

Decomposing Canada’s Post-2000 Productivity Performance and Pandemic-Era Productivity Slowdown

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Abstract

Labour productivity growth in Canada has been significantly lower since 2000, and has fallen further since 2019. In this article we examine why this has occurred. We approach the question from three angles: first we look at how Canada’s performance compares to other OECD countries, particularly the United States; second, we decompose Canadian productivity growth by sector, and look to see to what extent slower productivity growth is due to lower growth within sectors, or reallocations across sectors; and finally we perform a growth accounting exercise in order to understand the relative contributions of multifactor productivity, capital intensity and labour quality. We find that Canada’s productivity growth since 2000 has been similar to peer countries, but that the level of productivity is lower than for almost all other peer countries. Weak productivity growth after 2000 is largely attributable to weak productivity within sectors rather than sectoral reallocation. We also find that the slowdown in productivity growth post-2000 relative to 1981-2000 is largely a result of declines in multifactor productivity. However, during the latter part of the post-2000 period there was a pronounced slowdown in capital growth, particularly in ICT, that put downward pressure on productivity growth. More recently, productivity growth over the 2019-2022 period has been very weak. As a result, returning even to the pre-pandemic levels of productivity growth in the near term will be challenging.

Labour productivity growth in Canada has diminished considerably relative to the pre-2000 period, with business sector productivity dropping from an average of 1.74 per cent per year in the 1973-2000 period to an average of 0.96 per cent per year in the 2000-2019 period. Work by many productivity researchers finds a second step-

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wise reduction in the annual growth rate of labour productivity following the year 2000, resembling the substantial slowdown observed in the 1970s (Sharpe and Tsang, 2018).² This second productivity slowdown seems to be global, though it has been most pronounced in developed economies (Dieppe, 2020). This article aims to enhance and update understanding of Canadian productivity developments post-2000 by analyzing Canada's productivity performance from an international and historical perspective.³ The first section of this article uses recent OECD data to present a more detailed assessment of Canada's productivity performance relative to other economies. We compare Canada to a cohort of peer countries within the OECD, before moving to analyze the gap between the United States and Canada. In the second section, we perform the Sharpe and Thompson (2010) decomposition across sectors at the NAICS two-digit level, analyzing the within-sector and re-allocation effects on productivity in the post-2000 period. In the third section, we analyze productivity growth from 1961-2021 using official Statistics Canada estimates for the sources of productivity growth — i.e., capital intensity and labour quality. Multifactor productivity — and their contributions to growth pre- and post-2000. A final section concludes.

The Global Productivity Slowdown: Canada's Productivity Performance in International Context

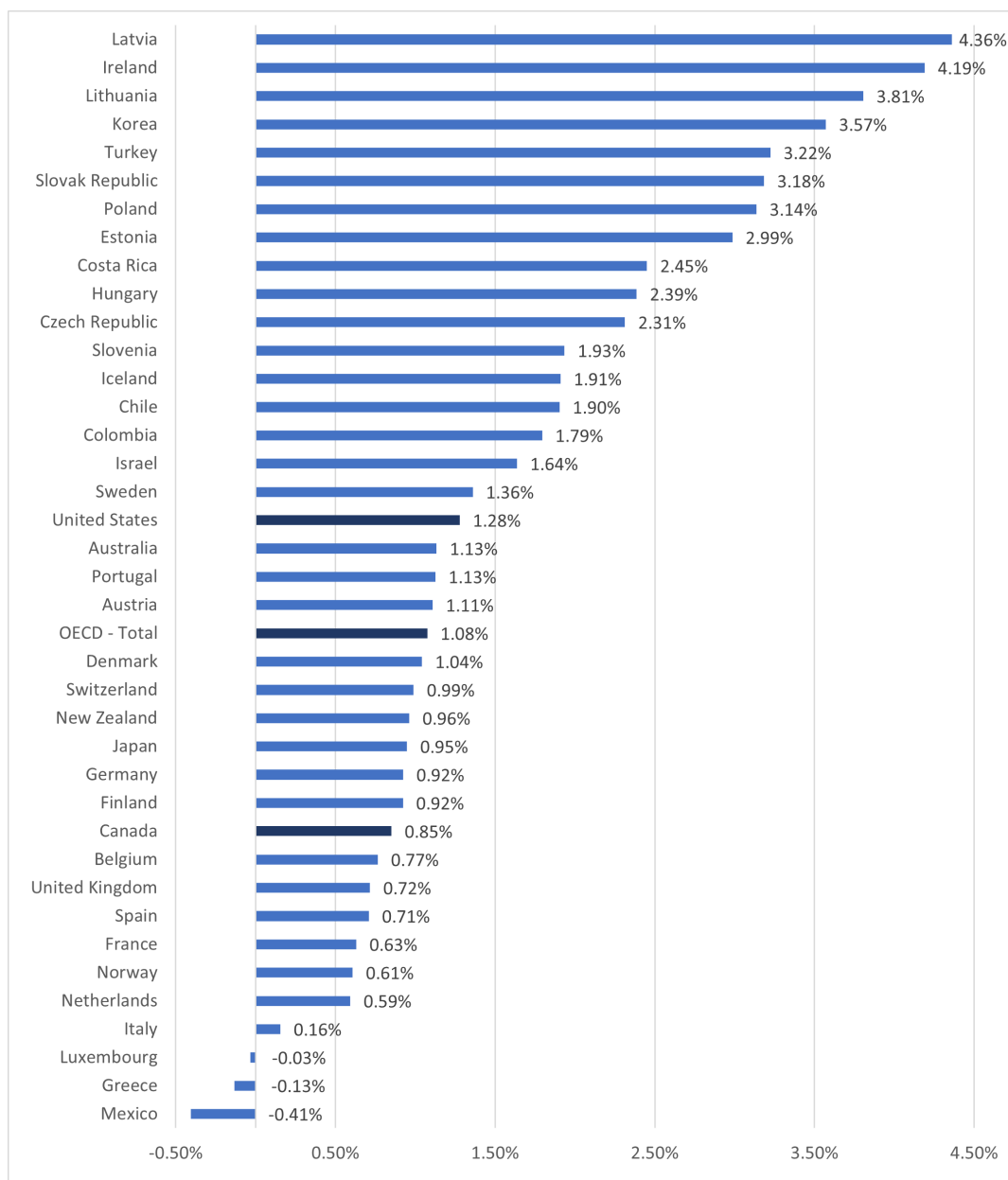
We begin our examination of Canadian productivity trends with an international overview of the post-2000 productivity slowdown. Chart 1 below shows the productivity growth rate for 38 OECD economies for the 2000-2022 period, as well as the average across all OECD countries. Note that the data in this chart are for labour productivity, measured as output per hour, and are for the total economy, not just the business sector.

Canada's relative productivity growth performance is weak but not unusual. As Chart 1 shows, the growth rate in productivity for the Canadian economy averaged 0.85 per cent annually between 2000 and 2022, placing it 28th out of 38 countries. Economies with slower average rates of labour productivity growth include the United Kingdom at 0.72 per cent per year, France at 0.63 per cent per year, Norway at 0.61 per cent per year, and the Netherlands at 0.59 per cent per year and Italy at 0.16 per cent per year among others. Several countries just slightly outperformed Canada, including Germany and Finland at 0.92 per cent per year, New Zealand at 0.96 per cent per year, and Australia at 1.13 per cent per year. The United States

² The first major slowdown in productivity growth was observed in the 1970s, with 1973 as the pivotal year. In an effort to align data with cyclical peaks (subject to data availability constraints), this article at times decomposes the pre-2000 period into the period spanning from 1961 to 1981 and the period spanning from 1981 to 2000. Readers should note that the use of such time periods masks the magnitude of the 1970s slowdown. That is to say, the slowdown between periods would be meaningfully larger if the periods were aligned with the turning point in 1973.

³ See Sharpe and Sargent (2024) for a general overview of the productivity landscape in Canada.

Chart 1: Total Economy Output per Hour Growth in OECD Countries, Average (Compound) Growth Rates, 2000-2022



Source: <https://stats.oecd.org/Index.aspx?DataSetCode=PDBGR>

Note: Some country series feature data breaks and estimated or provisional values instead of official statistics for some observations. For full detail on the countries and observations affected, please see the linked database.

and Sweden, meanwhile, performed significantly better than Canada, at 1.28 per cent per year and Sweden at 1.36 per cent per year, respectively.

Countries with rates of annual productivity growth above 1.5 per cent per year tended to be significantly less advanced than Canada at the start of the period, and so one would expect faster growth than Canada as they catch up to advanced economy levels of productivity. This would be true for post-Soviet and Eastern Bloc countries like Lithuania, Latvia, Estonia, Poland, Hungary, as well as Latin American economies like Chile and Colombia.⁴ One could also argue that Korea falls into this camp. Ireland, a consistent leader in productivity growth, is something of an anomaly due to its high-tech sector and the fact that many multinational firms book their profits in the country to take advantage of low tax rates (OECD, 2018; Papa, 2019).

As noted in the introduction, Canada's productivity growth slowed considerably after 2000. We now look at whether the post-2000 slowdown in productivity in Canada was unusual in the OECD. Chart 2 displays the period-to-period changes between the 1973-2000 period and the 2000-2022 period.

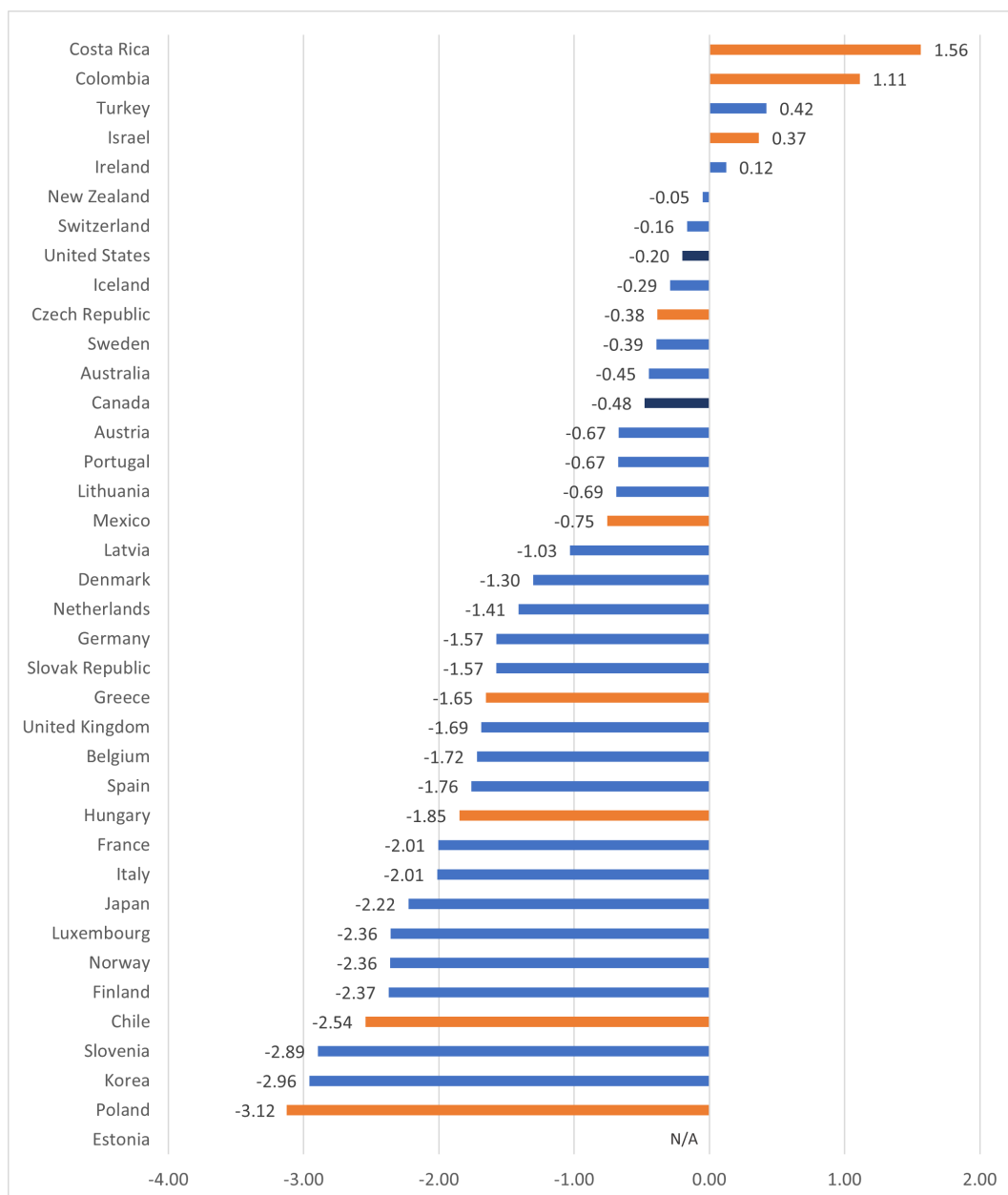
This chart shows that compared to other OECD economies, Canada's slowdown in productivity growth was not particularly severe: between the 1973-2000 period and the 2000-2022 period, the average annual rate of productivity growth in Canada fell

0.48 points, from 1.33 per cent per year to 0.85 per cent per year. Expressed differently, out of the 32 OECD economies for which a slowdown occurred, Canada experienced the 8th lowest slowdown. This relatively minor slowdown in productivity growth between periods reflects the fact that Canada's productivity growth was already relatively weak from 1973 onwards. With the exception of Mexico, all of the countries which experienced lower rates of productivity growth than Canada in the pre-2000 period saw less severe slowdowns, suggesting that there is indeed a positive relationship between pre-2000 rates of productivity growth and the magnitude of the post-2000 slowdown as less advanced countries approached advanced country level of productivity. Beyond this, there was no consistent pattern in the size of the productivity slowdown among countries.

We now turn to an examination of what these trends in productivity growth rates have meant for productivity levels. Chart 3 below shows that in 2022, Canada's total economy labour productivity stood at \$53.3 per hour USD (using 2015 PPPs), putting it in 18th place among the 38 OECD countries and on par with the OECD average of \$53.4 per hour. However, this average includes developing countries such as Mexico and Colombia. If we restrict our comparison to the 19 advanced countries that could be thought of as peers to Canada—the G7 countries, northwestern European countries such as Belgium, the Netherlands, Luxembourg, Switzer-

⁴ Mexico is an exception with a very bad productivity performance at -0.41 per cent per year on average between 2000 and 2022.

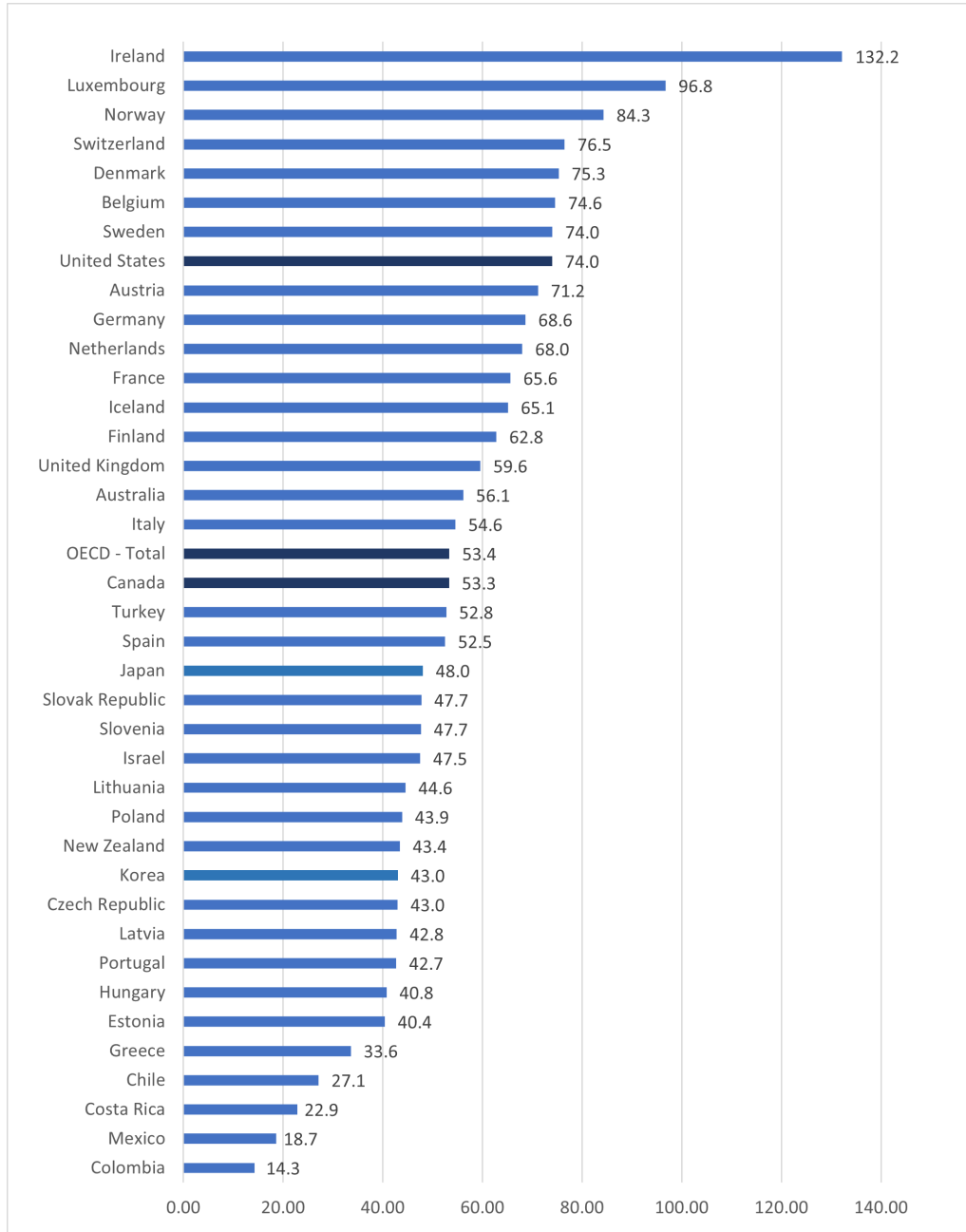
Chart 2: Period-to-Period Change in Average Annual Labour Productivity Growth Rate from 1973-2000 to 2000-2022 (percentage points)



Source: <https://stats.oecd.org/Index.aspx?DataSetCode=PDBGR>

Note: Orange highlights indicate countries for which data is not available for the entire 1973-2000 period. Data before 2000 is unavailable for Estonia. Some country series feature data breaks and estimated or provisional values instead of official statistics for some observations. For full detail on the countries and observations affected, please see the linked database.

Chart 3: Total Economy Output per Hour Levels in OECD Countries, 2022 (USD, constant prices, 2015 PPPs)



Source: <https://stats.oecd.org/Index.aspx?DataSetCode=PDBGR>

Note: Some country series feature data breaks and estimated or provisional values instead of official statistics for some observations. For full detail on the countries and observations affected, please see the linked database.

land, Ireland, Austria and the Nordic countries, and Australia and New Zealand — Canada is 17th, above only New Zealand and Japan. Canada's relatively weak productivity levels compared to its peers means that we can not blame weaker productivity growth in Canada on the country having relatively higher productivity levels. On the contrary, we would expect Canada's productivity growth to be a little higher than that of its peers, as it caught up to their higher levels of productivity.

Comparisons of Productivity with the United States

Among Canada's peer countries, the United States is perhaps the most natural point of comparison for assessing Canada's productivity performance, given the close geographic, economic, and social ties between the two countries. Chart 4 below provides the growth rates of business sector and total economy labour productivity for the United States and Canada for selected periods. Panel A shows the average (compound) growth rates for business sector productivity for three periods, 1947-1973, 1973-2000, and 2000-2022. Panel B focuses in on business sector productivity trends post-2000, providing rates of growth for the periods spanning 2000-2008, 2008-2019, and 2019-2022. Panels C and D offer rates of growth for the same periods but for the total economy rather than the business sector. However, due to lack of available data, the 1947-1973 period is omitted from Panel C.

The data show that business sector productivity growth in Canada has, on average, lagged that in the United States since

1973 and this phenomenon has become more severe after 2000. In the post-war period of 1947-1973 period Canadian business sector productivity growth over the period actually exceeded growth in the United States by 0.71 percentage points. However, during the 1973-2000 period, productivity growth in both countries fell sharply, although productivity growth was relatively less affected in the United States, falling 1.41 points period-to-period compared to a 2.19 points fall in Canada. This brought productivity growth of the two countries more-or-less in line with each other (1.74 per cent in Canada vs. 1.81 per cent in United States).

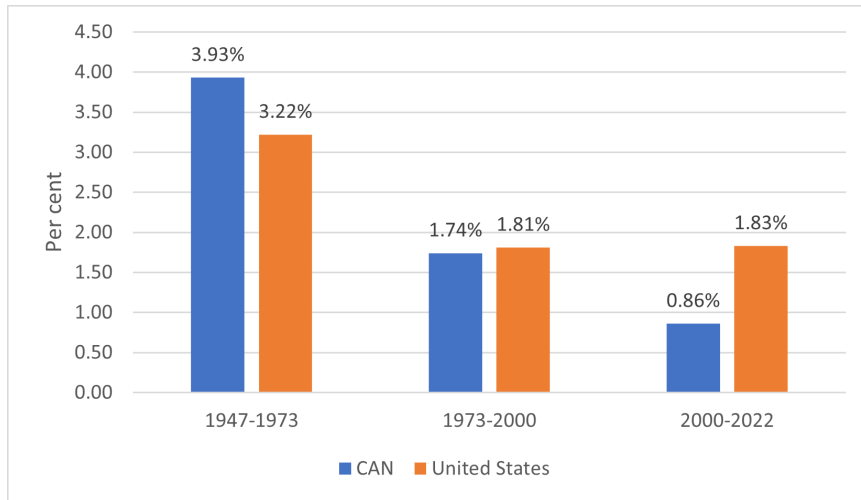
During the 2000-2022 period, Canadian business sector productivity fell once again, with average productivity growth falling 0.88 points from the 1973-2000 period. However, this drop was not mirrored by the American figures.

Comparing growth trends across Canada and the United States for shorter subperiods after 2000 we see that the largest discrepancy between the productivity growth rates of the two countries occurred in the 2000-2008 period, when productivity growth in the United States averaged an impressive 2.50 per cent annually while growth in Canada was quite low at 0.86 per cent annually: a differential of 1.64 percentage points.

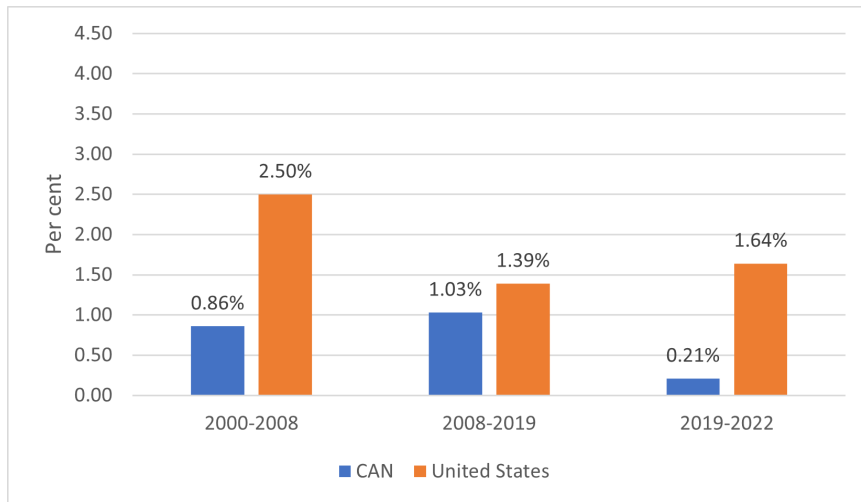
This discrepancy moderated significantly over the 2008-2019 period, as Canadian productivity growth rose 0.17 points to 1.03 per cent and productivity growth in the United States experienced a sharp decline of 1.11 points, down to 1.39 per cent. Altogether, this reduced average productivity growth in the United States to just

Chart 4: Labour Productivity Growth in Canada and the United States

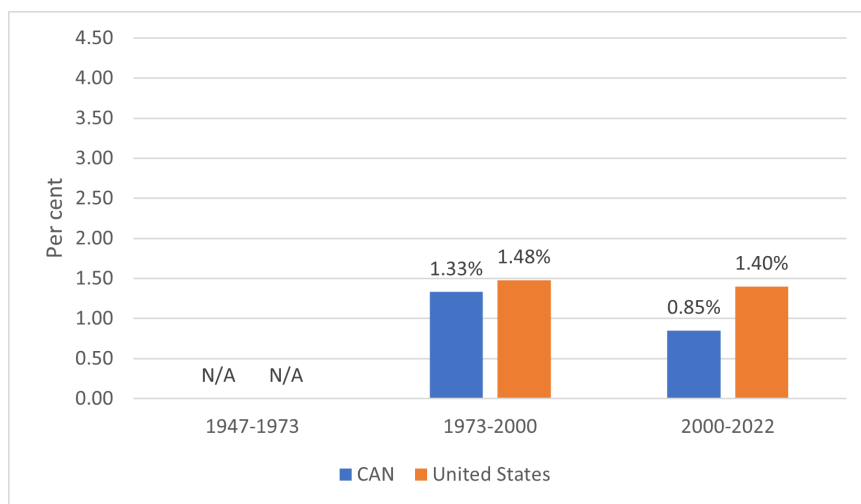
Panel A: Business Sector Output per Hour, Average (Compound) Growth Rates, 1947-2022



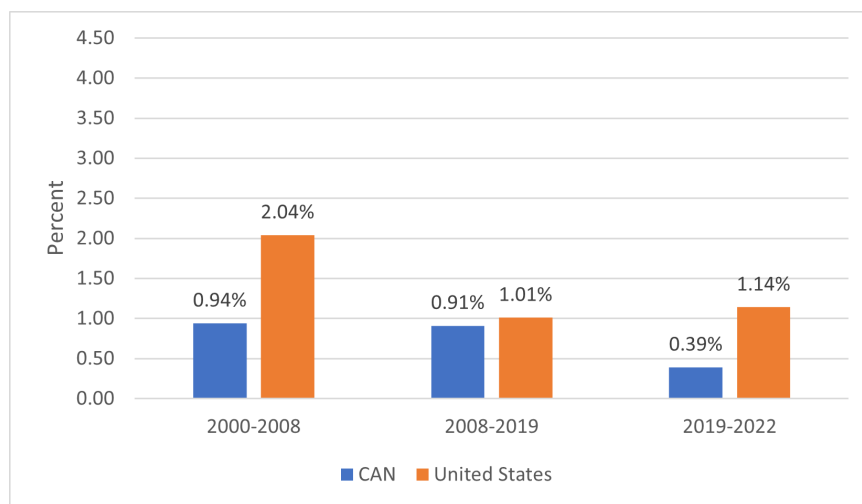
Panel B: Business Sector Output per Hour, Average (Compound) Growth Rates, 2000-2022



Panel C: Total Economy Output per Hour, Average (Compound) Growth Rates, 1973-2022



Panel D: Total Economy Output per Hour, Average (Compound) Growth Rates, 2000-2022



Sources: Canada business sector labour productivity data from Statistics Canada: Table 36-10-0305-01 for 1947-1960, Table 36-10-0208-01 for 1961-2021, Table 36-10-040-01 for 2022. United States business sector labour productivity data from BLS Labour Productivity and Cost Measures – Major Sectors – August 3, 2023 (XLSX sheet). Total Economy labour productivity data from OECD – Productivity and ULC – Annual, Total Economy: <https://stats.oecd.org/Index.aspx?DataSetCode=PDBGR>.

35 per cent above Canadian average productivity growth, likely reflecting the enduring, asymmetric effects of the 2008 financial crisis.

However, during the 2019-2022 period, any prospect of a return to parity in productivity growth trends between the two economies grew more remote; Canadian business sector productivity growth fell significantly in this period, dropping 0.82 points between 2008-2019 and 2019-2022 to just 0.21 per cent annually. This dramatic decline was not reflected in the United States; rather, American productivity growth actually rebounded somewhat, rising 0.25 points from an average of 1.39 per cent annually in the previous period to 1.64 per cent.⁵ These divergent trends resulted in a substantial widening of the cross-country disparity in growth. Average productivity growth in the United States in the 2019-2022 period exceeded that in Canada by 1.43 percentage points. This is slightly smaller than the absolute gap observed in the 2000-2008 subperiod; however, the gap in relative terms is by far the largest between 2019 and 2022, with average productivity growth in the United States nearly 8 times higher than that in Canada. These estimates for the 2019-2022 period should be interpreted with extreme caution however, given the extraordinary nature of the period and the fact that estimates for 2022 productivity growth may still be subject to significant revision.

For comparison, Panels C and D in chart 4 show rates of labour productivity for the total economy. With the exception of the 1973-2000 period, the gap between the rates of growth in United States and Canada is smaller in every period when using total economy measures rather than business sector measures. This is particularly visible in the 2000-2022 period, where the total economy gap is 0.55 points compared to 0.97 points in the business sector, and the 2019-2022 period, where the gap was 0.75 points in the total economy and 1.43 points in the business sector.

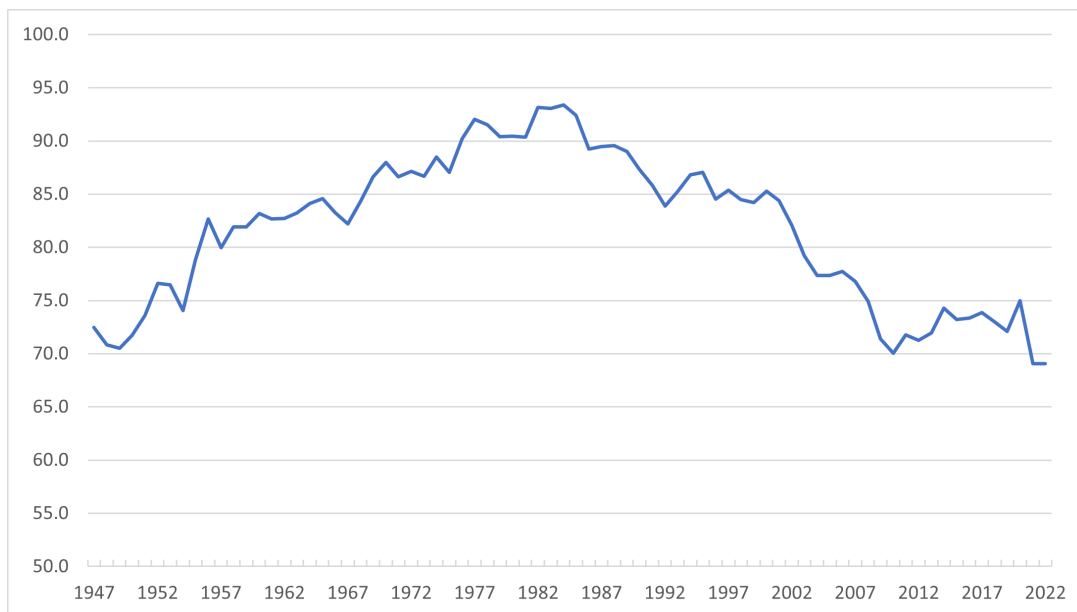
This discrepancy for the 2000-2022 period between estimates of the U.S.-Canada productivity growth gap that use business sector measures and those that use total economy measures is due to productivity growth rates in the non-business sector that are markedly lower than the non-business sector in the United States, but not in Canada. Why non-business sector productivity growth should be significantly lower in the United States than in Canada is puzzling and a topic for further research; for now we tend to place more reliance on business sector rather than total economy measures of productivity given the well-known problems in measuring output in the non-business sector.⁶

Chart 5 shows the implication of United States-Canada differences in growth rates for business sector productivity levels over the 1947-2022 period. The Chart shows

⁵ For a discussion of productivity level paths in Canada and the United States during the Pandemic see Blit *et al.*, (2020) and Stewart(2020).

⁶ See CSLS (2004) for a more detailed discussion of differences in the measurement of the non-business sector between the United States and Canada. It should be noted that an important part of the non-business sector for which there is real output growth is the imputed rents for owner-occupied housing.

Chart 5: Relative Labour Productivity Levels (GDP per Hour in the Business Sector in Canada), 1947-2022 (Canada as a per cent of the United States)



Source: Canada labour productivity data from Statistics Canada: Table 36-10-0305-01 for 1947-1960, Table 36-10-0208-01 for 1961-2021, Table 36-10-0480-01 for 2022. US labour productivity from BLS Labour Productivity and Cost Measures – Major Sectors – August 3, 2023 (XLSX sheet). 1999 benchmark of Canada’s output per hour at 84.2 per cent of US output per hour from Statistics Canada (2008) "Relative Multifactor Productivity Levels in Canada and the United States: A Sectoral Analysis" Catalogue no. 15-206-X, no. 019, July, p.32.

Note: US-Canada purchasing power parity estimate based on Statistics Canada benchmark of Canadian business sector output per hour at 84.2 per cent of US business sector output per hour in 1999 (Statistics Canada, 2008).

Canadian labour productivity levels (business sector output per hour) as a proportion of labour productivity levels in the United States, using a purchasing power parity (PPP) measure based on a 1999 benchmark developed by Statistics Canada (2008).⁷ We can see a narrowing of the productivity gap in the first half of the period, with Canadian productivity reaching 93.4 per cent of the U.S. level in 1984. However, the productivity gap began to widen after 1984, so that by 2007 Canadian business sector productivity had fallen to around 70 per cent of U.S. business sector productiv-

ity.

From 2007 to 2019, there was no deterioration in the gap. Rather, a small rebound began to materialize, as Canadian business sector productivity growth slightly outpaced that in the United States and pandemic-related re-allocation effects boosted Canadian productivity levels relative to the United States in 2020. However, economic disruption and further compositional shifts associated with the continuation of the pandemic quickly reversed these initial productivity gains, so that by 2021 Canadian productivity had fallen to below

⁷ This benchmark calculated Canadian business sector output per hour in 1999 as 84.2 per cent of United States business sector output per labour hour. Relative price indices were calculated using final or market prices in the two countries and then adjusted based on relative producer tax rates.

Table 1: Business Sector Output, Hours Worked and Annual Labour Productivity Growth Rates, United States and Canada, 2019-2022

	2019	2020	2021	2022	2019-2022
Canada					
output (2012 = 100)	117.3	109.5	115.0	119.6	-
hours worked (2012 = 100)	107.4	92.3	103.0	108.5	-
compound annual growth rate of labour productivity	0.62%	8.57%	-5.80%	-1.54%	0.21%
United States					
output (2012 = 100)	121.2	117.0	126.0	128.8	-
hours worked (2012 = 100)	112.3	103.8	109.4	113.6	-
compound annual growth rate of labour productivity	1.88%	4.42%	2.18%	-1.60%	1.64%

Sources: Canada labour productivity data from Statistics Canada: Table 36-10-0208-01 for 2019-2021, Table 36-10-0480-01 for 2022. United States labour productivity from BLS Labour Productivity and Cost Measures – Major Sectors – August 3, 2023 (XLSX sheet).

70 per cent of U.S. levels, the first time it has done so since 1947.

We now turn to an examination of the effect of the pandemic on the Canada-United States productivity gap, and in particular, the asymmetrical manner in which it affected labour productivity in the two economies, Table 1 shows the annual productivity growth rates for Canada and the United States for each year in the 2019-2022 period as well as indexes of output and hours worked. While both economies experienced a boost in aggregate productivity with the onset of the pandemic in 2020, this increase was larger in Canada where year-over-year productivity growth was 8.60 per cent compared to just 4.42 per cent in the United States. This seems to suggest that the initial re-allocation effects seen as workers in low-productivity industries worked fewer hours and left the workforce were stronger in Canada than the United States, likely owing to stricter public health measures and a more forceful pandemic response.⁸

As one might expect, this lack of a strong re-allocation-driven boost to productivity in the United States in 2020 seems to have manifested in a quicker return to normal when compared to Canada. Whereas Canada saw deeply negative productivity growth of 5.90 per cent in 2021 as these workers began to return to the workplace or increase their hours. United States productivity remained at an impressive 2.18 per cent. As these trends continued to play out, both economies saw negative productivity growth of a similar magnitude in 2022. Altogether, these asymmetric effects resulted in a reduction of Canadian business sector productivity relative to the United States, reducing the Canadian level to 69 per cent of the United States level. It is extremely challenging to decouple pandemic effects from non-pandemic related developments in productivity, and hence, readers must exercise caution in making projections for future productivity developments based on these most recent figures. Effects of both the pandemic and supply-shock driven in-

⁸ It is imperative to note that the re-allocation effect described here need not refer to the actual flow of workers between different industries. Rather, “re-allocation” refers to changes in the share of total economy labour input which individual industries account for. As such, asymmetric job losses, as occurred during the pandemic, are re-allocative to the extent that the input shares of the affected industries fall and, conversely, the input shares of other industries rise. In contrast, widespread job losses which affect all industries more or less the same, would have negligible or null re-allocation effects.

flation are still playing out, and so the 2019-2022 period is not a full cycle that can be easily be compared to earlier periods.

Decomposing Canada's Labour Productivity Growth by Sector

We now turn to a closer look at the performance of Canadian productivity growth by industrial sector.⁹ To identify the sources of slowing productivity growth, we use a decomposition formula that breaks down aggregate productivity growth into within-sector effects and re-allocation effects (Sharpe and Thompson, 2010). The decomposition can be expressed as follows:

$$\Delta P = \sum h_i^0 \Delta P_i + \sum (P_i^0 - P^0) \Delta h_i + \sum (\Delta P_i - \overline{\Delta P}) \Delta h_i$$

where P is the overall business sector labour productivity level, P_i is the labour productivity level in sector i , h_i is the share of total economy-wide labour hours which is employed in sector i , the subscript 0 indicates a variable in time 0 (the beginning of the period), Δ indicates change over the period, and $\overline{\Delta P}$ is the average change in business sector productivity across sectors over the period.

The first term in the decomposition captures what we call **within-sector effects**. Within-sector effects refer to aggregate productivity growth attributable to productivity growth within sectors. The latter two terms, meanwhile, capture two dis-

tinct re-allocation effects. Re-allocation effects stem from changes in the share of labour input associated with a sector. All else equal, an increase in the share of total labour input which is employed by a sector with above-average productivity will increase the aggregate labour productivity growth in the economy. Conversely, an increase in the labour input share of a sector with below-average productivity will reduce aggregate labour productivity growth in the economy.

These re-allocation effects can be further decomposed into the level effect and the growth effect: the second and third term in the decomposition equation, respectively. The **level effect** captures changes in the productivity level resulting from the movement of inputs across sectors with different productivity levels. Conversely, the **growth effect** captures changes which result from the movement across sectors which experience different degrees of productivity growth over the relevant period. It is important to note that this calculation is performed using absolute changes in labour productivity, and not rates of productivity growth. We apply this decomposition framework to the 2000-2022 period to identify what changes in Canadian labour productivity growth are due to slowdowns or losses in within-sector productivity and which changes are due to compositional changes in the Canadian economy.

Table 2 shows the results of this decomposition for aggregate business sector labour productivity growth for the post-

⁹ We also decomposed labour productivity growth by province and territory: the results are given in Haun (2023). In general we found that patterns in productivity growth are largely attributable to changes within provinces and territories, rather than reallocation of labour across provinces and territories.

Table 2: CSLS Decomposition by Industry, Within-Sector and Re-allocation Effects on Canadian Business Sector Labour Productivity Growth, 2000-2022

	2000-2008	2008-2019	2019-2022	2000-2022
Within-Sector Effect	0.73	1.15	0.18	0.86
Re-allocation Level Effect	0.52	-0.03	0.20	0.20
Re-allocation Growth Effect	-0.25	-0.06	-0.10	-0.13
Net Re-allocation Effect	0.27	-0.09	0.11	0.07
Summed Effects	1.00	1.06	0.29	0.93
Actual Business Sector Productivity CAGR	1.00	1.05	0.23	0.92
discrepancy (summed effects minus actual rate of growth)	0.00	0.01	0.05	0.01

Source: Authors' calculations based on Statistics Canada Table: 36-10-0480-01.

Note: For the underlying two-digit NAICS industry-level data on labour productivity levels and labour input for key years in the 1997-2022 period, as well as measures of productivity growth subperiods for each of the periods of interest, see Haun (2023)

Table 3: CSLS Decomposition by Industry, Contributions to Business Sector Canadian Labour Productivity Growth, 2000-2022 (percentage points per year)

	2000-2008	2008-2019	2019-2022	2000-2022
Business sector industries (actual)	1.00	1.05	0.23	0.92
Business sector industries (sum of contributions)	1.00	1.06	0.29	0.93
Agriculture, forestry, fishing and hunting	0.11	0.11	0.11	0.12
Mining and oil and gas extraction	-0.07	0.15	0.02	-0.05
Utilities	0.03	0.01	-0.01	0.02
Construction	-0.02	0.03	-0.03	-0.01
Manufacturing	0.15	0.12	-0.05	0.13
Wholesale trade	0.21	0.14	0.04	0.15
Retail trade	0.14	0.10	0.24	0.13
Transportation and warehousing	0.08	0.01	-0.07	0.02
Information and cultural industries	0.10	0.05	-0.04	0.06
Finance and insurance	0.13	0.20	0.29	0.19
Real estate, rental and leasing	0.07	0.06	0.06	0.06
Professional, scientific and technical services	0.02	0.06	-0.34	-0.02
Holding Companies	0.01	0.04	-0.06	0.01
ASWMRS	-0.02	0.03	-0.17	-0.03
Educational services	0.00	-0.01	0.01	0.00
Health care and social assistance	0.00	-0.03	0.03	-0.01
Arts, entertainment and recreation	-0.02	0.01	-0.01	-0.01
Accommodation and food services	0.06	-0.04	0.18	0.03
Other Private Services	0.03	0.03	0.10	0.04

Source: Authors' calculations based on Statistics Canada Table: 36-10-0480-01.

Note: ASWMRS is administrative and support, waste management and remediation services.

2000 period alongside three subperiods: 2000-2008, 2008-2019 and 2019-2022, along with a breakdown of the within sector and re-allocation effects.

Across the post-2000 period, Table 2 shows that the bulk of business sector productivity growth — 0.86 percentage points out of 0.93 percentage points — was accounted for by within-sector productivity growth. Re-allocation level effects also contribute positively to labour productivity growth; although the growth effect was

negative (-0.13), it was slightly outweighed by the level effect (0.20). As a result, productivity growth was increased by 0.07 percentage points, by the net movement of labour into sectors with above-average productivity. Table 3 presents the contribution to business sector labour productivity growth by NAICS two-digit industry for each of the periods in Table 2. These contributions represent the combination of within-sector and re-allocation effects. Table 4 shows the compound annual growth

Table 4: Labour Productivity Growth Rate by Business Sector Industry, Compound Annual Growth Rate, 2000-2022

	2000-2008	2008-2019	2019-2022	2000-2022
Business sector industries	1.00	1.05	0.23	0.92
Agriculture, forestry, fishing and hunting	1.85	3.73	4.05	3.09
Mining and oil and gas extraction	-4.57	1.52	0.54	-0.87
Utilities	1.05	0.93	0.24	0.88
Construction	-0.03	0.43	-0.13	0.19
Manufacturing	1.09	0.87	-0.31	0.79
Wholesale trade	3.23	2.05	0.51	2.27
Retail trade	2.89	1.28	2.62	2.04
Transportation and warehousing	1.37	0.46	-1.59	0.51
Information and cultural industries	2.74	1.00	-2.72	1.11
Finance and insurance	1.73	2.41	2.96	2.23
Real estate, rental and leasing	0.24	0.71	2.99	0.85
Professional, scientific and technical services	0.31	0.83	-3.19	0.08
Holding Companies	2.30	2.84	-24.45	-1.58
ASWMRS	0.69	0.58	-3.87	0.00
Educational services	1.24	-0.23	2.42	0.66
Health care and social assistance	0.08	-0.44	0.83	-0.08
Arts, entertainment and recreation	-1.46	0.52	-4.34	-0.88
Accommodation and food services	0.88	0.56	-0.46	0.54
Other private services	1.41	1.03	2.57	1.38

Source: Authors' calculations based on Statistics Canada Table: 36-10-0480-01.

Note: ASWMRS is Administrative and support, waste management and remediation services.

rate for each business sector industry in each period post-2000.

From Table 3 and Table 4 we can see that growth was driven mainly by within-sector productivity gains in five key sectors: finance and insurance (contribution of 0.19 points; growth rate of 2.23 per cent), wholesale trade (0.15 points; growth rate of 2.27 per cent), retail trade (0.13 points; 2.04 per cent), manufacturing (0.13 points; 0.79 per cent), and agriculture, forestry, fishing, and hunting (0.12 points; 3.09 per cent). Apart from the manufacturing sector, these were also the sectors with the highest rates of within-sector productivity growth. The weak performance of manufacturing is notable here. Although this industry is often thought of being the key driver of productivity in the economy, partly because the greater scope for automation than in some other sectors of the economy, the average productivity growth of 0.79 per cent is actually below the business sector average of 0.92 per cent. This

relatively poor performance is important because manufacturing is still an important part of the economy accounting for 1.8 per cent of total labour hours in 2022.

Between 2000 and 2008, within-sector productivity growth averaged 0.73 per cent, contributing about three-quarters of the aggregate productivity growth rate observed over the subperiod (Table 2). The reallocation level effect in this case was considerable, with a contribution equal to 0.52 points, The reallocation growth effect (-0.25 points) was smaller and negative, leading to a net re-allocation effect of 0.27 points. Much of this was driven by labour moving to the mining, oil and gas extraction industry which has high productivity levels but low productivity growth.

Looking at individual sectors, we see that productivity growth in 2000-2008 was driven by six key sectors: were wholesale trade (0.21 points; annual growth rate of 3.23 per cent), manufacturing (0.15 points; 1.09 per cent), retail trade (0.14 points;

2.89 per cent), and finance and insurance (0.13 points; 1.73 per cent), agriculture, forestry, fishing and hunting (0.11 points; 1.85 per cent), and information and cultural industries (0.10 points, 2.74 per cent). Altogether, these contributions overwhelmingly reflected within-sector productivity growth.

The 2008-2019 subperiod was different from the preceding subperiod; within-sector productivity exceeded the aggregate rate of business sector productivity growth, as business sector productivity growth averaged 1.05 per cent annually, while annual within-sector growth averaged 1.15 per cent. This dynamic arises because both re-allocation effects were negative, indicating that, on net, labour moved towards sectors with below-average productivity levels (level effect of -0.03 points) and below-average productivity growth (growth effect of -0.09 points). Still, these re-allocation effects were small in magnitude. Six sectors in particular drove productivity growth over the subperiod, contributing about 77 per cent of the business sector growth rate. These sectors were: finance and insurance (0.20 points; growth rate of 2.41 per cent), mining and oil and gas exploration (0.15 points; 1.52 per cent), wholesale trade (0.14 points; 2.05 per cent), manufacturing (0.12 points; 0.87 per cent), agriculture forestry, fishing, and hunting (0.11 points; 3.73 per cent) and retail trade (0.10 points; 1.28 per cent). Contributions from these industries almost exclusively reflected within-sector productivity growth. In general, re-allocation effects were extremely small across all industries in this subperiod.

Comparing the sectors that drove growth

in the 2008-2019 period with the 2000-2008 period, we see that five industries made significant contributions in both periods—manufacturing, wholesale trade, retail trade, finance and insurance, and agriculture, forestry, fishing and hunting. Mining, oil and gas contributed negatively in the first period, as its productivity growth was negative, but contributed strongly to productivity growth in the second period. Information and cultural industries, on the other hand, contributed strongly to growth in the first period but not the second, as productivity growth in this sector fell significantly.

The dramatic fall in labour productivity in the mining, oil and gas sector in the 2000-2008 period (productivity fell by 4.57 per cent annually, on average) was a result of a significant expansion in the industry, as high resource prices encouraged the exploitation of lower quality resources. Thus while the sector's share of total labour hours in the economy rose from 1.4 per cent in 2000 to 2.1 per cent in 2008, its productivity fell from \$356 per hour to \$245 per hour over the same period (See the Data tables in Haun, 2023). However, this massive expansion did not continue in the 2008-2019 period—its share of labour hours in the economy remained largely constant—and so productivity growth was positive, 1.52 per cent, on average, allowing the sector to make a significant contribution to productivity growth, instead of being a drag on growth.

As Table 2 above shows, the 2019-2022 period saw a substantial fall in the rate of business sector productivity growth, down from 1.05 per cent annually over 2008-2019 to just 0.23 per cent annually. Within-

sector productivity growth was very low over the period, with an average growth rate across the business sector of just 0.18 per cent annually. Labour input shifted towards industries with above-average levels of labour productivity, adding an additional 0.20 points to business sector productivity growth. However, because these industries also tended to have lower productivity growth, a negative reallocation growth effect (-0.10 points) offset about half of this increase.

The most substantial positive industry contributions stemmed from finance and insurance (0.29 points; growth rate of 2.96 per cent), retail trade (0.24 points; 2.62 per cent), accommodation and food services (0.18 points; -0.46 per cent), agriculture, forestry, hunting and fishing (0.11 points, 4.05 per cent) and other private services (0.10, 2.57 per cent). Retail trade, accommodation and food services and other private services, which have significantly lower productivity levels than the economy-wide average, generated significant positive reallocation effects, as their share of labour hours fell owing to the COVID-19 pandemic lockdowns. Indeed, even though accommodation and food services saw negative productivity growth, the fact that so much labour flowed out of this sector, and because its productivity are so low (in 2019 its productivity levels were \$22 per hour compared to the business sector average of \$57 per hour) meant that it nonetheless made a significant contribution to overall productivity growth in the economy.

Two industries exerted a significant drag on productivity growth during the 2019-2022 period: professional, scientific and technical services (-0.34 points; growth rate

of -4.02), and administrative and support, waste management and remediation services (-0.17 points; -3.87). In both cases within industry productivity growth was strongly negative, and there was also a negative reallocation effect as the share of hours in these industries rose. This reallocation effect came both from a level effect, as both these industries have below average productivity levels, and a growth effect, given the aforementioned declines in productivity growth.

Of the other industries which had contributed significantly to Canada's productivity growth over the 2000-2019 period, manufacturing productivity fell slightly (-0.31 per cent), wholesale trade saw only a slight productivity increase (0.51 per cent), and mining, oil and gas saw a productivity increase (0.54 per cent) that was mostly offset by a slight decline in hours worked in the sector. As a result, each of these three industries contributed little to productivity growth.

Given that, as mentioned above, 2019-2022 does not represent a whole business cycle, it remains to be seen whether these patterns of productivity growth by industry will persist. For finance and insurance, and retail trade, which had above average productivity growth over the 2008-2019 period, it seems likely that the pandemic has accelerated existing shifts to e-banking and e-commerce, allowing companies in these areas to shed or re-allocate employees in low-productivity positions, particularly in brick-and-mortar operations. For accommodation and food, which has less opportunity for using technology to increase output and shed labour, and which saw its productivity fall during the pandemic, it is

likely that it will once again be a drag on overall productivity growth as labour flows back to this low productivity sector with increased demand for in-person activities such as restaurant meals.

Sources of Canadian Labour Productivity Growth: A Growth Accounting Perspective

Another way of understanding labour productivity growth is to look at the underlying drivers of productivity using a growth accounting framework. Table 5 below presents Statistics Canada growth accounting estimates for business sector Canadian labour productivity growth from 1961 to 2021. 2022 data were not available at the time of writing, which limits our ability to make conclusions about the post-2019 period. Contributions to labour productivity growth are calculated for three sources of growth. The first is multifactor productivity (MFP also referred to as total factor productivity), which is the part of an increase in output which remains after accounting for changes in capital and labour input. MFP is usually thought of as depending on the pace of underlying technological progress, as well as economies of scale, changes in organizational structure, improvements in infrastructure and institutions, and spillover and network effects (OECD, 2023).

The second is capital intensity, the increased productivity which arises as each

unit of labour becomes equipped with more capital. The third source of growth is changes in the quality of labour input. In the case of the latter two sources, the contribution is calculated as the growth rate of the component weighted by the share of income which accrues to the relevant factor of production (capital or labour) and is expressed in percentage points.

Panel A of Table 5 provides the estimated contributions to labour productivity growth in absolute terms, while Panel B expresses contributions in relative terms, as a proportion of the total labour productivity growth rate.¹⁰ Panel C, furthermore, provides compound annual growth rates for the variables underlying the contributions, namely labour quality, capital input, and labour input in the form of hours worked. Finally, Panel D shows the share of input costs associated with capital and labour inputs, respectively.

As Table 5 shows, prior to 2000 productivity growth was strong in Canada, business sector labour productivity grew on average at 2.85 per cent over the 1961-1981 period and 1.72 per cent over the 1981-2000 period. Roughly half of this growth was attributable to capital intensity, with ICT capital intensity more important than non-ICT capital intensity after 1981. Multifactor productivity contributed a quarter (26.6 per cent) of productivity growth in the 1961-81 period and a third (34.4 per cent) in the 1981-2000 period. Labour quality contributed about a fifth of growth

¹⁰ The sources of growth decomposition performed here using official Statistics Canada data is not perfectly additive. As such, the relative contributions in Panel B, which are calculated using the contributions and the observed rates of labour productivity growth presented for each period in Panel A, do not add to 100 per cent. Still, the discrepancy is small.

Table 5: Sources of Canadian Business Sector Labour Productivity Growth, 1961-2021

Panel A: Absolute Contributions (percentage points)

	1961-1981	1981-2000	2000-2019	2000-2008	2008-2019	2019-2021
Labour Productivity Growth	2.85	1.72	0.96	0.86	1.03	1.09
Multifactor Productivity	0.97	0.46	-0.09	-0.54	0.24	-0.71
Capital Intensity	1.33	0.87	0.79	1.13	0.54	1.29
ICT Capital Intensity	0.18	0.56	0.22	0.43	0.07	0.14
Non-ICT Capital Intensity	1.20	0.35	0.56	0.70	0.48	1.15
Labour Quality	0.53	0.38	0.26	0.28	0.25	0.52
Total Contributions	2.82	1.71	0.96	0.87	1.03	1.10

Panel B: Relative Contributions (%)

	1961-1981	1981-2000	2000-2019	2000-2008	2008-2019	2019-2021
Labour Productivity Growth	100.0	100.0	100.0	100.0	100.0	100.0
Multifactor Productivity	34.0	26.6	-9.2	-63.3	23.7	-65.4
Capital Intensity	46.6	50.6	82.1	131.5	52.2	117.9
ICT Capital Intensity	6.2	32.4	22.4	49.5	6.8	12.6
Non-ICT Capital Intensity	42.3	20.3	58.8	81.0	46.3	105.4
Labour Quality	18.5	22.3	27.0	32.3	23.8	48.0
Total Contributions	99.1	99.5	99.9	100.5	99.7	100.6

Panel C: Compound Annual Growth Rates for Sources of Growth, Factor Costs, and Hours Worked

	1961-1981	1981-2000	2000-2019	2000-2008	2008-2019	2019-2021
Labour Quality	0.85	0.63	0.44	0.48	0.42	0.90
Capital Input	5.68	3.73	2.89	3.96	2.12	1.04
ICT Capital Input	8.17	13.51	5.18	9.23	2.33	1.15
Non-ICT Capital Input	5.46	2.43	2.54	3.15	2.09	1.03
Hours Worked	2.03	1.42	0.97	1.22	0.79	-2.06

Panel D: Labour and Capital Share of Input Costs

	1961-1981	1981-2000	2000-2019	2000-2008	2008-2019	2019-2021
Labour Share of Costs	62.0	60.5	58.9	58.7	58.8	58.5
Capital Share of Costs	38.0	39.5	41.1	41.3	41.2	41.5
ICT Capital Share	2.9	4.6	5.1	5.3	4.6	4.3
Non-ICT Capital Share	35.1	34.9	36.0	36.0	36.6	37.2

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

Note: Contributions from growth in multifactor productivity, capital intensity, and labour quality are official Statistics Canada estimates. Contributions from growth in ICT and non-ICT capital intensity are calculated using Statistics Canada data on hours worked and ICT/non-ICT capital inputs and costs for each period. Labour and capital cost shares are calculated by taking the arithmetic average of the share of costs for labour and capital at the start and end of each period.

in both periods.

As we have seen, average productivity growth was significantly lower in the 2000-2019 period: only 0.96 per cent, a decline of 0.76 percentage points from the 1981-2000 period. This decline is largely driven by a collapse in MFP growth, which fell from 0.46 per cent in 1981-2000 to -0.09 per cent in 2000-2019. The contribution of capital intensity fell only marginally (from 0.87 percentage points to 0.79 percentage points), as did that of labour qual-

ity (0.38 percentage points to 0.26 percentage points). Part of the decline in MFP is driven by the boom in the resource sector: as noted above, high commodity prices incent companies to develop lower quality and harder to exploit resources.

However, these averages for the 2000-2019 period mask considerable variation if we break the period down into its two component business cycles. In the 2000-2008 period MFP growth is strongly negative (-0.54 per cent on average); however,

the contribution of capital intensity grew quite fast (1.13 percentage points on average) due to strong growth in both ICT capital (which grew 9.23 per cent on average, contributing 0.43 percentage points to productivity growth) and non-ICT capital (3.15 per cent growth, contributing 0.70 percentage points). These fast growth rates in capital input were driven by the rapid adoption of ICT early in the 2000s, and the rise in commodity prices that incited investment in the resource sector.

The 2008-2019 period looks very different. MFP grew, albeit it at a historically low average rate of 0.24 per cent; however, the growth of capital slowed significantly, so that capital intensity contributed an average of only 0.54 percentage points, higher than that of MFP, but only around half of the 2000-2008 period. This slowing in capital input growth was greatest in the ICT sector, where growth declined dramatically to only 2.33 per cent; growth in non-ICT capital also slowed to 2.09 per cent. Part of the latter slowdown can be attributed to weaker commodity prices, especially after 2015, which reduced investment in the resource sector. The deep recession of 2008-2009 in the wake of the financial crisis will also have likely played a role in discouraging investment during this period.

Explaining the decline in multifactor productivity growth post-2000 is challenging, given that multifactor productivity is

essentially a residual: the part of growth that we can not explain through changes in capital intensity and labour quality. Changes in the growth of this measure are often attributed to changes in the adoption of new technologies, which is in turn linked to the underlying rate of scientific discovery. The fact that, as we have seen, productivity growth has declined across almost all OECD countries post-2000¹¹ suggests a common explanation. One possibility might be a slowing of the rate of technological change due to a slowing of the underlying rate of scientific discovery;¹² another is a general slowdown in the rate of adoption of new technologies. This is not to say that there would not be room for Canada to improve its adoption of new technologies—Canada’s low levels of labour productivity relative to other countries suggests considerable room for improvement—but simply that the decline relative to 2000 may not be the result of factors specific to Canada.

Conclusions

In this article we have examined Canada’s post-2000 productivity slowdown, and its 2020-2022 pandemic experience, from three different standpoints. The first was a comparison with other OECD countries, particularly the United States. The second was a decomposition by industry sector. The third was to use growth

11 While it is true that the United States, generally at the forefront of scientific innovation in many sectors, has not seen much of a decline in productivity growth in 2000-2022 compared to 1981-2000, this is because of very strong productivity growth in the United States in the early 2000s. Subsequent to 2008 there was a significant decline in business sector productivity growth, as Panel B of Chart 4 makes clear.

12 This explanation is supported by a recent paper by Park *et al.* (2023) in the prestigious scientific journal *Nature*, in which the authors find that “papers and patents are increasingly less likely to break with the past in ways that push science and technology in new directions.”

accounting to look at the contributions of factors of production.

We found that:

- Canada's post-2000 productivity growth has been similar to peer OECD countries; however, Canada's productivity levels are below almost all these countries.

- While Canada's productivity growth did not slow down as much after 2000 as it did in most other OECD countries, this was because pre-2000 growth was already relatively weak.

- While Canada's productivity growth was faster than that of the United States up until the early 1980s, it has generally been lower since then, so that by 2022 business sector labour productivity was less than 70 per cent of U.S. levels, lower than in any year since 1947.

- While productivity rose significantly in Canada in the first year of the pandemic, these gains have largely been eliminated; on the other hand, the United States has managed to retain most of its pandemic-era productivity increases.

- Productivity growth over the entire 2000-2022 period has largely been driven by growth within industries, rather than reallocation of resources across sectors.

- Key sectors driving growth were finance and insurance, retail and wholesale trade, manufacturing, and agriculture.

- Productivity growth in mining and oil and gas as well as flows of resources in and out of the sector were important for explaining trends in subperiods but did not explain much of productivity growth over the whole 2000-2022 period.

- The productivity slowdown since 2019 was largely a result of reductions in productivity within sectors such as manufac-

turing, professional scientific and technical services, and wholesale trade; these reductions offset productivity gains coming from sectors such as accommodation and food and retail trade.

- From a growth accounting perspective, most of the post-2000 slowdown in productivity growth can be explained by a collapse in multifactor productivity growth. However, breaking this period down into subperiods, we see a very significant slowdown in capital growth over 2008-2019 period, following a very significant boom in capital investment in the 2000-2008 period. In contrast, MFP Growth picked up a little over 2008-2019, although it remains weak.

In sum then, Canada's productivity growth since 2000 has been disappointing compared to previous decades, and while growth has been similar to many other OECD countries, it has been significantly lower than the United States, despite the close economic ties between the two countries. Furthermore, Canada's productivity level is lower than almost all its advanced country peers. The problem does not seem to be concentrated in one or two sectors, nor is it that labour is moving to sectors with lower productivity levels or growth rates. Rather, it is weak multifactor productivity growth that seems to be playing the biggest role in explaining the post-2000 slowdown, with declining capital intensity, especially in ICT, playing a key role in the last complete business cycle, 2008-2019.

Disappointing though productivity growth has been in Canada, the question for the Canadian economy at the current moment, given that productivity has barely increased since 2019, is less whether it can

attain 1.74 per cent—the level it enjoyed from 1981-2000, and close to the U.S. average since 2000—but whether it can even attain the roughly 1 per cent rate of annual productivity growth it enjoyed over the 2000-2019 period. While the United States seems to have hung on to some of the productivity gains that occurred during the pandemic, this has not been the case in Canada.

A return to even 1 per cent productivity growth will depend on the performance of the main drivers of growth. For capital inputs recent trends are not favourable: there has been a significant slowdown in both ICT and non-ICT investment in recent years, partly driven by lower resource prices. Looking forward, higher resource prices could change this picture; however, the commodity prices boom in the early 2000s was driven by industrialisation in developing countries, particularly China, on a scale that does not seem likely to be repeated in the near term. Furthermore, the resource sector, and the broader economy, are facing stricter environmental rules and regulations, which is likely to further reduce the pace of investment.

Another potential headwind to restoring pre-pandemic productivity growth is the historically high levels of immigration that Canada is currently experiencing in recent years. According to Statistics Canada's Labour Force Survey the foreign-born share of Canada's total employment increased by around 4 percentage points between 2017 and 2022, and based on recent trends this pace seems likely to accelerate. To the extent that immigrants, especially recent immigrants, have lower productivity than the Canadian-born, this trend could

put downward pressure on the growth of labour quality going forward, which in turn would put downward pressure on productivity growth.

What about MFP growth? As discussed above, there does seem to be evidence for a decline in productivity growth across advanced countries that might be consistent with a fall in the rate of technological progress or with a decline in the rate of adoption of new technologies. This situation might change if technologies such as artificial intelligence are sufficiently productivity-enhancing; however, they would need to be introduced at a scale across the economy to make a meaningful impact on overall productivity growth.

One reason for optimism about the prospects for stronger MFP growth in Canada is, somewhat paradoxically, its comparatively low levels of productivity compared to peer countries, which would seem to indicate that there should be considerable room for Canada to increase productivity by advancing towards the technological frontier. In principle, an open economy like Canada, with high levels of foreign direct investment, and with very close geographic, cultural and economic links to the relatively advanced U.S. economy, should find it relatively easier to import new innovations than many other countries. In practice though, as we have seen, Canada's productivity levels have not been catching up to other countries' levels over many decades, and Canada's historically weak investment in R&D also does not bode well for MFP growth. Overall then, the outlook for Canadian productivity growth does not seem particularly favourable, and rather than reverting to the higher growth rates

in the past, it may be that productivity growth will remain low for some time.

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