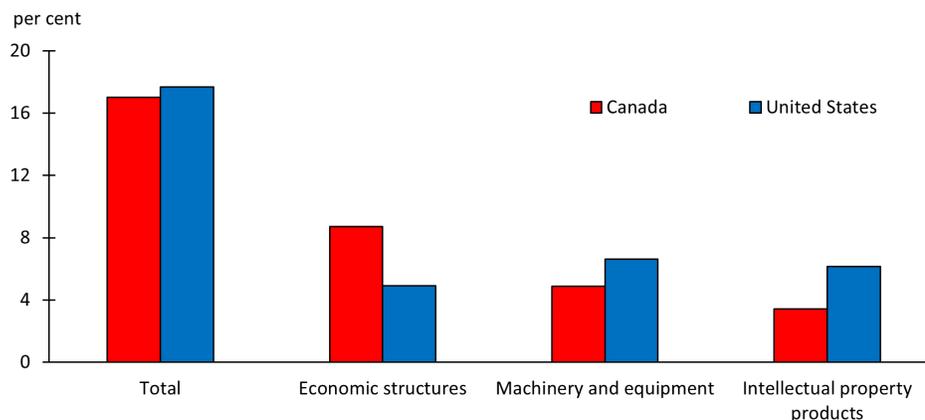
Source: OECD Productivity and ULC – Annual, Total Economy database, Authors’ calculations Note: Labour productivity reflects GDP per hour worked. Relative productivities are evaluated in constant prices and adjusted for purchasing power.

Chart 8: Canada-United States Decomposition of Labour Productivity Growth in the Business Sector*, 1999-2019



Source: Canada: Statistics Canada Table 36-10-0208-01; United States: U.S. Bureau of Labour Statistics, Authors’ calculations.
 Note: Labour productivity reflects real GDP per hour worked. *Data reflects growth in the business sector for Canada and the private business sector for the United States

Chart 9: Non-residential Investment Intensity by Type of Investment – Canada and the United States, 2019



Source: OECD and authors' calculations.

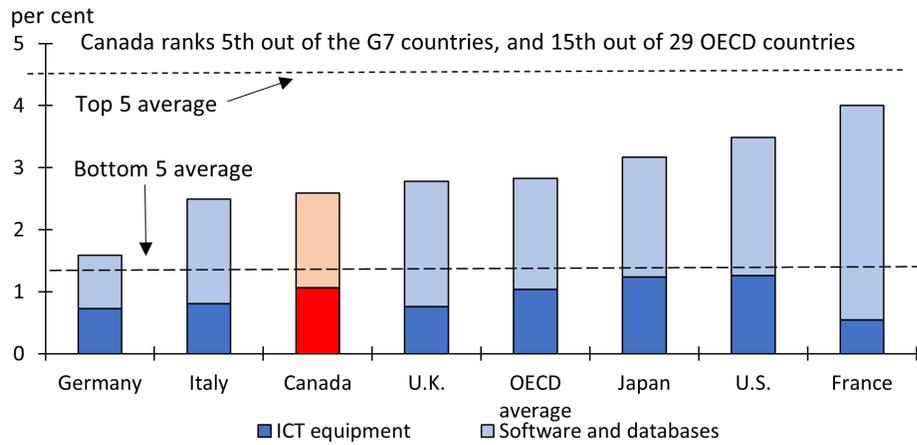
Notes: Investment intensity is calculated by dividing nominal investment by gross value added for the total economy. Canadian gross value-added data is adjusted using GDP PPPs, while Canadian investment data is adjusted using nominal gross fixed capital formation PPPs. Does not include investment in dwellings.

nologies such as machinery and equipment (M&E) and intellectual property products (IPP). When looking at total investment (gross fixed capital formation – construction excluding dwellings, M&E and IPP – by all sectors) intensity in Canada compared to the United States, there is only a small difference (17.0 vs. 17.7 per cent of nominal PPP-adjusted GDP). However, this masks significant differences in the composition of investment. While Canada has significantly higher investment intensity in economic structures (i.e. non-dwelling structures) due in part to its relatively larger resource extraction sector, it has significantly lower investment intensity in IPP (e.g. investment in research and development, or software and databases) and M&E (e.g. transportation and ICT equipment) (Chart 9). Lower investment intensity in these assets was seen across most industries, including the manufacturing and the ICT sectors. This is not to say that investment in structures is not important for

productivity. However, investment shortfalls in M&E and IPP underweights the direct link these investments can make to an individual worker's productive capacity as they provide tools necessary to implement new ideas and become more productive in a technology-driven economy.

Canada's poor investment performance in key capital assets is not limited to the comparison to the United States. For instance, with M&E investment intensity at 4.5 per cent, Canada was ranked nearly last among 33 OECD countries over 2015-2019 (Chart 10). Canada does slightly better when examining ICT investment, including both ICT hardware and software (Chart 11). In ICT investment intensity, Canada ranked around the middle of OECD countries and 5th out of the G7 countries. However, the overall ICT investment figure is mostly driven by the relatively better performance in physical ICT equipment (3rd among the G7), rather than intangible ICT assets such as software and databases.

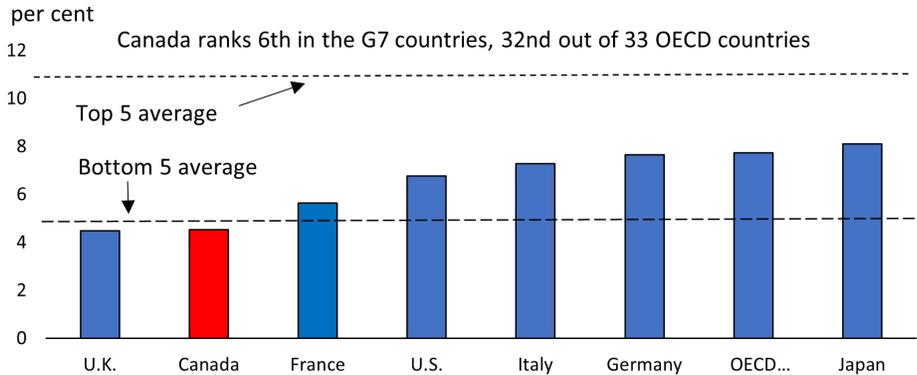
Chart 10: Average Annual Machinery and Equipment Investment Intensity G7 Countries, 2015-2019



Source: OECD and authors' calculations.

Notes: Investment intensity is calculated by dividing machinery and equipment and weapon systems investment by gross value-added for the total economy. OECD countries are only included if they have data for every year under consideration. Top 5 and bottom 5 are among the countries with data.

Chart 11: Average Annual ICT Equipment and Software and Database Investment Intensity G7 Countries, 2015-2019



Source: OECD and authors' calculations.

Notes: Investment intensity is calculated by dividing ICT equipment and software and database investment by gross value-added for the total economy. OECD countries are only included if they have data for every year under consideration for both ICT and software and database investment. Top 5 and bottom 5 are among the countries with data, and their averages reflect total rate of ICT equipment and software and database investment rates.

When looking only at those two assets, Canada is second last in the G7.

Sectoral Composition and Investment Intensity

There are several factors that could be behind Canada's weak investment performance, some of which we explore in Section 4. However, one factor that does not seem to be a major driver of this weak investment performance is the sectoral composition of Canada's economy. Although some sectors naturally invest more in M&E and IPP than others, Canada's weak investment is broad-based and does not appear to be purely driven by its sectoral composition.

Charts 12 and 13 show the differences in investment intensities in M&E and IPP between Canada and the United States decomposed into the difference in sectoral composition (structural effect) and within sector gaps (intensity effect). The results show that within sector intensity gaps rather than structural effects are the main factor behind Canada's weak investment performance vis-à-vis the United States. Of the 3.3 percentage-point gap in IPP investment between Canada and the United States in 2019, almost 80 per cent of it is due to intensity effect. Similarly, all of the 2.3 percentage-point gap in M&E investment intensity is due to intensity effect.

These results highlight the significant gap in investment performance for Canada as compared to other advanced economies and the broad-based need to improve the investment intensity across sectors. Will the situation for Canada be better in the post-COVID world? So far, Canada's eco-

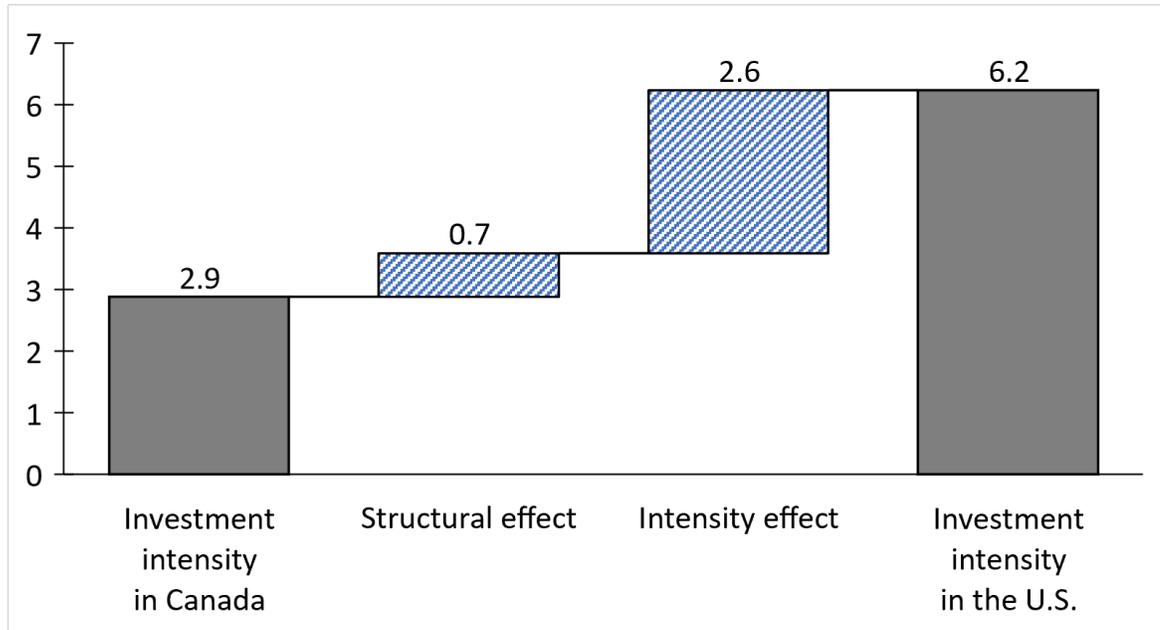
nomical recovery has been driven by growth in employment, and a corresponding increase in investment has yet to materialize. One might expect that investment would catch up to allow for a rebalancing of the capital to labour ratio. With a steep rise in employment, the marginal productivity of capital increases, which should create greater incentives for investment, and as time progresses, more investment could take place in Canada.

That said, there are also headwinds against investment in the current economic environment. The cost of capital has risen with the increases in the interest rate. Although real wage growth has been stronger lately, making investment more attractive, the rise in capital cost has been as high, if not higher, potentially offsetting investment incentives. Adding to these headwinds is Canada's long-standing weak investment performance, driven by the poor performance within each sector. Regardless of the near-term advantages or challenges, it is important to understand potential factors behind Canada's broad-based long-standing poor investment performance, some of which are explored in the next section.

Potential Factors behind Investment and Productivity Performance

No one factor is responsible for Canada's low investment and weak productivity performance on its own; various components shaping the country's economic environment contribute to these issues. These factors are often interrelated and self-reinforcing, for example some of the fac-

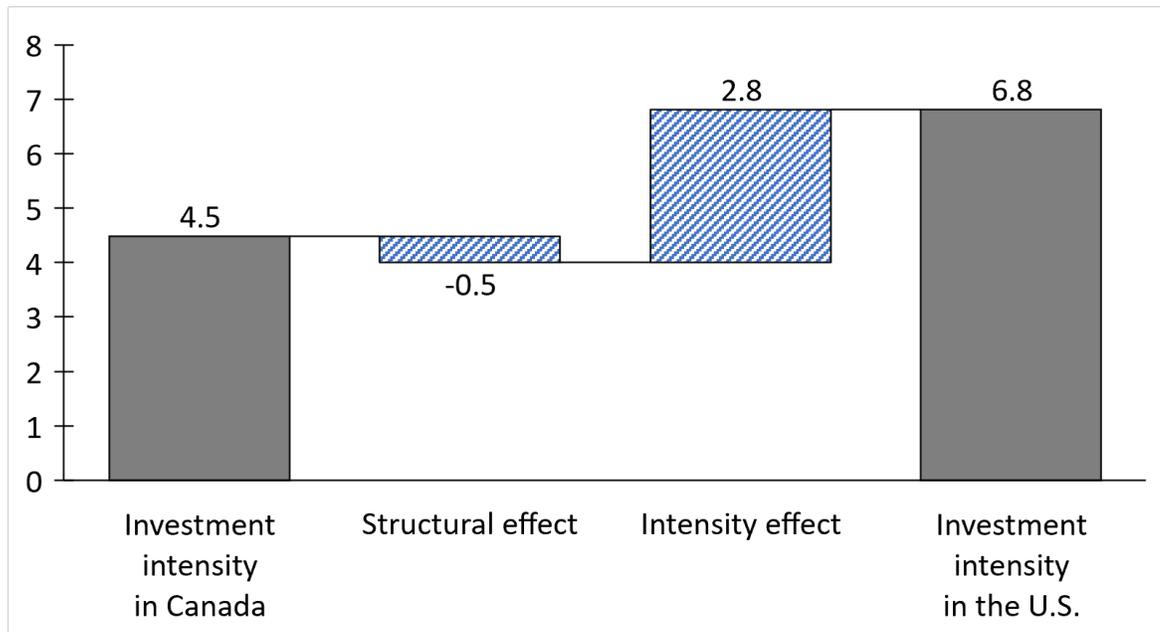
Chart 12: Decomposition of Intellectual Property Products Investment Intensity – Canada and the United States, 2019



Source: OECD and authors' calculations.

Notes: Investment intensity calculated by dividing gross capital formation by gross value added in that industry. Canadian data is adjusted using 2017 PPPs. Business sector investment excludes public administration, education, and human health and social work activities.

Chart 13: Decomposition of Machinery and Equipment Investment Intensity – Canada and the United States, 2019



Source: OECD and authors' calculations.

Notes: Investment intensity calculated by dividing gross capital formation by gross value added in that industry. Canadian investment data is adjusted using 2017 PPPs. Business sector investment excludes public administration, education, and human health and social work activities.

tors highlighted below are a symptom of weak competition, while others are likely contributing to weakness in competition. Some factors are observed across many advanced economies, others are more unique to Canada. Further still, some of these factors have worsened over the last decade, while others are more static but their impacts may have been amplified due to other ongoing trends (e.g., interactions between market size and growing importance of agglomeration and network economy).

In this section, we examine various potential factors behind the poor investment and productivity performance, namely:

- Small market size and dispersed markets;
- Regulatory framework;
- Large presence of small firms;
- Zombie firms in Canada;
- Growing gap between frontier and non-frontier firms;
- Skills and skill mismatch; and
- Management education.

The factors are not listed by order of importance and are by no means exhaustive. We have selected them in part to highlight the diversity of likely factors and draw focus on the difficulties inherent in addressing these areas of concern. Some factors such as regulatory issues could be addressed through direct policy changes while others such as an abundance of small firms pose more nuanced challenges.

Small Market Size and Dispersed Markets

Canada is a relatively small country with markets scattered across a large landmass, limiting economies of scale in local markets. For instance, the Quebec City-Windsor

corridor, the most densely populated area in Canada, is 1100 km long representing a large distance between major cities. Vancouver, which is the third largest city in Canada, is nearly 1000 km away from the next major city, Calgary. Although free trade and modern transport and communications have greatly alleviated this challenge, the literature has shown that the international borders and distances between cities can still pose barriers to productivity growth.

Ahrend *et al.* (2017) finds that a 10 per cent rise in the distance-weighted count of city residents within a 300 km radius is associated with a 0.1–0.2 per cent increase in productivity. This implies that cities can, to some extent, leverage the agglomeration of their neighboring counterparts. Likewise, OECD (2015) finds that spillovers from larger cities to smaller cities and surrounding regions are significant. In particular, population growth in smaller municipalities is higher the closer they are to large cities while cities with more than half a million inhabitants experience significantly higher growth than those without a large urban centre.

The impacts of distance and density seem to also apply to innovation and investment performance as they ease search frictions in labour and product markets, which helps with attracting high-skill workers, facilitating economies of scale, and fostering start-up communities. Carlino and Kerr (2015) find that there are positive innovation spillover effects of being within one mile of another company in one's own industry, which is at least 10 times greater than the positive effect realized when locating two to five miles away. Turning

to investment, research based on German data estimates that the probability of a financing relationship decreases if the journey time increases (Lutz *et al.*, 2013).

Regulatory Framework

Regulations are critical for protecting consumers, the environment, and social objectives. Regulations also have an essential role to play in providing certainty to businesses seeking to make investments. Ensuring that regulation is well tuned to meet multiple objectives and balance appropriate trade-offs poses a challenge for all governments. An excessively restrictive regulatory environment has clear consequences for business costs, competitiveness, and investment incentives. This direct effect receives much of the attention and call for action. However, poorly tuned regulation can also have potentially more negative effects on competition in cases where they limit contestability by presenting barriers to entry.

The OECD's Product Market Regulation (PMR) index attempts to provide a measure of the restrictiveness of regulations in terms of deviation from best practices. At the economy wide level Canada's regulatory system ranks in the bottom 5 among OECD countries (2018 PMR Index). Of particular concern are regulations that raise barriers to trade and investment (e.g. barriers to FDI, barriers to trade facilitation, and differential treatment of foreign suppliers) as these can limit competition and opportunities for technology spillovers from abroad in important areas of the economy. Improving regulations could have significant positive impacts on pro-

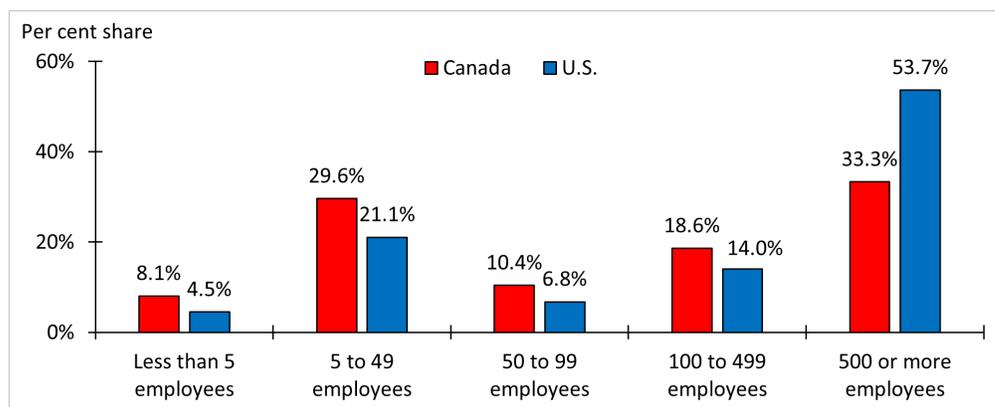
ductivity growth. Iorwerth and Rosell (2018) estimate improving the general competitiveness of regulations in Canada (as measured in the PMR) to the standard of better performing peers like the United States has the potential to raise GDP per capita by as much as 5.3 per cent in the long-run.

The challenges of establishing efficient and well-balanced regulations in Canada is made more difficult by the division of regulatory authorities across Canada's different levels of government. This is most apparent in the area of inter-provincial trade and labour mobility where despite improvements over the years, regulatory difference between provinces and territories continue to inhibit the potential for productivity gains through lower costs, greater economies of scale, and improvement in allocative efficiency. The impacts on productivity from regulatory misalignments and other barriers to internal trade is difficult to assess but could be significant. For example, the Bank of Canada (2017) estimated that a 10 per cent reduction in internal trade barriers in Canada introduced in 2018 could increase potential output growth by an average of 0.2 percentage points per year out to 2020. Likewise, an International Monetary Fund study by Alvarez *et al.* (2019) estimates that a complete removal of internal trade barriers in Canada could increase GDP per capita by as much as 4 per cent.

Large Presence of Small Firms

Canada has a large number of small firms, and when compared to the United States a larger portion of our labour force is

Chart 14: Distribution of Employees by Enterprise Size, Non-agricultural Business Sector, 2019



Sources: Statistics Canada Table 14-10-0215-01. U.S. Census Statistics of U.S. Businesses. Authors' calculations.

Notes: Unclassified businesses and Agriculture (NAICS 11) are excluded. Public Administration (NAICS 91) is excluded from Canada to align with U.S. Private Sector estimate. Enterprises with over 500 employees in Educational Services and Health Care (NAICS 61 and 62) in Canada were excluded, as they were assumed to be public sector enterprises. Employee counts exclude enterprises without paid employees.

concentrated in small firms (Chart 14). In Canada, large firms (500 or more employees) only accounted for one-third of employment while the figure was more than half for the United States in 2019.

This high concentration of resources tied to small firms could be contributing to Canada's poor productivity performance as small firms tend to be less productive on average compared to larger firms, in part as a function of their limited ability to benefit from economies of scale. For example, Baldwin *et al.* (2014) find that, in Canada, small firms (i.e., those with less than 500 workers) were 47 per cent as productive as large firms (i.e., those with 500 or more workers). As a result, they estimate that the relative abundance of smaller firms in Canada and their much lower productivity compared to large firms account for about 60 per cent of the aggregate labour produc-

tivity gap between Canada and the United States countries in 2008 . In the same research, large Canadian firms performed relatively on par with their U.S. counterparts, although the data used in the study is now quite dated and since then the United States has seen the emergence of a number of super-star firms in high-tech sectors.

The large presence of small firms in Canada may have more significant implications than their own contributions to the aggregate productivity. Research has shown that there could be congestion effects among firms, where they compete for inputs in short supply (e.g. labour), and having a large number of unproductive small firms competing for the resources that can be used by more productive firms may hinder the latter's performance.¹¹ Such congestion effects could also pose as a barrier to scaling-up by produc-

11 For example, Banerjee and Hofmann (2020) find that zombie firms, which tend to be smaller, create congestion effects by competing for resources that negatively affect other firms and reduce aggregate productivity.

tive small firms, which in turn, would hinder their ability to challenge large firms and may end up creating a fragmented marketplace with lower aggregate productivity as a result. We explore these issues further in the next two subsections (4.4 and 4.5).

Zombie Firms in Canada

There has been a growing interest in understanding the effects on aggregate productivity from firms that are systemically underperforming from a financial perspective (Hoshi, 2006; Acharya *et al.*, 2019; Carreira *et al.*, 2022). These firms are colloquially referred to as zombie firms and are commonly defined as at least 10 years of age with earnings less than interest payments for three consecutive years (Amundsen *et al.*, 2023), although various definitions exist in the literature. These zombie firms weigh on aggregate productivity growth both directly as they tend to be less productive than healthy firms, and through their impact on allocative efficiency as their failure to exit traps resources that would be otherwise used by more productive firms.

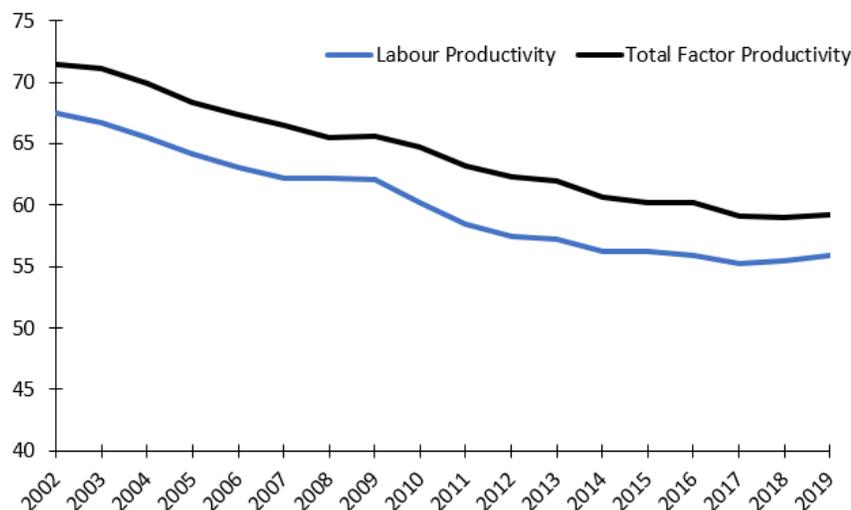
Thus far, much of the research on zombie firms in Canada has focused on Canada's relatively small number of publicly traded firms. This research finds that as in other countries Canada has seen an increasing prevalence of zombie firms. Banerjee and Hofmann (2020) estimate that the share of zombie firms increased from about 5 per cent in 1985 to 35 per cent in 2017. Likewise, Altman *et al.* (2021) estimate the share increased from 4 per cent to 25 per cent between 1990 and 2021. However, a recent working paper by researchers at Statistics Canada and the Department of

Finance Canada (Amundsen *et al.*, 2023) which leverages the universe of firms in Canada, puts the share at between 5 to 7 per cent of all firms and finds that rather than an increasing prevalence of zombie firms in Canada, it is their worsening productivity performances relative to healthy firms that is of greater consequence for aggregate productivity.

Amundsen *et al.* (2023) finds that when looking at the universe of firms in Canada, the share of zombie firms did not materially increase between 2002 and 2019, although they are more prevalent in some industries than others (e.g., Arts, entertainment, and recreation; Mining, quarrying and oil and gas extraction; Real estate and rental leasing; Wholesale trade). However, the relative productivity of zombie firms to healthy firms declined substantially over the period from 67 per cent to 56 per cent (72 to 59 per cent when for TFP) (Chart 15). All told, the presence of zombie firms is estimated to have reduced the aggregate level of labour productivity by 4 per cent in 2019, up from 2 per cent in 2002. This is a large effect. For example, based on the estimate for 2019, the implied gains from eliminating zombie firms would equate to more than \$2,800 per person and would be of the same order as the estimated gains from complete liberalization of internal trade in goods in Canada as suggested by Alvarez *et al.* (2019).

Amundsen *et al.* (2023) also show that an increasing share of zombie firms within an industry could negatively impact the performance of the industry as a whole. The results show as the capital and payroll share of zombie firms increase, labour productivity declines at a rate of 0.6 and

Chart 15: Labour Productivity of Zombie Firms Relative to Healthy Firms in Canada, 2002-2019



Amundsen, Lafrance-Cooke, and Leung (2023).

1.0 percentage points, respectively, for each 1 percentage point increase in share. Although these results only imply a correlation, not necessarily causation they do provide some suggestion that the presence of zombie firms could be affecting the performance of healthy firms.

Growing Gap between Frontier and Non-frontier Firms

Just as zombie firms are falling increasingly behind healthy firms in productivity, frontier firms (i.e. firms that are at the leading edge of their respective industries in terms of productivity) are pulling farther ahead.¹² OECD analysis by Andrews *et al.* (2015)¹³ has highlighted the

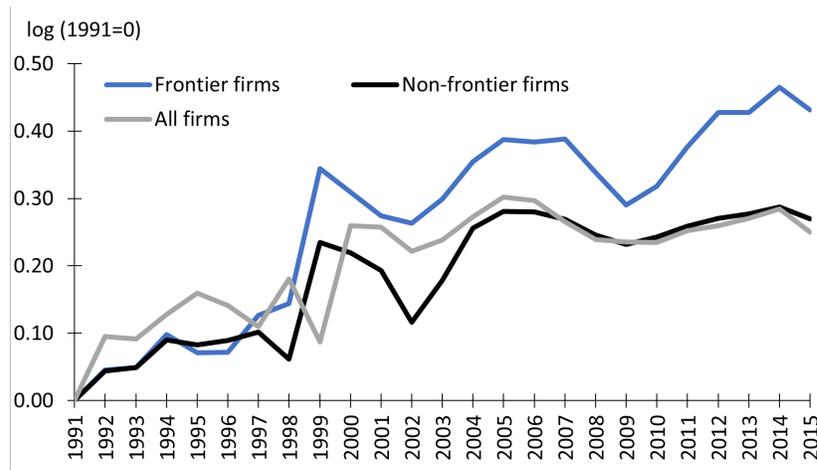
productivity gap between non-frontier and frontier firms as a factor behind productivity slowdown observed in many OECD countries after 2000. This line of research suggests that slowing technology diffusion from global frontier firms to national frontier firms, which in turn slow down technology diffusion from national frontier firms to national non-frontier firms, may have been a factor behind the productivity slowdown observed in advanced economies.

Research conducted by Statistics Canada provides a similar insight for Canada. In particular, Gu (2020) shows lower productivity growth of national non-frontier firms in Canada accounted for about 90 per cent of the decline in Canadian aggregate productivity growth be-

¹² The definition of frontier firms varies in the literature. The OECD (i.e., Andrews *et al.*, 2015) defines frontier firms using an absolute measure. Specifically, “global” frontier firms are the top 50 or 100 globally most productive firms within each year in each industry while “national” frontier firms are the top 10 most productive firms nationally each year within each industry. In contrast, Gu (2020) uses a relative measure. It defines national frontier firms as the top 10 per cent most productive firms in an industry each year. Gu (2020) focuses on Canadian firms and cannot consider global frontier firms.

¹³ This analysis used firm-level data across selected OECD countries. However, Canadian data was not included.

Chart 16: Labour Productivity of Frontier and Non-frontier Firms, 1991-2015



Source: Gu (2020).
 Note: Log values of labour productivity are set to 0 in 1991.

tween the 1991-2000 and 2000-2015 periods. However, in contrast to the OECD study that finds evidence of strong catch-up from national non-frontier firms since the early 2000s, Gu (2020) finds that the productivity gap between the most and less productive in Canada has actually increased, continuing the trend observed before 2000 (Chart 16).¹⁴

The increasing performance gap between frontier and non-frontier firms is a concern because it could affect incentives for non-frontier firms to invest. Bérubé *et al.* (2012) find that, in the manufacturing sector, competition’s influence to spur research and development (R&D) diminishes as the distance to the frontier grows. This result would be consistent with Gu (2020), in that a widening productivity gap between frontier and non-frontier firms could

be because of the difference in investment and innovation performance. This could be driven by a declining incentive and capacity to compete against frontier firms as the gaps in productivity increases.

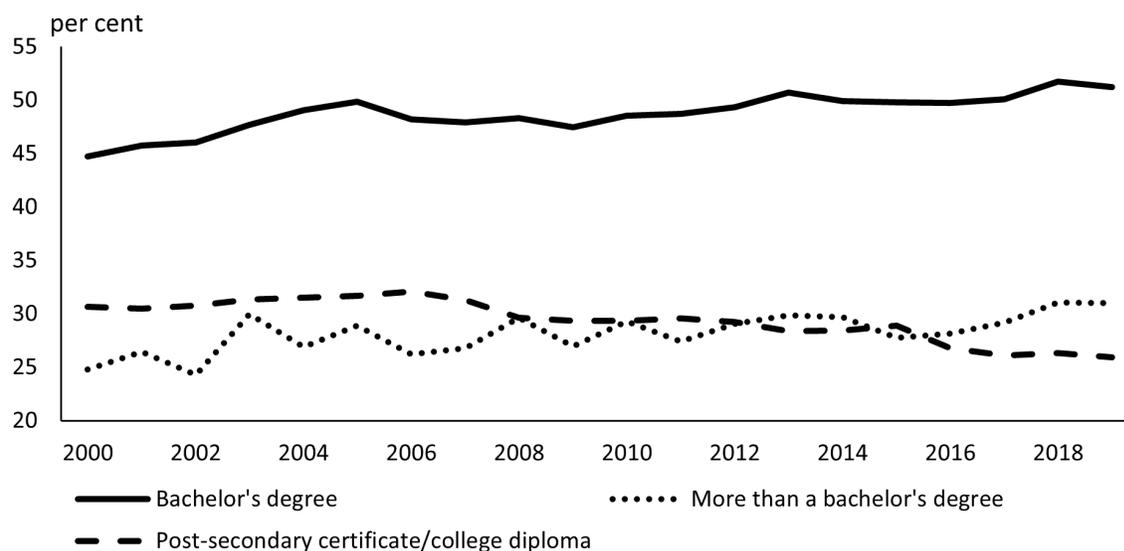
Skills and Skill Mismatch

Canadians are very well educated—the share of post-secondary educated Canadians in the 25 to 64 age group increased from 39 per cent in 1999 to 59 per cent in 2019, the highest share in the OECD and well above close peers like the United States (48 per cent in 2019). However, the story is more complex than these statistics suggest on their own. Canada sat behind our OECD peers in 2019 in terms of higher education ranking 18th out of 38 OECD countries in terms of the share of the population aged 25-64 with a university level

14 Andrews *et al.* (2015) contend that while diffusion is slow, the technology bottleneck resides where technologies make their way from the most productive firms globally to the most productive firms in each country.

15 In the OECD, Canada has the highest share of people who have attained a non-university post-secondary education (e.g., certificates or diplomas from a community college, CEGEP, or school of nursing). This share stood at 26 per cent in 2019 and combined with the share of people with a university education (i.e., 33 per cent had a Bachelor’s degree or higher).

Chart 17: Share of Overqualified Workers in Employment by Education Level, 2000-2019



Source: Statistics Canada, Labour Force Survey, RTRA., Authors' calculations.

Notes: Sample is restricted to full-time, non-managerial workers aged 25-54 with a bachelor's degree. Overqualification defined as a worker employed in a job not requiring a university degree.

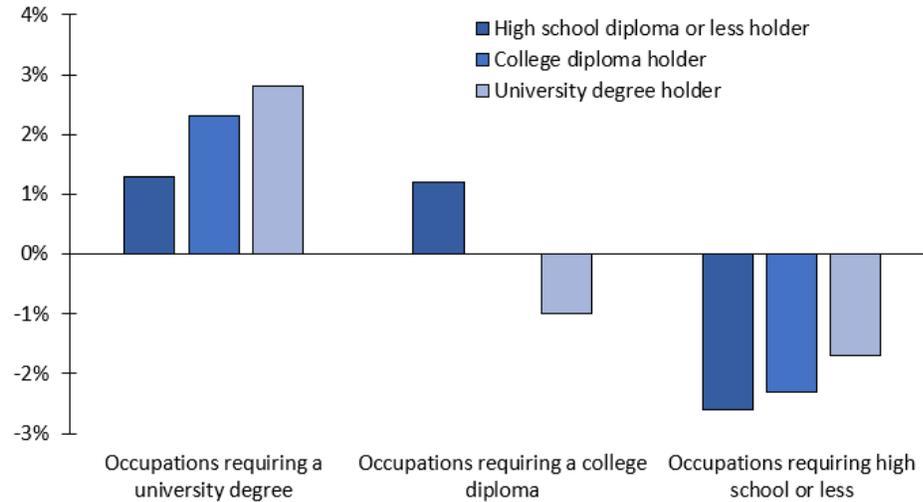
education.¹⁵ This is despite the significant increase in the share of Canadians with university level education from 19 to 33 per cent between 1999 to 2019. Interestingly, the number of new STEM graduates as a share of the 25- to 34-year-old population was comparable to the United States in 2019 at 1.4 per cent. This is however lower than in other peer countries including Germany (2.3 per cent), France (1.9 per cent), and Finland (2.4 per cent).

Increased levels of educational attainment do not however guarantee that skills will be fully utilized. Even if workers have the skills that are in-demand by the business sector, they may not be currently matched with a job that requires their level of skill. In 2019, approximately a third of all post-secondary educated workers were employed in jobs that did not require post-secondary education. This is especially significant for bachelor's degree holders, whose rate of overqualification has

increased from 45 per cent in 2000 to 52 per cent in 2019 (Chart 17). This increase is, at least partially, due to relatively slow growth in jobs requiring a university degree. From 2000 to 2019, the share of jobs requiring a university degree grew less than half as fast as the share of individuals with a university degree. Limiting overqualification can have significant impacts on productivity. For example, based on data for 19 countries, McGowan and Andrews (2015) estimate that a 1 per cent decrease in the rate of overqualification can increase productivity by 1.3 per cent.

Despite this longer-term trend of overqualification, since the pandemic there have been shifts in the types of employment available and skills that are demanded. Jobs in industries which typically require a higher level of education have been increasing fastest. In particular, as of 2023Q2 the number of jobs in Information and cultural industries is 15.1 per cent higher than

Chart 18: Change in Occupational Employment Share by Educational Attainment, 2019-2022



Source: Statistics Canada, Labour Force Survey, RTRA. Authors' calculations.

it was pre-pandemic (3 times faster employment growth than the overall economy since 2019Q4), and professional, scientific and technical services is a staggering 28.7 per cent higher (nearly 6 times faster than overall employment growth).

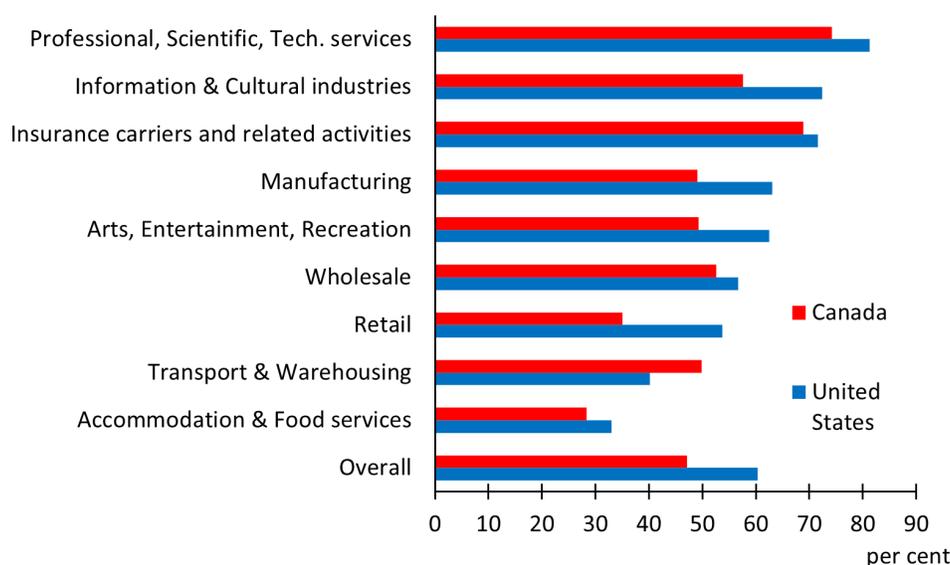
These sectoral shifts have led to more workers occupying higher-skill jobs, regardless of their own education level. Chart 18 shows that employment in occupations requiring a university degree has increased more than any other category, but these jobs are being filled not just by university degree holders, but by college diploma holders and those with high school or less. This could be evidence of a partial correction of previous over-qualification issues. However, this trend could also signal an increase in under-qualification or inexperience problems in the current labour market that could ultimately be negatively impacting productivity. Further research will be needed to better understand the implications of this shift including whether it will have transitory or more persistent impacts

on Canada's productivity.

Management Education

Related to the skill issues, the education level of managers in Canadian firms has been raised as a possible impediment to productivity growth and weaknesses in innovation focused investment. The impacts of high-quality management practices on firm performance, productivity and innovation have been well documented (Bloom *et al.*, 2013; Brouillette and Ershov, 2014), as have the effects of university education on better management practices Bloom (2011). Intuitively, the positive link between management education and better firm performance makes sense. Managers are responsible for making important decisions, often under clouds of uncertainty. It is important to have broad-based knowledge and understanding of the world to be able to make an informed decision that helps the company. This link is likely more important as the economy becomes more

Chart 19: Share of university managers in selected industries and overall, 2021, Canada and US



Source: Statistics Canada Labour Force Survey, RTRA; U.S. Census Bureau Current Population Survey. Author's calculations.

Note: Shares of managers with a university degree reflects the portion of managers 30-64 years of age in 2021 with a bachelor's degree or higher.

technology-driven as the education is more critical to understanding the technology.

In Canada, managers are generally less educated than their U.S. counterparts, in that Canadian managers are less likely to have university education, despite being more likely to have some sort of tertiary education. According to data from the Canadian Labour Force Survey (LFS) and the U.S. Current Population Survey (CPS), only about 47 per cent of managers have a university degree in Canada compared to 60 per cent in the United States (Chart 19). This gap is broad-based with Canada trailing the United States across almost all industries, including industries associated with technology (i.e. Information and Cultural industries, professional, scientific and technical services), but also in industries that are not as technology driven such as retail and accommodation and food ser-

vices. Even in such industries, management education could be important as they would have to adopt more and more technologies to become productive in an economy that is becoming more technology-driven overall. In spite of this management education gap, business administration and management is a popular field for Canadian university graduates comprising 21 per cent of the bachelor's degree holding population according to the 2021 census. This may suggest that many these graduates are not using their management education when they enter workforce.

Perspectives on Canada's Future Productivity Challenges

Thus far, we have provided insights into the history of Canada's lagging productivity, focusing on both the trends and the

underlying factors of this persistent challenge. In this section, we offer perspectives on how four fundamental structural transformations—population aging, the green transition, the realignment of global trade, and the increasing digitization and use of AI—will impact productivity growth going forward. Each of these has uncertain implications for productivity, potentially exacerbating existing challenges while offering opportunities for improvement. In providing these perspectives, although we raise more questions than answers, our aim is to highlight areas that could shape an agenda for future research on productivity in Canada.

Population Aging

As with most other economically advanced countries, Canada will contend with a decreasing working-age to population ratio in the coming years as the baby boom generation continues to move into retirement. On balance, it is not yet clear whether population aging will increase or decrease productivity. Should we expect that older workers have experiences and skills that younger workers have yet to obtain and that an ageing workforce may result in reducing productivity if many of the most skilled and experienced workers exit the workforce? Conversely, can we expect this effect will be counteracted by the fact that younger workers tend to be more educated, may have more of a risk-taking or entrepreneurial spirit and have a better capacity to adapt to new production processes or the use of new technologies in the

workplace? The existing research on this dynamic is largely inconclusive. However, as the consequences of population aging begin to take hold the answer is likely to become clearer. From a structural perspective, should we expect the aging population to dampen aggregate productivity growth as the composition of the economy shifts towards lower-productivity service industries such as health care?

Immigration can help to mitigate the effects of population aging on Canada's labour force growth and public finances. However, the impact of immigration on productivity is ambiguous and largely depends on the skill level of the immigrants and their ability to integrate into the labour market. On average, principal applicant economic immigrants integrate swiftly, achieving labour market outcomes that match or exceed those of the average Canadian worker within five years.¹⁶ This quick integration is expected, given that principal economic applicants are selected for their potential to assimilate effectively into the Canadian economy. However, it may take a decade or more for other immigrant categories, including secondary economic applicants and family-sponsored applicants, to reach similar outcomes than Canadian-born workers.

As other advanced economies continue to grapple with population aging and as the source countries of highly skilled immigrants to Canada continue to develop economically one question emerges: How effectively will Canada compete in attracting the most highly skilled immigrants

16 Authors' calculations using Statistics Canada tables 43-10-0010-01, 11-10-0239-01, and 18-10-0005-01.

who have the greatest potential to enhance Canada's productivity? One area for improvement is in credential recognition. Immigrants are of greater likelihood of being mismatched and overqualified for their positions, in part due to weaknesses in credential recognition. Resolving issues with credential recognition would have the dual benefit of enhancing the productivity of the current cohort of immigrants and increasing Canada's competitiveness for attracting future immigrants.

The Green Transition

The green transition is accelerating around the world, leading to shifts between sectors and economies. As countries pivot towards more sustainable energy, production and consumption, firms will need to innovate and adopt new technologies to stay relevant and the labour force must be capable of adapting to the skills required to match these changing needs.

The process of this transition can be disruptive but could also present opportunities for productivity. For example, the Porter Hypothesis (Porter, 1991; Porter and van der Linde, 1995) contends that environmental policy may induce innovation that can partially, if not entirely, offset negative impacts of satisfying environmental requirements.¹⁷ This follows from the perspective that pollution is a manifestation of economic waste (Lanoie *et al.*, 2008), and policies meant to lower pollution could also improve resource utilization and pro-

ductivity. However, the Porter Hypothesis remains very much a hypothesis, and research remains inconclusive on its potential and broad applicability.

Even within the context of the Porter Hypothesis, the net productivity impact on the economy will depend on how well and where resources are reallocated. Canada's experience with zombie firms and a large number of small firms pose difficult questions about how well Canada's economy is prepared to efficiently reallocate resources over the transition. Further research on this question is particularly important given the existence of zombie firms in the resource sector. Similarly, what does the growing gap between frontier firms and non-frontier firms imply about the potential for fluid technology diffusion from leaders in the adoption of green technologies to the broader business sector.

The green transition could also bring sectoral shifts that have impacts on aggregate productivity. As suggested by the sectoral decomposition, commodity price declines in 2014-15 increased the importance of shift-effects with a significant negative impact on aggregate productivity growth. While it is not clear if this is a beginning of a long-term trend, what is clear is that the potential for a negative impact from these sectoral shifts away from commodity producing sectors with a high productivity level is significant. This may mean that Canada needs to improve within-sector productivity growth, which requires broad-based improvement across sectors.

¹⁷ For example, for Canada, Lanoie *et al.* (2008) finds evidence that the long-run impact of environmental regulation on Quebec manufacturing productivity has been positive.

Realignment of Global Trade

The system of global trade has been undergoing a significant transformation, with rising geopolitical tensions ushering in a realignment of trade flows as countries aim to strengthen the resiliency of supply chains through reshoring and friendshoring. This shift could have important implications for small open economies like Canada. Historically, Canada has benefited significantly from the liberalization of international trade that evolved over the past 50 years. Although friendshoring and reshoring may help to increase resiliency, there is a risk that this increase in resilience could come at the cost of declines in efficiency.

A move toward friendshoring by our allies could also create opportunities for a stable democracy like Canada. If this realignment allows for greater interaction with firms at the global productivity frontier, as most would likely reside in “friend” countries, it may improve the ability of Canadian firms to take advantage of productivity and technology spillovers. Perhaps the greatest challenge for Canada is the speed at which this transition could unfold. Decisions made by our major trading partners could have significant impacts on Canada’s economy with little predictability. Given Canada’s experience with lagging investment and potentially relatively weaker management capacity, yet another question emerges: how well prepared is Canada to navigate these kinds of shocks

and what impact will this added uncertainty have on productivity and investment decisions?

Digitalization and AI

Advanced technologies, such as digitalization, and artificial intelligence (AI), have the potential to be disruptive forces by enabling the automation of tasks currently performed by workers. In particular, the rapid advances in large language AI models and their recent release through various apps promise to revolutionize the way information is created and spread. This could increase productive efficiency, lower costs, and ultimately spur the demand for labour. As such, new technologies represent an opportunity to reverse sluggish productivity growth and to alleviate tight labour markets. In particular, it has been estimated that generative AI has the potential to boost labour productivity growth in the United States by 0.5 to 0.9 percentage points annually through 2030 (Ellingrud *et al.*, 2023).

The key issue about digitalization and the adoption of new technologies in Canada is whether businesses have invested enough and if, for any reason, many are holding back investments that would make them more productive. The overall proportion of businesses using AI in Canada is lagging the United States, likely reflecting the large presence of small firms, the growing gap between frontier and non-frontier firms, and less educated management. Canada is how-

18 Source of data: OECD.AI (2023), visualisations powered by JSI using data from Preqin, accessed on 14/11/2023, www.oecd.ai. World Development Indicators (World Bank).

ever out-performing the EU in cumulative venture capital investments in AI as a share of GDP.¹⁸

As highlighted earlier, uneven technology adoption has been suggested by the OECD to constrain aggregate productivity growth (Andrews *et al.*, 2015). Digitalization and declines in the costs of automation have led to increased market concentration in many industries. Similar to past technologies, the commercialization of AI will entail large fixed costs, complement organizational complexity and require complementary innovations to enable the technology to generate growth. Advantages held by large technology firms in access to data and computational resources will become more consequential. The incorporation of AI into production is therefore expected to increase existing scale advantages, already reflected in substantial disparities in adoption rates between the largest firms and SMEs in Canada. Extreme gaps between the capabilities of leading private large language models and open-source alternatives may portend strong anti-competitive effects from AI diffusion.

Conclusion

In this article, we have chronicled Canada's productivity performance over recent decades up to the present, emphasizing the country's investment challenges and identifying potential factors contributing to productivity and investment outcomes in Canada. Currently, Canada, like most other advanced economies, is in a challenging situation, experiencing the lowest rates of productivity growth in a generation while confronting major structural changes.

Understanding the historical context of Canada's productivity performance is crucial in identifying areas that require attention from both governments and the private sector. However, much more work is necessary to comprehend the forward-looking implications for productivity growth arising from population aging, the green transition, a realignment of global trade, and the increasing digitization and use of AI. It is our hope that this article inspires more researchers to delve deeper into the challenges of productivity growth that Canada has faced, both old and new, providing essential evidence and insights that enhance our collective understanding of Canada's productivity performance.

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Appendix Table 1: Detailed Sectoral Decomposition of Labour Productivity Growth, Business Sector, 1961-2019 (percentage points per year)

	Within-Sector Effect				Shift Effect				Total			
	1961-1985	1985-2007	2007-2014	2014-2019	1961-1985	1985-2007	2007-2014	2014-2019	1961-1985	1985-2007	2007-2014	2014-2019
Agriculture, forestry, fishing and hunting	0.2	0.1	0.1	0.1	-0.2	-0.2	0.0	0.0	0.1	-0.1	0.1	0.1
Mining and oil and gas extraction	0.1	-0.1	-0.2	0.4	0.3	0.2	0.3	-1.1	0.4	0.1	0.1	-0.6
Utilities	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
Construction	0.2	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.2	0.1	0.3	-0.1
Manufacturing	1.0	0.5	0.2	0.0	-0.5	-0.5	-0.5	0.1	0.5	0.0	-0.3	0.1
Wholesale trade	0.2	0.2	0.2	0.0	0.0	-0.1	-0.1	0.0	0.2	0.1	0.1	0.0
Retail trade	0.2	0.1	0.1	0.1	-0.1	-0.1	0.0	0.0	0.2	0.1	0.0	0.1
Transportation and warehousing	0.3	0.1	0.1	0.0	-0.1	0.0	0.0	0.2	0.1	0.0	0.1	0.2
Information and cultural industries	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1
Finance, insurance, real estate and renting and leasing	0.1	0.3	0.2	0.5	0.3	0.1	0.0	-0.2	0.4	0.3	0.2	0.2
Professional, scientific and technical services	0.0	0.1	0.1	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2
Administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0
Arts, entertainment and recreation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accommodation and food services	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1
Other private services	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
Total	2.6	1.4	1.0	1.1	0.2	-0.0	0.1	-0.5	2.8	1.4	1.0	0.7

Source: Statistics Canada, authors' calculations. Notes: Based on the methodology from Almon and Tang (2011). Annual average calculated by performing the decomposition for each year and averaging over the period. Totals may not add up due to rounding.