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The Distributional Origins of the Canada-US GDP and Labour Productivity Gaps

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Abstract

Gross domestic product (GDP) per adult in Canada fluctuated between 70% and 90% of that of the United States between 1960 and 2020. Behind this gap lie large, systematic differences in relative incomes across the Canadian and US income distributions. There are small differences in average incomes among lower percentiles of the income distribution while large gaps exist for high-income earners, with larger gaps for business owners and the university-educated. Using data from the World Inequality Database, we find that the top 10% of the income distribution accounts for three-quarters of the gap in GDP per adult between Canada and the United States and up to two-thirds of the measured labour productivity gap. While average hours worked per working-age adult in Canada and the United States were similar in 1970 and 2019, persistent shifts in relative hours worked per adult appear to play a significant role in measured labour productivity differences between 1970 and 2019. Our work suggests that selective emigration of high-ability workers—commonly referred to as brain drain—to the United States may play a significant role in accounting for the gaps in GDP per adult and labour productivity. The lower level of innovative activities in Canada is consistent with larger income gaps for high-income earners.

Topics: Productivity
JEL codes: D31, E24, J24, J61, N12, O47, O51

Résumé

Entre 1960 et 2020, le produit intérieur brut (PIB) par adulte au Canada a varié entre 70 % et 90 % de celui des États-Unis. Cet écart persistant masque des différences de revenus relatifs importantes et systématiques parmi les distributions des revenus au Canada et aux États-Unis. Nous observons qu'il existe de faibles différences de revenus moyens dans les centiles inférieurs, mais de forts écarts chez les personnes à revenu élevé, et que ces écarts sont plus substantiels chez les propriétaires d'entreprises et les universitaires. En utilisant les données de la World Inequality Database (base de données sur les inégalités dans le monde), nous constatons que le décile supérieur de la distribution des revenus représente les trois quarts de l'écart de PIB par adulte entre le Canada et les États-Unis et jusqu'à deux tiers de l'écart de productivité du travail mesuré. Alors que le nombre moyen d'heures travaillées par adulte en âge de travailler au Canada et aux États-Unis était similaire en 1970 et en 2019, il semble que les différences de productivité du travail mesurées entre ces deux années soient largement attribuables à des changements persistants du nombre relatif d'heures travaillées par adulte qui se sont produits dans l'intervalle. Nos travaux tendent à montrer que l'émigration sélective vers les États-Unis de travailleurs hautement qualifiés – phénomène communément appelé « fuite des cerveaux » – pourrait expliquer une partie importante des écarts observés sur les plans du PIB par adulte et de la productivité du travail. Par ailleurs, le niveau plus faible des activités innovantes au Canada cadre avec des écarts de revenus plus importants chez les personnes à revenu élevé.

Sujets : Productivité
Codes JEL : D31, E24, J24, J61, N12, O47, O51

1 Introduction

Canadian GDP per adult has fluctuated between 70 and 90 percent of that of the United States for over 100 years. This persistent gap is puzzling as Canada and the United States share similar institutions and economic structure, (largely) speak a common language, and share a relatively open border. Despite these similarities, the last decade has seen a widening gap in GDP per adult and measured labour productivity. This widening gap has renewed interest in what factors account for lower GDP per adult and productivity in Canada.

In this paper, we examine the contribution of differences across the Canadian and US income distribution to the GDP per adult gap. Despite a significant literature documenting higher levels of income inequality in the United States than in Canada (e.g., Saez and Veall (2005), Burkinshaw et al. (2022)), surprisingly little work has examined differences in the level of Canadian and American income across the distribution. We show that the systematic variation in the gaps across the income distribution is informative in accounting for the long-run evolution of the Canada-US GDP and productivity gaps, and can also help discipline our evaluation of the role of human and physical capital differences and firms and innovation in accounting for these gaps.

We use several data sources to compare pretax income in Canada and the United States across the income distribution. Our primary source is the World Inequality Database (WID), which reports the income share of the top 1 percent, the top 2–10 percentiles, the 50–89 percentiles, and the 1–49 percentiles. Although this is a relatively coarse division of the distribution, the WID provides a long-term perspective as it is available annually since 1920. We also draw on the primary household wealth surveys, the Canadian Survey of Financial Security (SFS), and the US Survey of Consumer Finances (SCF), which over-sample higher-income households where we find the largest income gaps. Although these surveys are less frequent, they allow us to examine how income varies by education as well as for business and nonbusiness owners. Finally, we examine data for employees aged 25–54 from the Global Repository of Income Dynamics (GRID) over 1998–2016 to isolate differences in employee income.

We find that the top 10 percent of income earners in the WID account for the majority of the Canada-US GDP per adult gap. In 2019, the top 10 percent accounted for just over one-third of Canadian income, but three-quarters of the GDP per adult gap. Even more striking is that the contribution of the top 1 percent is as large as that of the next 9 percent combined. This is due to the very large differences in average income at the top of the distribution: The average income of the top 1 percent in Canada in 2019 was roughly 40 percent of the United States, a gap nearly twice as large as that in GDP per adult. The counterparts to the large income gaps at the top are smaller gaps for the rest of the distribution. In 2019, the gap for the bottom 50 percent was 5 percentage points and that of the 50–89 percentiles was roughly 15 percentage points. Although these gaps fluctuate over time, the gaps in 2019 were close to the average of 1960–2020.

To confirm our findings based on the WID, we use the US SCF and the Canadian SFS to compare the distribution of pretax household income for 25–65 year olds in 2018 and 1998. Similarly to the WID, we find much larger gaps at the top of the income distribution and small differences in the bottom half of the distribution. We also find these gaps are 10–15 percentage points wider for those with a university degree than for non-degree holders, and are also larger for business owners. Although we find similar patterns for employees aged 25–54 from the GRID spanning 1998–2016, the magnitude of the gaps for top earners is relatively small. The smaller gaps for top income earners that we document in the GRID data are consistent with the exclusion of self-employment and business income, as well as the restriction to workers under age 55.

We show that measured labour productivity comparisons are affected by two compositional forces. First, the large differences between Canada and the United States at the top of the distribution mean that the top 10 percent account for roughly two-thirds of the measured Canada-US labour productivity gap. When we remove the top 10 percent, our illustrative calculations suggest that the gap between Canadian and US labour productivity for the bottom 90 percent of the income distribution in 2019 is roughly the same as in 2001. A second compositional force that affects relative labour productivity is the large swings in relative hours worked per working-age adult. Although hours worked per working-age adult were similar in 1970 and 2019 in Canada and the United States, relative hours worked can vary by 5–10 percent over a decade. Because these swings in relative hours are largely due to relatively lower paid workers, this compositional force can significantly impact medium-term trends in measured relative labour productivity.

The neoclassical growth model is the standard framework (and source of intuition) for quantifying the contribution of differences in capital and human capital to cross-country income differences. We thus use the neoclassical growth model to guide our analysis of whether common explanations of the Canada-US GDP and productivity gaps are consistent with the differences across the income distribution. We group explanations into three broad categories: 1) a human capital gap; 2) a lack of capital investment; and 3) an innovation or firm structure gap. The growth model offers strong implications for the relationship between these explanations and cross-country differences across the income distribution as it implies that differences in TFP or capital per worker shift the distribution of income proportionately. Hence, cross-country differences in TFP or capital do not give rise to different income gaps for high- and low-income earners. However, differences in the distribution of human capital or firm-level differences can lead to cross-country differences in income across the income distribution.

We show that a standard efficiency unit measure of human capital based on observed income differences could account for the gap in GDP per adult. However, the implied human capital differences are inconsistent with modest Canada-US differences in educational attainment. This leads us to explore the implications of selective emigration by high-ability workers (i.e., "brain drain"). In contrast to Helliwell (1999), we find that selective emigration could play a significant role in accounting for the GDP gap. Central to our exercise is the observation that a Pareto distribution of ability that matches the right tail of income also implies that emigration of a relatively small number of high-ability workers can significantly lower average output. We show that although the stock of Canadian emigrants in the United States is likely too small to fully account for the Canada-US GDP per adult gap, it is large enough to be a significant factor in accounting for both the gap in GDP and income differences across the distribution. We also document that Canadian-born individuals living in the United States are both more highly educated and on average earn more than those who are born in the United States. In addition, our analysis suggests that the net flow of university graduates is not a good proxy for brain drain.

An innovation gap could complement the impact of selective immigration. Evaluated through the lens of the workhorse growth model, the rise of US superstar firms (Autor et al., 2020) and the persistence of small Canadian producers (Leung et al., 2008; Ranasinghe, 2017) are consistent with a sharper rise in US markups (De Loecker and Eeckhout, 2018) and a more modest decline in Canadian labour share. We document that concurrent divergence R&D expenditures across countries correlate strongly with the divergence in incomes among the top 10 percent. This suggests a complementary relationship between high-ability workers and innovative activity. It is also consistent with the important role of highly productive firms in the rise in US income inequality.

Although lower Canadian investment is often cited as an explanation of the output and productivity gap, we argue that it is more likely a symptom than a fundamental cause of those gaps. As discussed above, in the workhorse neoclassical growth model, a difference in capital per worker is unable to account for differential gaps across the income distribution. Moreover, if we input the differences in human capital required to match the gap in GDP per adult, the growth model implies that Canada has too much capital per worker. In addition, the decline in Canadian investment compared to the United States in recent decades coincides with an outflow of capital from Canada, which also suggests there are low returns on marginal investments in Canada.

Our paper builds on a broad literature that studies the large gap between Canadian and US GDP per capita and productivity. A frequent theme is that lower innovation and investment in Canada are important contributors to the GDP gap and that the gap has persisted despite policy reforms such as trade liberalization and a stable macro policy framework (e.g., Harris (1999), Macklem (2003)). Sharpe (2003) argues that the widening gap between Canadian and US GDP per worker and labour productivity between the 1980s and 2002 reflects lower capital intensity and less innovation in Canada due to a less developed tech sector, proportionately fewer scientists and engineers in R&D, and more limited economies of scale and scope due to a smaller market. Trefler (1999) argues that the innovation and R&D gap is largely responsible for the gap in Canada-US manufacturing productivity in the 1980s and 1990s, driven by lower R&D spending in Canada and a brain drain. Canadians who emigrate to the United States are disproportionately highly educated and knowledge workers (e.g., Zhao et al. (2000)), and are often selected from higher income and more advanced degrees (Damas de Matos and Parent (2019)). The quantitative implications for the macroeconomy of selective emigration are more debated (e.g., Kesselman (2001), Helliwell (1999)). Ranasinghe (2017) and Alexopoulos and Cohen (2018) also point to lower innovation in Canada as an important factor. More recently, the smaller size of Canadian firms (Leung et al., 2008) and a lack of superstar tech firms in Canada has been remarked upon. Robson and Bafale (2023) document the lower levels of capital per worker in Canada compared to the US. We add to this by showing that innovation stories could be consistent with the large cross-country gaps observed for higher income earners, as well as the large quantitative effects of selective emigration of high-ability workers.

In recent work, Conesa and Pujolas (2019), Loertscher and Pujolas (2024), and Gu (2018) argue that the resource sector in Canada over 2002–2014 play a significant role in the slower measured TFP growth in Canada than in the US. Conesa and Pujolas (2019) focus on the slow growth in measured TFP growth in Canada, rather than the level difference with the United States, over this period.[1] Gu and Willox (2023) also document a slowdown in Canadian business sector productivity growth relative to the United States since 2001. Our analysis suggests that part of this divergence in measured TFP may be due to shifts in the composition of hours worked and that a widening gap in the incomes of the top 10 percent accounts for most of the divergence in Canadian and US labour productivity since the early 2000s.

Our paper also builds on work examining the distribution of income in Canada and the United States. Wolfson and Murphy (1998) and Blackburn and Bloom (1991)) use data from the Canadian Survey of Consumer Finances and the March supplement to the US Current Population Survey (CPS) to compare household income across the distribution. Wolfson and Murphy (1998) show that disposable income for low-income Canadian households is higher that that of their counterparts in the United States, but that US household incomes at the top of the distribution are higher than top Canadian incomes. While we find similar patterns, our analysis is less impacted by top coding of income, which results in larger income gaps for top earners. We also document the long-lasting nature of these gaps across the income distribution and show that they play an important role in accounting for the Canada-US GDP and measured labour productivity gaps.

The remainder of the paper is organized as follows. Section 2 documents differences in income between Canada and the United States across the income distribution, and the role of higher-income earners in accounting for the Canada-US GDP per adult gap. Section 3 examines the role of high-income earners and shifts in hours worked per adult in measured relative labour productivity. In Section 4, we examine the implications of the data for proposed explanations of the Canada-US GDP and productivity gap. Section 5 sets out some potential directions for future research, while Section 6 concludes.

[1] A divergence in measured TFP has been documented during the Great Depression, which saw a more persistent decline in TFP in Canada than in the United States over 1929–39 (Amaral and MacGee (2002)).

2 Canada-US Income Differences

The lower degree of income inequality in Canada than in the United States is well documented (e.g., see Green et al. (2016), Saez and Veall (2005), Veall (2012)). The implications of these differences in inequality for differences in income across the distribution have been (surprisingly) less explored. Intuitively, the lower level of inequality in Canada should result in relatively smaller gaps for lower-income and larger gaps for higher-income earners.

We confirm that this intuition holds in the data. What is surprising is the quantitative implications of these gaps. Using data from the WID, we find that more than three-quarters of the average gap in GDP per adult over 1960–2022 is accounted for by the top 10 percent of income earners. Although our analysis focuses on 1960–2020, in Section 2.1.2, we document that the gaps across the income distribution over 1920–1960 were similar to those observed since 1960.

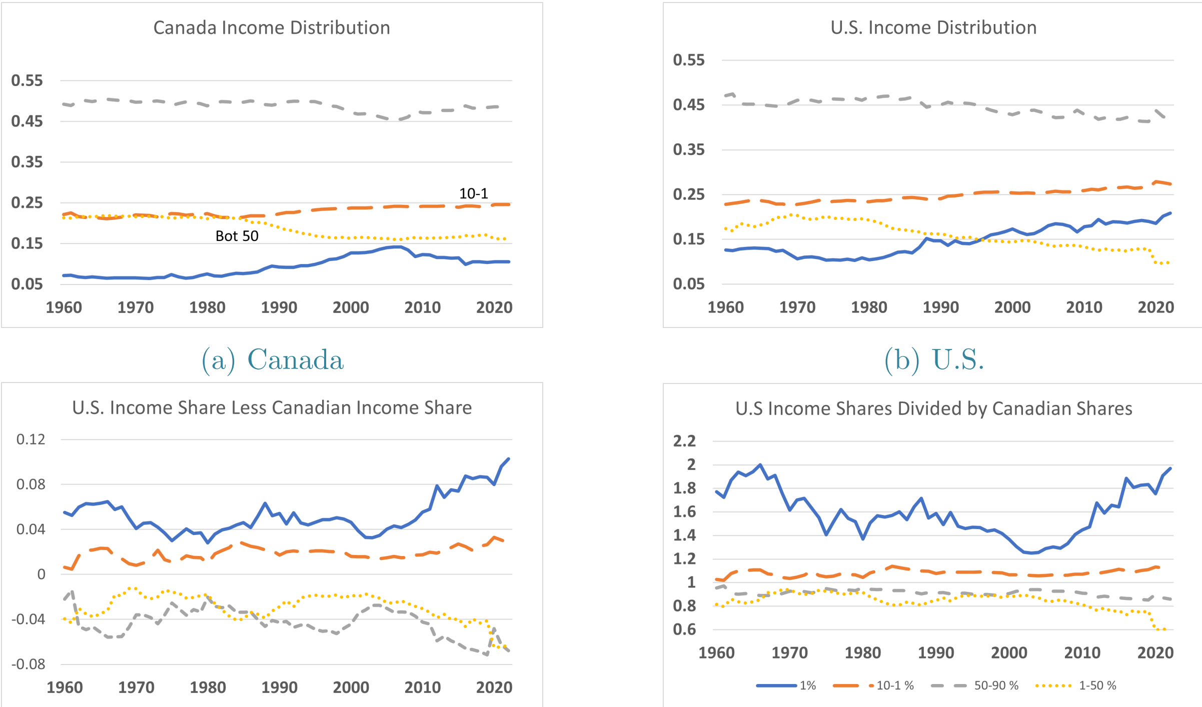
We show that this pattern of large differences in income for high-income earners and smaller gaps lower in the distribution holds in other data sources. Comparing the distribution of household income in the SCF and SFS, we find that the income gaps are largely attributable to university-educated individuals and business owners. We also document a similar pattern for employees aged 25–55 over 1998–2016 using data from the GRID.

2.1 World Inequality Database

The World Inequality Database (WID) provides data on the share of income in Canada and the United States over 1920–2022 for the top percentile, the top 2–10 percentiles, the 50–89 percentiles, and the 1–49 percentiles (see Figures 1a and 1b). The WID is part of the development of distributional national accounts (see Saez and Zucman (2020), Blanchet et al. (2021)), and provides comparable distribution data across countries.

The WID measure we look at is "fiscal income," which corresponds to taxable income plus income tax deductions. This yields a pretax income measure. An important issue in the allocation of income across the distribution is whether income is reported by individual tax filers or at the household level (Veall (2012)). The WID controls for this by evenly splitting income between adults (aged 20 and older) within a household. The aggregate income concept in the WID is net national income (NNP) (see Blanchet et al. (2021)). Net national income accounts for roughly 82 percent of Canadian GDP. The main difference is that NNP excludes depreciation (Capital Consumption Allowance), although NNP also includes net foreign income. The WID measure of net foreign income includes imputations for income from offshore tax havens as well as reinvested income on net foreign portfolio investment. In attributing shares of fiscal income to GDP, we assume that capital consumption is allocated proportionately to income.

Although there is some debate over the share of labour and capital income of high-income earners, several studies report that labour income is the key factor behind the surge in top incomes (Atkinson et al. (2011), Saez and Veall (2005) and Veall (2012)). This suggests that the contribution of the top percentile to the gap is not primarily driven by capital income, but



(a) Canada

(b) U.S.

(c) U.S. Share minus Canada Share

(d) U.S. Share Div. by Canada Share

Figure 1: Top 1, 10-1, 50-90, and Bottom 50 Shares, 1960–2022

Notes: The income shares are from the World Inequality Database (WID). The 50–89 group is constructed by subtracting the shares of the bottom 50 and top 10, and the top 10–2 percentiles is constructed as the top 10 share minus the top 1 share.

instead reflects a mix of changes in income per hour worked and hours worked. In Section 3, we show that there have been sizable variations in hours worked per working-age population between Canada and the United States. This suggests that part of the variations in income shares for the bottom 50 percent (and perhaps the 50–89 percentiles) could reflect differences in hours worked.

2.1.1 The Distribution of Income in Canada and the United States

Despite following similar trends, there are significant differences between the Canadian and US income distributions (see Figure 1). Since the 1970s, the Canadian bottom 50 share has declined by less and the share of the top 1 percentile of earners has increased by less than in the United States (see Chart 1c). As a result, differences in income shares have widened since the early 2000s, particularly for the top 1 percent (see Figures 1c, 1d).[2]

To construct mean income across the income distribution, we use the income shares to allocate GDP per adult across the top 1 percent, the top 10–2 percent, the 50–89 percent and

[2]The smaller rise in Canadian top income shares is similar to that in Europe (e.g., Blanchet et al. (2022)).

the 1–49 percentiles. Since nominal GDP per adult corresponds most closely to shares of total nominal income, we use the nominal GDP per adult series from WID along with the OECD PPP exchange rate to convert Canadian GDP into USD per adult. The ratio of income for income group i (e.g., the top 1 percentile) is $\frac{\text{GDP per adult}^{Can}}{\text{GDP per adult}^{US}} \frac{\text{Inc Share}^{Can,i}}{\text{Inc Share}^{US,i}}$. From Chart 1d it is clear that this calculation will imply larger income gaps at the top of the income distribution than at the bottom, and that these gaps vary with shifts in income shares.

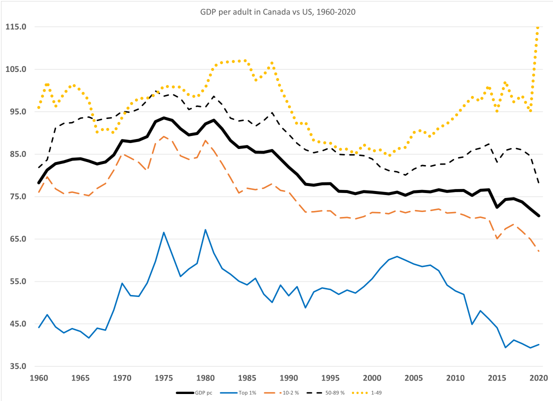
As expected, the gaps in income per adult are much larger for higher-income earners than the gap in GDP per adult (see Figure 2a). The income of the top 1 percent in Canada is less than 40 percent of that of the US top 1 percent in 2019. In contrast, the income of the bottom 50 percent of earners is close to their US counterparts, while the gap for those in the 50–89 percentiles is roughly three-fifths of the average gap in GDP per adult.

Although the ordering of the gaps across the income distribution have persisted, their magnitudes have varied over the past sixty years. The narrowing of the gap in GDP per adult in the 1960s and 1970s was broad based across the top half of the income distribution, with the largest catch-up taking place in the top 1 percent. However, shifts in relative income since the 1980s have been more uneven. The widening of the gap in GDP per adult over the 1980s and 1990s was broad based outside of the top 1 percent. However, since the early 2000s, the top 1 percent income gap has significantly widened at the same time as the gaps for the 1–49 and 50–89 percentiles have narrowed.

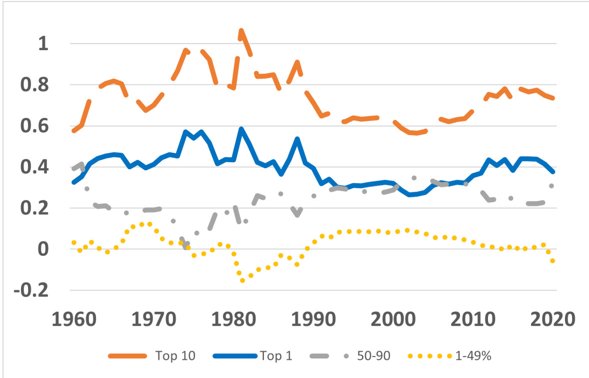
To examine the quantitative implications of these differences, we decompose the contribution of each income group to the GDP per adult gap. Over 1960–2020, the top 1 percent of earners (on average) account for 40 percent of the gap in GDP per adult between Canada and the United States (see Figure 2b). In most years, the contribution of the top 1 percent to the GDP per adult gap is at least as large as the contribution of the next 9 percent (i.e., the 10–2 percentiles). Although the top 10 percent of income earners account, on average, for 75 percent of the gap in GDP per adult over 1960–2020, their contribution varies from roughly 57 percent in 2003 to 106 percent in 1981. The widening of the top 10 percent gap plays an important role in accounting for the recent widening of the Canada-US GDP gap. Between 2015 and 2019, Canadian GDP per adult declined from roughly 76.6 percent of the US GDP to 72.1. Roughly two-thirds of the increase in the GDP gap (of 4.5%) can be accounted for by a widening of the income gap for the top 10 percent of the income distribution.

Given the large contribution of the top 10 percent, the contribution of the remaining 90 percent is modest (see Figure 2b). The 50–89 percentiles account for roughly one-fifth of the difference in GDP per adult between Canada and the United States. However, the contribution of the bottom 50 percent is small and sometimes negative, since the average income is similar and sometimes higher in Canada. The contribution of the bottom 90 percent comoves (necessarily) in the opposite direction to the contribution of the top 10 percent. Thus, the 1980s and 1990s saw a rise in the contribution of the bottom 90 percent to the GDP gap, and then a decline over the 2000s.

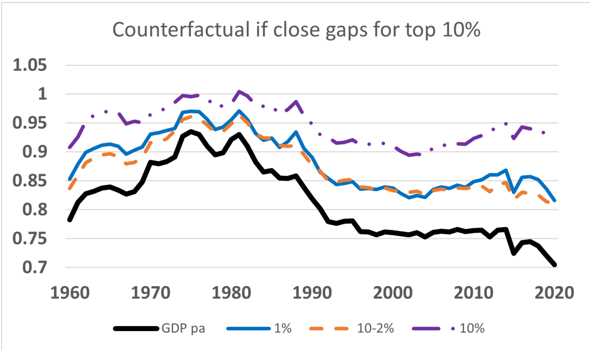
An alternative approach to quantifying the implications of the gaps across the income distribution is via a counterfactual where we increase the income of different segment(s) of the



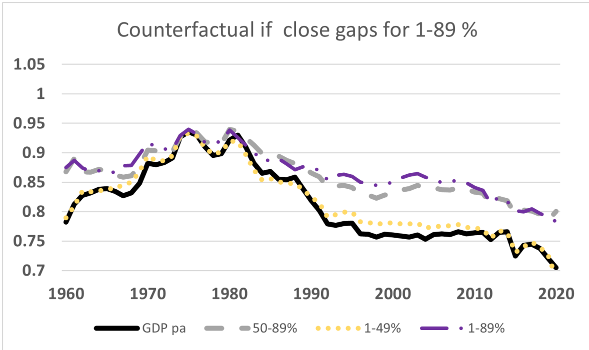
(a) Can-US Incomes



(b) Contribution to GDP pa Gap



(c) Equalizing 1, 10-2 & 10-1 Gaps

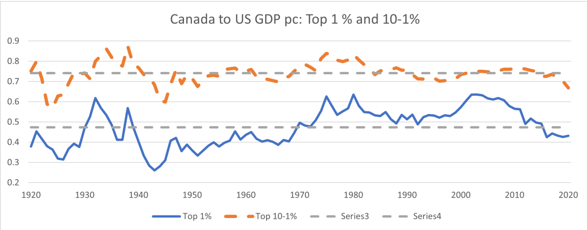


(d) Equalizing 1-49, 50-89 & 1-89 Gaps

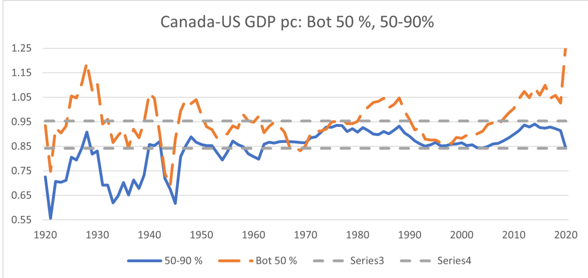
Figure 2: Relative Incomes Across Income Distribution and Counterfactuals of Closing Gaps by income groups, 1960–2020

Income shares and nominal GDP per adult are from World Inequality Database (WID). Nominal GDP for Canada is converted to US dollars using OECD PPP exchange rate. For each counterfactual in panels c and d, the amount of income required to bring Canadian income to the level of their US counterpart is added to Canadian GDP per adult.

Canadian income distribution to the *level* of their US counterparts. In Figure 2c we plot the counterfactuals where we impose the US income level for the top 1 percent, the top 10–2 percent and the entire top 10 percent. This counterfactual implies a smaller decline in Canadian GDP per adult relative to the United States in the 1990s. Moreover, if the top 10 percent of Canadians earned the same as their US counterparts, the gap in GDP per adult would have narrowed since the early 2000s to roughly 5 percentage points. In Figure 2d, we repeat this exercise for the 1–49 and 50–89 percentile groups. Since the implied gap for the 1–49 percentile is small, equalizing incomes for this part of the distribution has a small impact on the GDP gap. Interestingly, while equalizing the income gap for the 50–89 percentiles would reduce the GDP gap by about one-fifth, the contribution is smaller on average than the contribution of the top 1 percent.



(a) Top 1 %, 10-1%



(b) Bottom 50 %, 50-10%

Figure 3: Ratio of Relative Incomes Across Income Distribution, 1920–2020

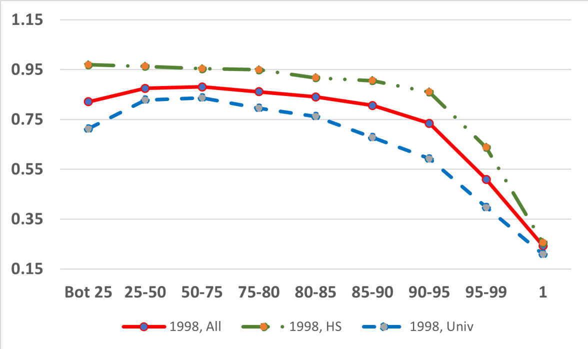
The income shares are from World Inequality Database (WID) and the real GDP per capita in 1990 PPP from Madison, downloaded from MacroHistory Database (rgdpmad). The horizontal lines are the average for each relative income series over 1920–2020.

2.1.2 Long Run Gap: 1920–2020

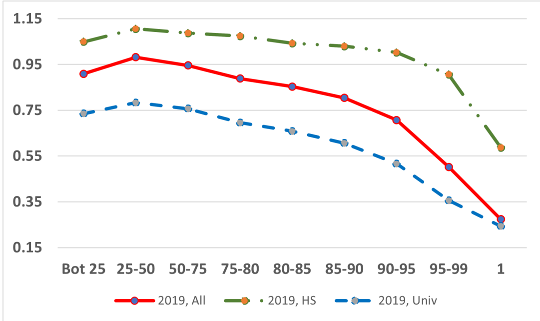
Our focus in this paper is on the drivers of the gap in GDP per adult since 1960. However, the pattern of differential gaps across the income distribution has persisted since at least 1920 (see Figure 3). Indeed, the relative gaps between Canadian and US income across the income distribution have remained remarkably stable over the past 100 years. The top 1 percent of Canadian income earners average less than half (roughly 47 percent) of their US counterparts over 1920–2020, while the next 9 percentiles average just under three-quarters of the US level. In contrast, the income of the bottom 50 percentiles average over 95 percent and the 50–90 percentiles average around 84 percent of US income. We use the persistent pattern of gaps across the income distribution in assessing explanations of the Canada-US GDP and productivity gap.

2.2 Other Data Sources: SCF/SFS and GRID

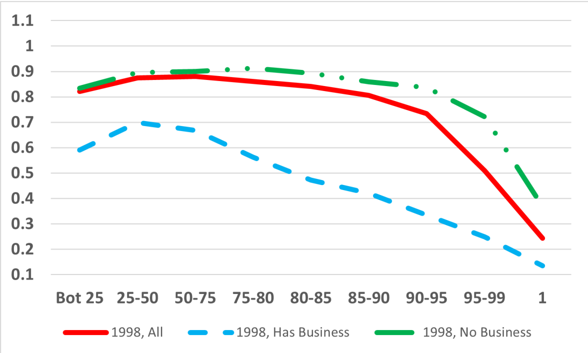
To examine the robustness of our findings from the WID as well as to explore the role of education and business ownership, we examine household survey data from the US Survey of Consumer Finances (2019, 1998), the Canadian Survey of Financial Security (2019, 1999), and the Global Repository of Income Dynamics (GRID), which is based on administrative data on employee earnings. These data sources offer complementary perspectives to the WID data. While the SCF and SFS are only available in some years, they provide broad coverage of household market income without any assumptions on how income is distributed within a household. The GRID data offers near universal coverage of employees in Canada and the US with the added benefit that the statistics on earnings across the income distribution which we use have been constructed similarly for the US and Canada.



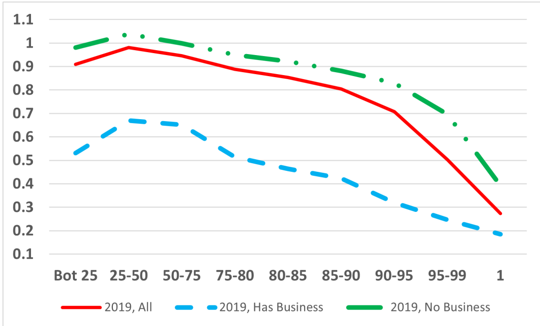
(a) Canada-US Income, 1998



(b) Canada-US Income, 2018



(c) Canada-US Income, 1998



(d) Canada-US Income, 2018

Figure 4: Canada-US Household Incomes by Education and Business Ownership

Canadian income is from the 2019 and 1999 Survey of Financial Security and US income is from the 2019 and 1998 Survey of Consumer Finance. Income in each survey is for the preceding year. We use the OECD PPP exchange rate for 2018 and 1998, and we scale the 1998 SCF income by US nominal GDP growth from 1997 to 1998.

2.2.1 Household Surveys: The SFS and SCF

We compare the Canadian and American income distributions using the 2019 SCF and SFS and the 1998 SCF and the 1999 SFS.[3] An advantage of these surveys is that they over-sample high-net-worth households, which are more likely to be high income (where the income gaps are largest).[4] To facilitate comparability with the WID data, our SFS and SCF household income measures are pre-tax and exclude transfers (see Appendix A). We restrict attention to households with a head between the ages of 25 and 65 in order to focus on households most likely to be active in the labour force. We also use the SCF and SFS to examine income differences by education and business ownership.

We find a similar picture to the WID data for household income in 1998 and 2018: There are

[3]The Survey of Financial Security begins with the 1999 wave. The previous household wealth survey run by Statistics Canada was in 1984.

[4]Bricker et al. (2016) argue that the SCF does a good job of measuring US income and wealth inequality, although by design it does not include the roughly 400 richest households. Brzozowski et al. (2010) find that Statistics Canada public-use data files provide a good estimate of income inequality since the early 2000s, although top coding can reduce the income of the top 1 percent.

small gaps in income for most households but large gaps for higher-income households (the solid line in Figure 4a and 4b).[5] In 2018, households in the lower 75 percentiles in Canada (pretax) income average between 90 and 95 percent of the US level. Even for the 85–90 percentiles, Canadian incomes are within 20 percent of their US counterparts. The gap widens rapidly over the top 10 percentiles, with the top 1 percent of households in the 2019 SFS averaging roughly 25 percent of the incomes of their US SCF counterparts. The 1998 comparison (Figure 4a) is similar to 2018, although Canadian incomes average a few percentage points lower throughout the distribution. We also compute the average age across the income distribution. In both countries, the average age for households in the top 5 percent is near 50, while the average for most of the distribution is in the low- to mid-40s.

Both the SFS and the SCF report the educational attainment of the main income earner (SFS) or the reference person (SCF).[6] We sort households into two education groups: less than high school diploma, high school diploma, or college diploma; and university degree.[7] For each of these groups, we look at the relative distribution of household income (i.e., we compare households in the same part of the income distribution for each education level).

The pattern of larger gaps for higher-income households in both 1998 and 2018 remains across educational groups, with smaller gaps for households lower in the income distribution and larger gaps for higher-income households (see Figures 4b and 4a). However, the magnitude of the gaps varies with education: Income gaps for university-educated households are larger, and those with less than a university education are smaller. For those in the 1–80 percentile group with a university degree, Canadian incomes are 70–83 percent of their US counterparts. The income gaps widen rapidly as we move further to the right, with the top 1 percent in Canada averaging less than 25 percent of the income of the top 1 percent in the United States. The level of gaps for households with a head who did not complete university, in contrast, sees income in Canada slightly above their US counterparts in 2018 for all but the top 15 percent and above 90 percent in 1998 for all but the top 10 percentiles.

Both the SFS and the SCF ask whether a household has ownership in a business. The ownership rate is higher in Canada at roughly 21 percent of households compared to roughly 15 percent of households in the SCF.[8] We find larger gaps across the distribution for business owners than for non-business owners (see Figures 4d and 4c). For the top 1 percent of non-business owners, the ratio of income in the SFS is between 35–40 percent of the SCF. For business owners, the top 1 percent range between 13–19 percent across the 2019 and 1999/1998 surveys.

[5]GDP per adult is similar in 1998 and 2018 at 75.7 and 73.8. The ratio of income for households with a head between the ages of 25 and 65 is slightly lower at 65.4 and 69.8.

[6]These questions provide similar information since the reference person is often the main income earner, and there is positive associative matching in education levels for couples.

[7]The fraction of the SFS (SCF) accounted for by those with less than a high school diploma is only 12 (9) percent, which is why we bundle this group with high school or college.

[8]This suggests there could be a difference in the way respondents interpreted this question.

2.2.2 Global Repository of Income Dynamics

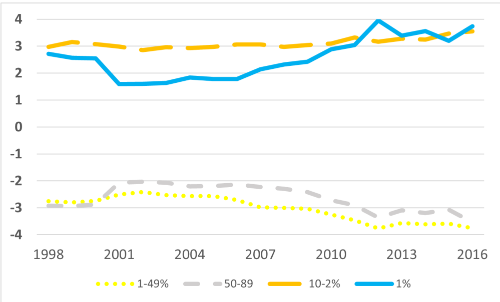
We use the Global Repository of Income Dynamics (GRID) to compare individual-level pre-tax (employee) income across the distribution in Canada and the United States. An advantage of the GRID data is that it is based on administrative records, has been harmonized for cross-country comparability, and is available by age and gender. However, the GRID data is only available for 1998–2016, as the Canadian GRID data spans 1983–2016 and the US data covers 1998–2019. GRID data is also restricted to people aged 25–55 years who are employees, as it excludes self-employment income.[9]

We plot the US minus Canadian income shares for the top 1, top 10–2, top 50–89, and bottom 50 percentiles over 1998–2016 in Figure 5a. Similar to the WID, the GRID points to widening income gaps at the top of the earnings distribution. However, the difference in income shares for the top 1 percent in the GRID is roughly half as large as in the WID. This is qualitatively consistent with our findings in Section 2.2.1 using household balance sheet surveys where the top percentiles of earners are more likely to be over 55 years of age (and hence not included in GRID) and the larger gap for business owners.

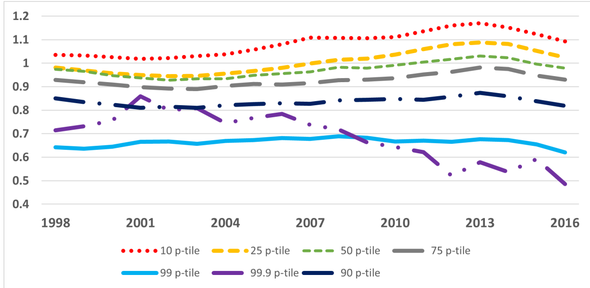
Similarly to the WID data, the GRID data also imply small differences in the level of income for workers lower in the income distribution and larger gaps for higher-income earners (see Figure 5). Indeed, the tenth percentile of earners has a higher income in Canada than in the United States over 1998–2016, while the 25th and 50th percentiles rise from roughly 90 percent of US levels in the early 2002s to over 100 percent in 2014. However, relative earnings in Canada decrease as we move further to the right of the income distribution, with incomes at the top 1 percent of employees at roughly two-thirds of the US level (see Figure 5b). The ratio of top incomes in the GRID are above the WID, as even for the top 0.1 percentile Canadian incomes are roughly half those of the United States in 2016. However, the GRID points to an even larger relative decline in Canadian employee income at the top of the distribution over the 2000s.

The GRID data allows us to examine whether these patterns vary by gender or age. The patterns of small gaps for lower-income workers and larger gaps for higher-income workers persist for both male and female employees (see Figures 5c and 5d). However, for male workers in the lower percentiles, Canadian earnings relative to US earnings are several percentage points higher than female earnings. In contrast, for the top percentiles, male earnings in Canada compared to the United States tend to be a few percentage points lower than the equivalent ratio for females. Although this pattern also holds when we look across age groups (see Figures 5e and 5f), the GRID data highlights the substantial decline in the relative incomes of 45–55-year-old men in the top 0.1 percentile.

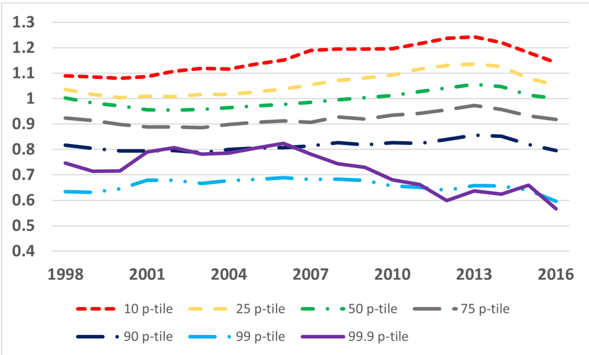
[9] The GRID data drops very low income earners. In some US states, some corporate officers are not included. For an overview of the GRID, see Guvenen et al. (202). The Canadian data is examined in Bowlus et al. (2022) and the US in McKinney et al. (2022).



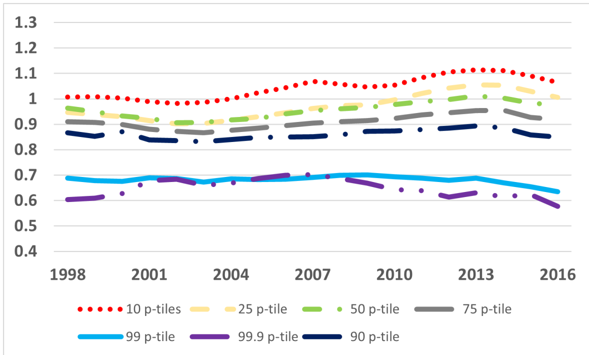
(a) US Income Share minus Canadian Share



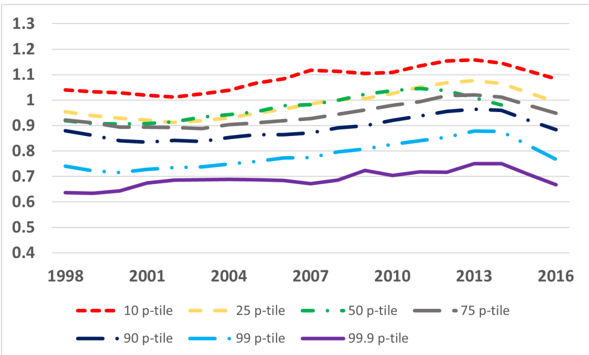
(b) Canada/US Income, selected percentiles



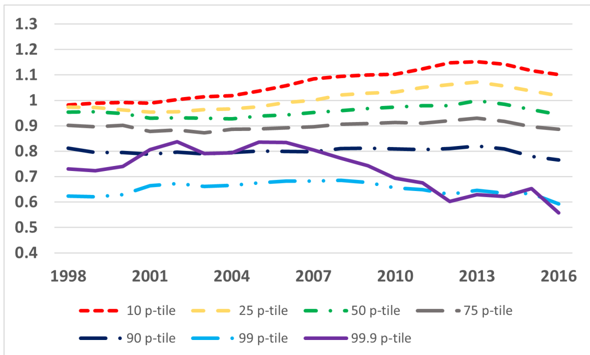
(c) Canada/US Income, Males 25–54



(d) Canada/US Income, Females 25–55



(e) Canada/US Income, 25–34



(f) Canada/US Income, 45–55

Figure 5: Relative Income Across Income Distribution for Employees, 1998–2016

The percentile ratios are Canadian income (converted to USD using 2018 OECD PPP) divided by US income for that percentile from the GRID (the GRID data uses a common base year (2018) with income deflated by CPI).

2.3 Summary: Income Gaps Across the Distribution

The gaps between Canadian and American income vary systematically across the income distribution. We find small differences in pretax income for lower earners and larger differences for higher-income earners. Importantly, we document similar patterns for the gap across the income distribution using the WID estimate of pretax income that is allocated equally across adults within a household, the SCF and SFS where we compare a pretax estimate of household income, and in the GRID, which reports employee income for individuals. Although the gap appears to be larger for business owners and for those with a university degree, even within these groups there are small differences in pretax income for lower earners and larger differences for higher-income earners. This pattern of larger gaps at the top of the income distribution is long-standing. There has been no sustained narrowing of the income gaps for workers in the top 10 percent of the income distribution since at least 1920.

3 Labour Productivity and GDP per Adult

Productivity is the primary determinant of GDP per adult over the long run. Perhaps the most commonly cited productivity estimate is labour productivity measured as GDP per hour worked. In addition to being straightforward to compute, a standard accounting identity of output (Y_t) per working-age person (N_t) decomposes it into the product of labour productivity and hours worked (H_t) per working-age person:

$$\frac{Y_t}{N_t} = \underbrace{\frac{Y_t}{H_t}}_{\text{Labour Prod}} \times \underbrace{\frac{H_t}{N_t}}_{\text{Hrs per Adult}} \tag{1}$$

In this section, we discuss some simple calculations that show that shifts in relative income across the distribution and changes in the composition of hours worked bring to bear compositional forces that significantly impact measured labour productivity in Canada relative to the United States.

Canadian GDP per adult and labour productivity relative to the United States both decline by roughly 15 percentage points between the 1970s and 2010 (Chart 6a).[10] However, the timing of the decline in output and labour productivity varies, with much of the decline in Canadian labour productivity relative to the United States taking place nearly a decade after the decline in output per adult. In contrast, hours worked per working-age adult in Canada and the United States are similar in 1970 and 2019. However, between 1970 and 2019 there are prolonged periods of divergence, with hours worked in Canada falling below the United States during the 1990s and US hours falling below Canadian hours following the 2008 Great Financial Crisis (GFC).

[10]There is a large literature on Canada-US productivity differences and the slowdown in labour productivity growth in Canada since 2002 (e.g., see Haun and Sargent (2023), Arsenault and Sharpe (2008)). This slowdown in labour productivity growth is broad based across the OECD, although Canada's performance is relatively weak (Haun and Sargent (2023)).

The divergence in relative GDP and labour productivity in the 1980s and 1990s coincides with a fall in hours worked per adult in Canada relative to the United States (see Figure 6c). The recovery of hours worked per adult to levels similar to the United States is accompanied by a decline in relative labour productivity. The comoving in opposite directions of Canada-US labour productivity and GDP per worker—the correlation is -0.6 between annual changes in relative labour productivity and relative hours worked over 1970–2019—suggests that relative declines in hours worked in Canada (United States) involves a disproportionate decline in relatively lower paid hours worked.

What is the contribution of shifts in earnings across the income distribution and the composition of hours worked in shifts in relative labour productivity since the 1970s? To construct a ballpark estimate, we compute labour productivity over 1970–2019 where we remove the top 1 and 10 percent of earners. To do this, we need to decide on how many hours to attribute to the top 1 and 10 percent. For the purposes of this exercise, we assume that each working-age person in the top 1 percent works 3000 hours annually, or roughly 60 hours a week, which is nearly three times the average number of hours worked per working-age adult. This estimate is above the average hours of the top 1 percent reported by Lemieux and Riddell (2016), which varies between 46 and 49 hours per week across the 1981, 2006, and 2011 Canadian census.[11] For the top 10 percent of earners, we assume annual hours worked of 2200 hours. Given these assumptions on hours worked, we remove the top 1 (10) percent share of income from GDP as well as the hours worked (assuming that the top 1 (10) percent works 3000 (2200) hours annually). To compute labour productivity excluding the top 1 (10) percentile groups, we multiply labour productivity (GDP per hour) by the share of income divided by the share of hours.[12]

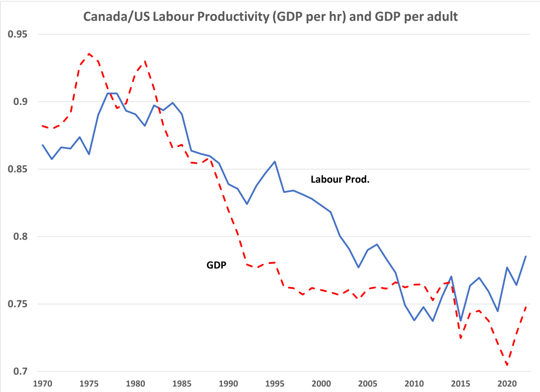
Consistent with smaller income gaps outside of the top 10 percent, the exclusion of the top 1 (10) percentiles of earners implies a smaller gap for relative labour productivity between Canada and the United States than for aggregate labour productivity (see Figure 6d). For 2019, the gap in labour productivity for the bottom 90 percent is roughly 10 percentage points versus more than 25 percentage points for total labour productivity. Moreover, labour productivity in Canada relative to the United States for the bottom 90 percent in 2019 is similar to its level in 2001.[13]

The shifts in relative labour productivity for the bottom 90 percent of earners tracks the broader trends in relative hours worked. The fall in Canadian labour productivity relative to the United States between 1999 and 2004 for the bottom 90 percent of roughly 10 percentage

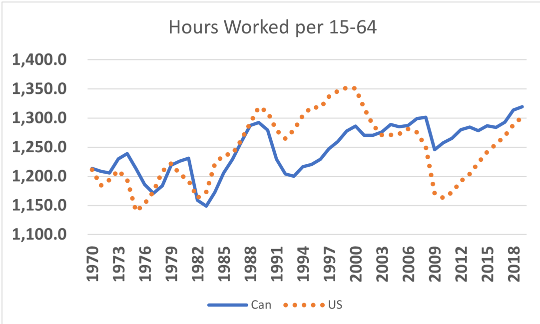
[11] Lemieux and Riddell (2016) report data for workers only. Average hours worked outside of the top 1 percent is roughly 39 hours per week, somewhat below 80 percent of the top 1 percent. On a practical level, there is limited scope for variations in the hours worked of the top 1 percent to have a large impact on total hours worked given that they are full-time workers. For the United States, Heathcoate et al. (2023) find that top incomes vary over time primarily due to wages (not hours), while earnings for lower-income workers are largely driven by hours worked due to variations in the extensive margin.

[12] For example, labour productivity excluding the top 1 percent is $LabProd * \frac{1-Incshare^{1\%}}{1-hoursshare^{1\%}}$.

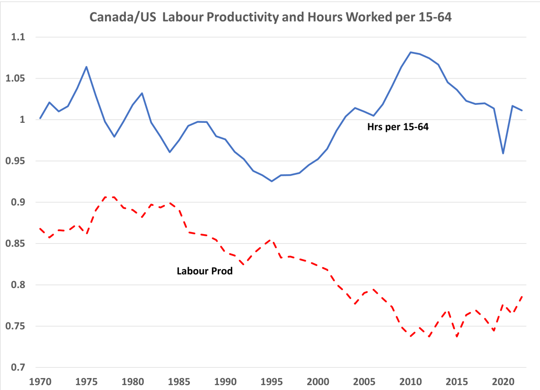
[13] A potential bias is that hours worked by higher-income households has risen over time. This would imply that the hours worked by the bottom 90 percent of earners declines more than in our calculations and implies a higher level of labour productivity for this group. If this differential shift in hours worked of higher-income households is larger in the United States, this would imply a larger decline in relative labour productivity in Canada for the bottom 90 percent of earners.



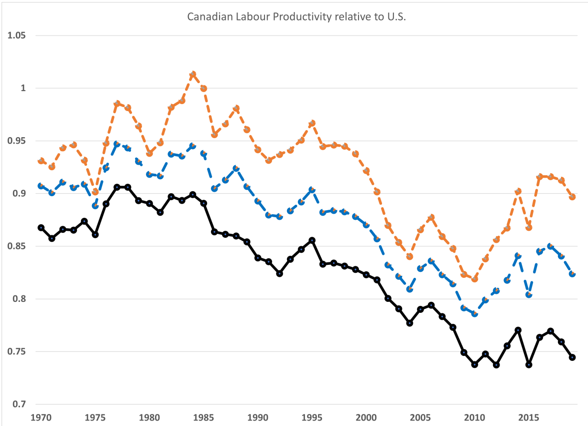
(a) Canada/US GDP per Adult and Labour Productivity



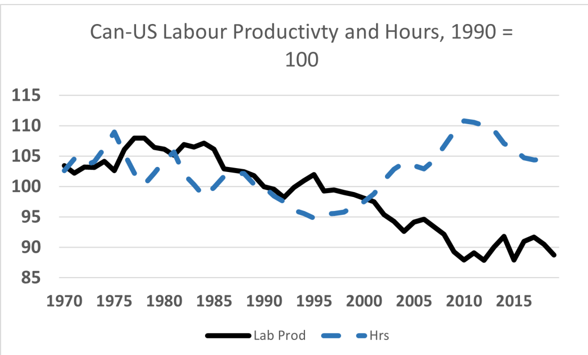
(b) Hours per Working-Age Person (15–64)



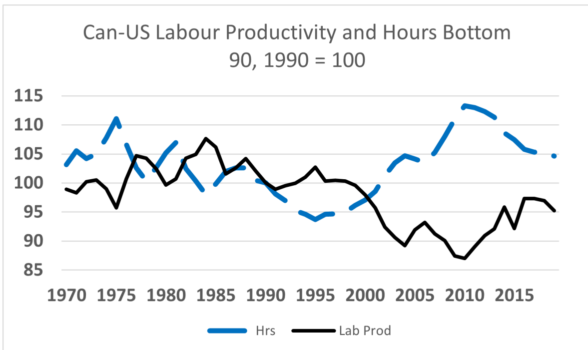
(c) Canada/US Hours and Labour Productivity



(d) Relative Labour Productivity, All Workers, Excluding Top 1, 10%



(e) Relative Labour Productivity and Hours per WAP, All Workers, 1990=100



(f) Relative Labour Productivity and Hours WAP, Excluding Top 10 %, 1990=100

Figure 6: Relative GDP per Adult, Labour Productivity and Hours Worked per Adult

Hours worked per adult and labour productivity are from the OECD. GDP per adult is from WID. The OECD PPP is used to convert current dollar GDP into USD. Panel (c) plots Canadian hours per working age person divided by US hours per working age person and Canadian labour productivity divided by US labour productivity. Panel (d) plots relative labour productivity for all workers (black line), all workers except the top 1 pct (blue line), all workers except those in the top 10 pcts (orange line). Panel (e) plots the relative labour productivity and relative hours per working-age person (WAP) where the 1990 value is normalized to 100. Panel (f) plots relative labour productivity and relative hours per WAP excluding workers in the top 10 percentiles.

points coincides with a rise in hours worked per adult in Canada relative to the United States of roughly 8 percentage points. This shift is larger for relative hours worked per adult for the bottom 90 and 99 percentiles (see Figure 6b).

To further illustrate the tighter (negative relationship) between relative hours worked and labour productivity for the bottom 90 percent of the income distribution, in Figures 6e and 6f we plot the ratios of relative labour productivity and hours worked for the entire economy and excluding the top 10 percent.[14] Unlike the aggregate measure, for the bottom 90 percent the fall in hours worked in the United States following the GFC is reflected in a rise in labour productivity in the United States relative to Canada. These shifts in relative hours worked appear to be largely due to changes in hours worked of lower-paid workers. The post-GFC fall in US labour force participation from roughly 66 percent in 2008 to under 63 percent in 2016 is particularly pronounced for groups with lower earnings, such as teenagers, 20–24-year-olds, and high school graduates with no college diploma (Hipple (2016)). This compositional effect pushes up US labour productivity relative to Canada during this period. Similarly, between 1989 and 1997, the 2.7 percentage point decline in Canadian participation rates sees much larger declines for the young (15–25) and older (over 55) populations (Sharpe and Grignon (1999)). Similarly, Bowlus et al. (2022) document that the decline in earnings during the 1990s recession is particularly pronounced for lower-income (especially male) earners.[15] These persistent declines in hours worked of lower-productivity workers are consistent with significant effects on relative labour productivity over the medium run.

This exercise highlights two compositional forces that impact Canada-US labour productivity. For high-income earners, it is shifts in relative earnings across Canada and the United States that translate into changes in relative labour productivity. Since high-income earners work above-average hours, there is limited scope for shifts in relative hours across countries. In contrast, for lower-income earners, there are episodes where hours worked see sizeable shifts. Although these shifts also lead to declines in output, since the earnings per hour are relatively low, their impact on labour productivity is positive while the negative impact on GDP is modest.

These compositional forces are important for understanding the divergence in labour productivity between Canada and the United States since the 1970s. Our counterfactuals suggest that much of the decline in labour productivity since 2000 has been driven by a widening gap for the top 10 percent and a rise in hours worked by lower-income earners in Canada relative to the United States This pattern of hours reflects large cyclical shocks: The deeper recession in Canada in the 1990s shows up in a fall in Canadian hours per WAP, and then the deeper GFC impact in the United States shows up in the opposite direction. Although we focus on labour productivity, our analysis also has implications for measured TFP in Canada and the United States. For example, Conesa and Pujolas (2019) document the relatively worse performance of

[14]The correlation between annual changes in relative labour productivity and relative hours worked for the bottom 90 percent over 1970–2019 is larger, at -0.68 compared to -0.605 for the aggregate economy. In a regression of changes on relative labour productivity for the bottom 90 percent on relative hours per WAP over 1970–2019, the coefficient on relative hours is roughly -.77.

[15]Jones and Riddell (2019) argue that most of the divergence in labour markets between Canada and the United States over 1997–2017 is accounted for by individuals with marginal labour force attachment. MacGee and Yu (2002) document cyclical effects in the composition of the labour force in Canada.

TFP in Canada over 2002–2014. Our analysis suggests that shifts in the composition of hours worked during this period, as well as a widening gap for top earners, could have played a role in the slower growth in Canadian compared with American TFP.[16]

4 Implications of Gaps Across the Income Distribution for Common Explanations of the GDP Gap

There is a large literature examining possible drivers of the gap between Canadian and US GDP per capita and productivity (e.g., see Sharpe (2003)). We group these explanations into three broad categories: 1) a human capital gap or "brain drain"; 2) lower physical capital (investment); and 3) an innovation gap.[17] Our evaluation of these explanations uses the neoclassical growth model as a guide for organizing the data and evaluating whether each explanation can account for both the gap in the lower level of GDP per adult in Canada compared to the United States and the larger (smaller) income gaps for high (low) income earners.

The neoclassical growth model is arguably the most commonly used framework to quantify the contribution of productivity, capital, and human capital to cross country income differences (e.g., see Jones (2016)). An implication of the growth model is that differences in TFP and capital per worker have a uniform effect on cross-country income differences across the income distribution, while differences in the distribution of human capital across countries can lead to differences in relative incomes across the income distribution. Our analysis builds on a standard accounting exercise (e.g., see Conesa and Pujolas (2019)) for the evolution of output per working age person:

$$\frac{Y_t}{N_t} = \underbrace{A_t}_{\text{Productivity}} \times \underbrace{\left(\frac{K_t}{Y_t}\right)^{\frac{\alpha}{1-\alpha}}}_{\text{Capital Intensity}} \times \underbrace{\frac{H_t}{N_t}}_{\text{Hrs per Adult}} \tag{2}$$

where Y_t is GDP, A_t is total factor productivity, K_t is the capital stock, N_t is the working age population, H_t is hours worked, and α is the capital share from a Cobb-Douglas aggregate production function $Y_t = A_t K_t^{\alpha} (H_t N_t)^{1-\alpha}$. We consider measures of hours based both on total hours worked and an efficiency units estimate.

To examine the role of human capital, we first construct efficiency units of labour where we use relative income from the WID as weights. Although an efficiency units measure based on observed income differences could account for the difference in GDP per adult, the implied gaps in human capital differences are inconsistent with the modest (and narrowing) differences in educational attainment. However, we show that if these differences reflect selective emigration by high-ability individuals, human capital could be a large part of the gap. Indeed, our illustrative calculations based on a simple Pareto distribution of ability suggest that the level of observed emigration to the United States could quantitatively account for a significant share

[16] Sharpe et al. (2008), Greenspon et al. (2021), and Uguccioni (2016) argue that higher top incomes plays a significant role in the gap between median wage growth and labour productivity since the 1970s.

[17] Given the long-lasting nature of the gaps across the income distribution, we do not examine episode specific explanations such as the fall in resource prices in 2015.

of the output gap for a reasonable parameterization. As a check of this exercise, we use the Annual Economic and Social Supplement to compare the income of the Canadian-born living in the United States with the US-born. Although top coding and the limited sample limit our ability to unpack the top income, we document that the Canadian-born living in the United States are more highly educated and are overrepresented in the top 10 percent of the US income distribution.

We show that while differences in capital per worker can account for the output gap, low investment in physical capital is likely a symptom rather than a cause of low labour productivity since it cannot account for the disparate gaps across the income distribution. One visible aspect of the innovation gap is the reshaping of the US economy by the rise of large, highly productive *superstar* firms in recent decades (Autor et al. (2020), De Loecker et al. (2020)). To approximate the impact of superstar firms, we correct for differential markups and technology. Differential markups plausibly account for all of the observed difference in income per capita in 1980 and two-thirds of the income difference in 2016.

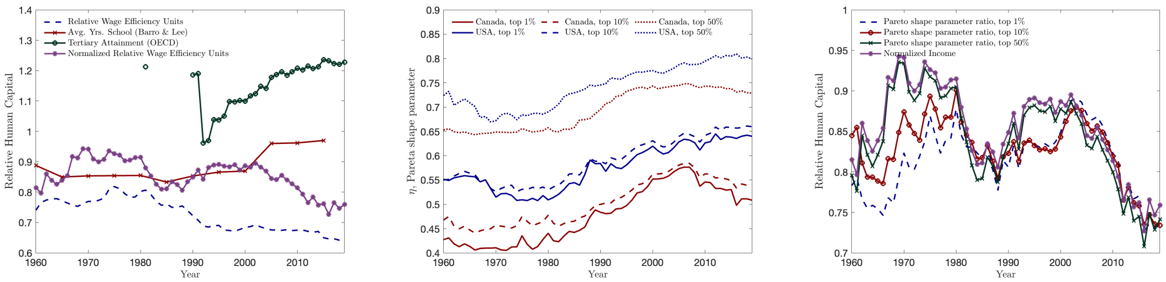
Our analysis points to a potential interrelationship between innovation and human capital based on selective emigration. As we discuss in Section 5, this is a promising direction for future research to deepen our understanding of the underlying drivers of the Canada-US output gap.

4.1 Human Capital Differences

Can differences in human capital between Canada and the United States account for the income per capita gap? In this section, we show that while a standard approach to constructing a stock of human capital based on relative wages can largely account for the gap in GDP per adult and the varying gaps across the distribution, measures of educational attainment point to modest and narrowing gaps in human capital between Canada and the United States. This leads us to examine the role of selective emigration by high-ability Canadians.

We begin by constructing an efficiency hours series where the human capital weights in each country are the ratio of average income, w^{CA}/w^{US}, from WID. The underlying assumption is that wages are proportional to the ratio of the average human capital stock h^j in country j, $h^{CA}/h^{US} = w^{CA}/w^{US}$.[18] The dashed blue line in Figure 7 panel (a) plots the human capital ratio between Canada and the United States implied by average wage differences. It suggests that the United States enjoys a comparative human capital advantage of roughly 20 percent between 1960–1990, which widens after 1990 to nearly 35 percent. Viewed through the lens of our Cobb-Douglas aggregate production function, equalizing this human capital gap would (more than) equalize GDP per adult.

[18]In both countries, we normalize the human capital of workers in the bottom 50 percent to 1. Since we lack data on hours, we use the average earnings constructed from the WID income shares as weights.



(a) Education and Wages (b) Shape Parameters (c) Pareto Dist. & Human Cap.

Figure 7: Human Capital, Education, and Income Across Countries

In panel a, average years of schooling are from Barro et al. (2015). Average tertiary attainment is from OECD (2024). The Average Income Differences (WID) is constructed using the ratio of human capital across countries implied by average wages from WID. Normalized income divides income by average income in the bottom 50 percentiles of the WID data in each year.

On the one hand, this conclusion is difficult to reconcile with standard cross-country measures of education and human capital accumulation. For example, relative average years of schooling from Barro et al. (2015) (the red line with x's in Figure 7) suggests that the United States enjoys a small but narrowing human capital advantage between 1960 and 2020. Similarly, the fraction of the population with tertiary education (OECD, 2024), the green line (with circles) in Figure 7, suggests that Canada sees a relative human capital advantage since 1990, which widens with time. On the other hand, ignoring common country-specific differences in wage levels may exacerbate the efficiency unit measures of human capital differences. Jones (2014) documents that a traditional, and theoretically consistent, approach normalizes wages by those of the lowest income group. Performing this normalization on the WID data yields an efficiency units series (the normalized wage series in Panel a of Figure 7) that follows the Barro et al. (2015) data closely up to the year 2000 but diverges sharply thereafter, again suggesting that the human capital gap is both large and growing across countries. Moreover, the recent rise in the cross-country human capital gap occurs concurrently to the widening of the gap in top incomes across countries.

The gap in average human capital can be directly linked to the income distribution. Jones (2015) argues the income distribution in most countries can be described by a power law and parsimoniously approximated by a Pareto distribution. That is, in any country j, the fraction of income going to the top p percentiles equals $(100/p)^{\eta_j - 1}$, where η_j is the Pareto shape parameter. Under the Pareto distribution assumption, traditional human capital accounting (Jones, 2014) implies that the ratio of human per worker can be compactly summarized by the ratio of Pareto shape parameters, $\frac{1-\eta_{US}}{1-\eta_{CA}}$.[19] Letting w_j^p and $\bar{w}_j$ represent the average income among across the top p percentiles and all percentiles, respectively, the Pareto shape parameter for each country

[19]This follows from the fact that for a given normalization, average income from an unbounded Pareto distribution is $1/(1-\eta_j)$.

can be recovered from the WID data in each year as $\eta_j = 1 + \frac{\ln\left((w_j^p/\bar{w}_j)\times p/100\right)}{\ln(100/p)}$.

The estimated value of η_j depends on the share of the distribution used to estimate its value. Panel (b) of Figure 7 plots three different estimates of shape parameter implied by the WID data between 1960 and 2019. The first estimate uses the share of income earned by the top 1 percent of earners. The second uses the share of income for the top 10 percent of earners, while the third uses the share of income earned by the top 50 percent of earners. Although shape parameters estimated using a greater number of percentiles in each country are systematically higher than those that focus only on the very top incomes, in each case we observe 1) rising estimates, consistent with greater within-country income inequality in each location, and 2) a widening gap between countries, consistent with the disproportionate rise in top US incomes. Each series suggests that *the gap* in shape parameters is smallest in 2001 and has doubled in the following two decades.[20]

The gap in human capital per worker implied by the respective Pareto shape parameters correspondingly suggests a substantive human capital gap over the entire 1960–2019 period, with a significant widening since 2000. The path of human capital implied by the Pareto shape parameters closely tracks the value of measured human capital implied by normalized wages over the entire sample, especially since 1980 (see panel (c) of Figure 7) and especially for the implied human capital series based on the Pareto shape parameters estimated using the top 50 percentiles of the respective income distributions.[21] The close correlation between each series in panel (c) further suggests that the evolution of relative income per worker across countries, and the implied human capital gap, can be broadly explained by variation in the upper tail of the income distribution.

Alternatively, differences in income may reflect differential rates at which human capital is utilized across countries if high-income Americans work substantially longer hours than high-income Canadians. Although we do not have systematic direct evidence of hours worked by income, the available evidence suggests that differences in hours worked across the distribution are unlikely to account for the differences in income. Indeed, high-income Canadians would need to work a fraction of the hours of their American counterparts if differences in hours worked are to account for income differences among top percentiles. In general, differences in hours worked across the income distribution are generally too small to account for observed income differences (Mishel et al., 2012) and do not necessarily shrink observed real earnings differences (Bick et al., 2018). Moreover, large gaps in hours among high-income earners would also imply further gaps lower down the income distribution, inconsistent with the intuitive findings in Section 3.

The incongruity between estimates of human capital based on educational attainment and that implied by earnings suggests that standard theory is missing a key mechanism that drives a wedge in incomes between countries. One possibility is that a more nuanced evaluation of human capital and selective emigration could reconcile these estimates; we revisit this in Section 4.2. At the same time, evidence of increased earnings dispersion points to the role of firms. Bowlus

[20]These estimates are in line with Jones (2015) who estimates a value of 0.6 for the United States using top income shares.

[21]Note that the divergence for the series using top incomes alone occurs partly during the 1991-2000 period when hours per worker diverged across countries, as documented Section 3.

et al. (2022) document a more modest rise in income inequality in Canada compared to the United States between 1983 and 2016. We examine the role of firms in Section 4.4.

4.2 (E)migration

Selective emigration of high-ability Canadians ("brain-drain") is often cited as a potential explanation for the observed differences in relative earnings across the income distribution (e.g., Gordon (2020), Trefler (1999)). Unfortunately, emigration can be difficult to measure accurately and we rarely observe income immediately before and after emigration, particularly since Canadians are not required to report their departure from the country.[22] To estimate the potential impact of selective emigration, we adopt two approaches. First, we ask how large would selective emigration flows have to be to account for the gaps across the income distribution. Second, we look at data on the Canadian-born living in the United States and ask what impact moving them back to Canada would have on the GDP-per-adult gap.

Given the observed aggregate stock of Canadians working in the United States, we can use the observed income distributions to bound the potential size of selective migration across the income distribution. Under the assumptions that 1) the underlying distribution of education and ability is similar across countries,[23] and 2) *net* migration is driven entirely by the disproportionate outflow of high-skill Canadians to the United States, we can use the difference in income distributions to infer an implied stock of emigration for each income class. Specifically, we compute the threshold income level that would characterize the top percentile if the US Pareto shape parameter also characterizes the distribution of Canadian-*born* workers. Assuming that net migration among workers in the bottom 50 percentiles is zero, applying the (normalized) US median income threshold to the (normalized) income distribution of Canadian-*resident* workers, we can compute the number of Canadians in the United States relative to the Canadian labour force.[24] Given the estimated relative size of Canadian-born labour force living in the United States, the difference in estimated Pareto shape parameters across countries further implies the fraction of Canadians in each income segment. We repeat this calculation for each income group and each shape parameter to estimate the implied share of Canadians living outside of Canada.

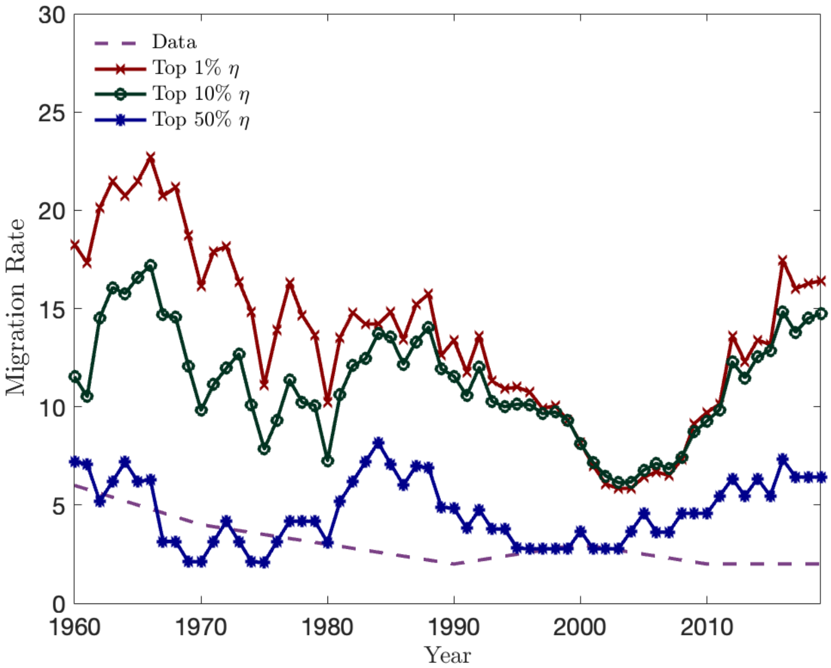
Panel (a) of Figure 8 plots the implied migration rate for each set of estimates of the Pareto shape parameters. In each case, a declining migration rate is implied by the simple model of selective migration until 2001 and a rise thereafter, corresponding to the narrowing and widening of the gap in estimated shape parameters. The implied level of migration declines

[22] One empirical proxy uses Canadian tax filings to measure whether Canadians have left the country. Zarifa and Walters (2008) use the National Graduate Survey to document that graduates from the 2000 cohort who move to the United States are concentrated in knowledge economy fields and have higher wages than those who remain in Canada.

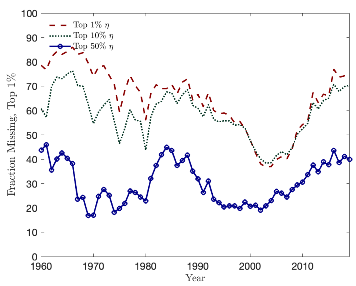
[23] On the other hand, to the degree that there exist systematic differences in the shape of Canadian and American income distributions across time, or their relative evolution, inferring net migration flows from the distributional differences may lead to misleading conclusions.

[24] For example, let $x > 50$ define the percent of Canadian resident workers have (normalized) income below the median US (normalized) income. Under assumptions (i) and (ii) 50 percent of Canadian born workers have (normalized) income below the same threshold, implying that the net migration rate can be computed as $2x - 100$ percent. If $x = 53$, the implied net migration rate is 6 percent.

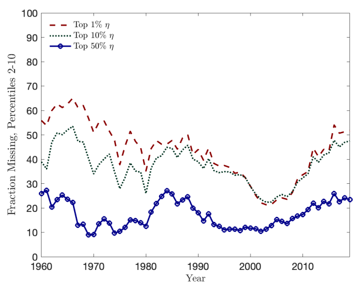
as a greater number of percentiles are used to estimate the shape parameters across countries. Are the implied migration trends plausible? Combining historical census statistics from Canada (Canada, 1994, 2021) and the United States (Gibson and Jung, 2006) along with US Census Bureau American Community Surveys (Israel and Batalova, 2021), we approximate the net stock of Canadians living in the US as a fraction of the Canadian labour force (see panel (b) of Figure 8). Strikingly, the observed and implied net emigration series track each other remarkably closely between 1960–2010 for the shape parameters implied by the top 50 percentiles of the income distribution. After 2010, there is a modest divergence in the two migration series: the implied series suggests greater migration than that observed in the data.[25]



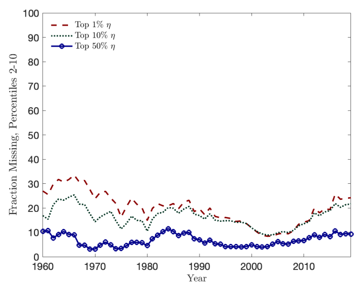
(a) Shape Parameters and Predicted Migration



(b) Frac. Miss., Top 1



(c) Frac. Miss., Pcts 2-10



(d) Frac. Miss., Pcts 11-50

Figure 8: Income Distribution and Migration

Panels (b)–(d) of Figure 8 plot the implied fraction of Canadians working outside of Canada by each income group. Although they represent a small share of total migration, the quantitative

[25] This divergence may reflect a movement in Canadian capital to the US, as reflected in panel (c) of Figure 9. However, the recent surge in new emigration flows from Canada to the US suggests that the more recent implied migration flows may be reasonably accurate (see Tasker (2024)).

importance of high income migrants is significant. In 2019, one Canadian emigrant with mean income at the top 1 percent would reduce aggregate Canadian income by the equivalent of roughly 30 emigrants from the bottom 50 percentiles. The addition of a Canadian migrant to the US top 1 percent adds the equivalent income of 73 workers from the bottom 50 percentiles. Since the difference in median income in both countries is modest, migration of middle-income workers has little impact on the Canada-US GDP per adult gap. However, high-income emigrants have a large impact on the income gap by simultaneously reducing average Canadian income and raising that of the United States. Indeed, the cross-country differences in the distribution of income suggest that at least 40 percent of Canadians whose ability would place them in the top income percentile reside outside of Canada.

Our estimates imply that the fraction of Canadians whose ability would place them in the top 1 percent of income in Canada has evolved substantially over time: Between 1960 and 2005, this share is estimated to have fallen by almost half; between 2005 and 2019, it is estimated to have almost doubled regardless of which shape parameter we use to estimate implied migration flows among the top 1 percent. On the one hand, the large fraction of high-earning Canadians working outside of Canada suggests that selective migration has a plausibly large quantitative impact on the Canada-US average income and measured productivity gap. On the other hand, implications from the tail of a Pareto distribution should be interpreted cautiously as the contribution of migrants in the top 1 percent is inherently sensitive to the measured Pareto shape parameter. Moreover, it is challenging to validate estimation among the richest Canadians as their income is often top-coded in detailed labour force surveys in either country.

Yet, the striking pattern of implied net out-migration for Canadians in the top 2–10 percentiles is similar to that in the top 1 percent, though the relative magnitudes are smaller. Implied net migration suggests that roughly one-third to one-half of these earners resided in the United States between 1960–1970, while just over 20 percent chose to do so by the early 2000s. Since then, this fraction is predicted to have risen to 30–50 percent. Returning the implied "missing" Canadian workers in the top 2–10 percentiles to Canada and holding fixed their (normalized) US earnings would nearly equalize average human capital per capita across Canada and the US. Feeding this implied human capital stock into the growth model—holding fixed capital per worker and TFP—would shrink the average income gap in 2019 by 14 percentage points. In contrast, net migration from earners in the top 11–50 percentiles is low and stable across all years. Moreover, the predicted gains from returning workers in this income group back to Canada are modest given that their earning potential is similar to the existing Canadian average.

Our exercise makes a strong assumption that all of the emigrants come from the top 10 percent and thus likely overestimates the direct impact of selective emigration on the GDP gap. We investigate the degree to which selective migration can further be validated for earners in the top 10 percent below. We show that while Canadian emigrants in the United States earn more on average than their US counterparts, the number of high earning emigrants is less than implied by our exercise above.

4.2.1 The Canadian-Born Living in the United States

Although we lack longitudinal data that tracks Canadians who migrate to the United States, some cross-sectional surveys do report the respondent's country of birth. We draw on data from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS) to compare individuals born in Canada living in the United States to those born in the United States. Consistent with selective emigration, the Canadian-born living in the United States are on average more highly educated and have higher earnings than those born in the United States.

The ASEC surveys roughly 75,000 households each year between February and April (mainly in March). Importantly for our purpose, the survey asks respondents their country of birth, educational attainment, and income. The ASEC has two key limitations for our purposes. The first is that income is top coded, which limits our ability to observe the top 1 percentile of earners. Second, although the annual sample is relatively large, since the Canadian-born comprise roughly 0.3 percent of the US population, the ASEC only contains a few hundred Canadian observations each year. This leads us to pool the ASEC over 2000–2023 in order to obtain a larger sample of the Canadian-born.

Consistent with immigration rules that make it easier for more highly educated workers to formally migrate to the United States, the average education level of the Canadian-born living in the United States is higher than those of the US-born. Over 2000–2023, more than half of the Canadian-born aged 30–65 have a bachelor or advanced degree versus one-third of the US-born. This gap is most pronounced for advanced degrees: roughly 5.5 percent of the Canadian-born had a doctorate degree versus 1.5 percent of the US-born. Although the gap in educational attainment between the Canadian- and US-born in the United States is longstanding (e.g., see Card (2003)), if anything it has widened slightly since 2000.

With the selective emigration of high-ability workers, one would expect that the mean income of the Canadian-born in the United States would exceed that of the US-born. In the ASEC data, this is indeed the case. On average over 2000–2023, the Canadian-born aged 30–65 earn roughly 36 percent more than their American-born counterparts.[26] Part of this income gap can be explained by differences in educational attainment. Comparing average income for those with a university or advanced degree (college or less), we find a somewhat smaller mean income gap of roughly 30 percent (21 percent).[27]

The higher mean incomes for the Canadian-born reflect a disproportionately higher (lower) probability of the Canadian-born being in the top decile (bottom 50) of the income distribution. Using ASEC data on individual income for those aged 30–65 over 2000–2023, we find the annual cut-offs for each decile of the US income distribution. For the Canadian- and US-born, we then compute the average fraction over 2000–2023 in each decile of the income distribution. The US-born population is slightly more (less) likely to be in a higher (lower) income decile (see

[26] This premium likely understates the difference in mean income since Canadians are overrepresented in the top 1 percent of income earners, which are top coded.

[27] Even within the university degree or advanced degree group, the mean education level of the Canadian-born is higher.

Table 1: Fraction of Canadian- and US-Born Across the US Income Distribution 2000–2023, aged 30–65

Decile	90-99	80-89	70-79	60-69	50-59	0-49
US Born	10.45	10.55	10.53	10.46	10.41	47.60
Can Born	12.07	10.29	10.26	11.45	10.33	45.61
Can-US	1.62	-0.25	-0.27	0.98	-0.09	-1.99

Notes: Individuals aged 30–65 are sorted by income. We then compute the fraction of the Canadian- (US-) born population in each decile of the income distribution in each year between 2000–2023. The numbers in the table are the average of these yearly values.

Table 1). The Canadian-born are more likely than the US-born to be in the top 10 percent of the income distribution: Roughly 12 percent of the Canadian-born are in the top 10 percent of earners in the United States versus 10.5 percent of the US-born.[28]

We use this data to ballpark the impact of moving the Canadian-born back to Canada on Canadian GDP per adult. The Canadian-born are roughly .3 percent of the US population, which translates into roughly 2.7 percent of the Canadian population. On average, their income is roughly double that of Canadians. If one were to move the Canadian-born in the United States back to Canada, holding fixed their US earnings, the direct effect would increase Canadian GDP per adult by roughly 3 percentage points. This is likely an underestimate since top coding lowers the mean income advantage of the Canadian-born and there is evidence that the income of top-income earners are underreported in the ASEC. To ballpark the potential impact of top coding and under-reporting, we double the mean income of Canadians in the United States. This adjustment would increase the impact on GDP per adult in Canada to about 6 percentage points, about one-sixth of the gap in GDP per adult, which is less than half of what the exercise above implies.

This illustrative calculation comes with two key caveats. First, it assumes that the Canadian-born could return to Canada with their US income. Since a driving force in emigration flows is likely higher earnings in the United States, this assumption likely overestimates the impact of return migration on GDP. Working in the opposite direction is the indirect effect on the productivity of Canadian workers from having more high-ability colleagues to collaborate with. As we discuss in Section 5, this points to an important direction for future research.

4.2.2 Selective Emigration: Big Enough To Matter

The contribution of selective emigration of high-ability Canadians ("brain-drain") to the Canada-US GDP per adult gap has been long debated (e.g., Kesselman (2001), Gordon (2020), Trefler

[28] The income distribution includes the entire US population. The distributional data in Table 1 thus implies that the income of non-US or Canadian-born immigrants is somewhat lower.

(1999)). In contrast to Helliwell (1999), we find that selective emigration could play a significant role in accounting for the GDP gap. Central to our exercise is the observation that a Pareto distribution of ability that matches the right tail of income also implies that emigration of a relatively small number of high-ability workers can significantly lower average output. We show that although the stock of Canadian emigrants in the United States is likely too small to fully account for the Canada-US GDP per adult gap, it is large enough to be a significant factor in accounting for both the gap in GDP and income differences across the distribution.

The high rates of net migration among high-income earners implied by our analysis may seem somewhat shocking. However, they are consistent with the findings of other studies of Canada and the United Kingdom. For example, Cockburn et al. (2023) document suggestive evidence that inventor migration explains the weaker relationship between productivity and patenting in Canada. Likewise, Damas de Matos and Parent (2019) report that among male immigrants to Canada aged 30–39 with a postgraduate degree, over 18 percent move to the United States within a five-year window of arrival. Damas de Matos and Parent (2019) argue that these migration patterns would be even larger for a longer time period, and thus the evidence points toward large outflows from Canada to the United States of young, highly skilled migrants. The importance of high-skill migration is also replicated in other countries. Advani et al. (2024) document that immigrants are twice as likely to be in the top percentile of the UK income distribution than in any of the bottom 97 percentiles.[29] Understanding the relationship between migration, productivity, and firm dynamics represents an important avenue for future research.

4.3 Low(er) Investment in Physical Capital

Lower investment in physical capital in Canada compared to the United States is often cited as a key driver of the widening gap in GDP per adult and productivity (e.g., Robson and Bafale (2023, 2024)). Capital per worker is lower in Canada than in the United States: Between 1970 and 2019, Canadian capital per worker ranged between 51 and 66 percent of US capital per worker (see Figure 9, panel (a)). Perhaps more striking is that while the gap in capital per worker has narrowed since 1970, the gap in equipment per worker, a key component of innovative activity, has widened.[30] While equipment per capita in Canada is 68 percent of the United States in 1970, by 2019 it falls to 49 percent. These trends underlie concerns that Canadian investment and capital allocation have deteriorated. However, there are several reasons to view low investment in physical capital as largely a symptom of Canada's relatively poor productivity performance.

At first glance, the growth model seemingly points to capital per worker playing a key role in accounting for the Canada-US GDP and productivity gap. If we assume that the aggregate production function in Canada is the same as that in the United States, we can use the observed

[29] Advani et al. (2024) further document that high-earning immigrants account for over 90 percent of the growth of the share of income accruing to the top income percentile, a particularly striking feature since the large majority of income for international migrants is labour income.

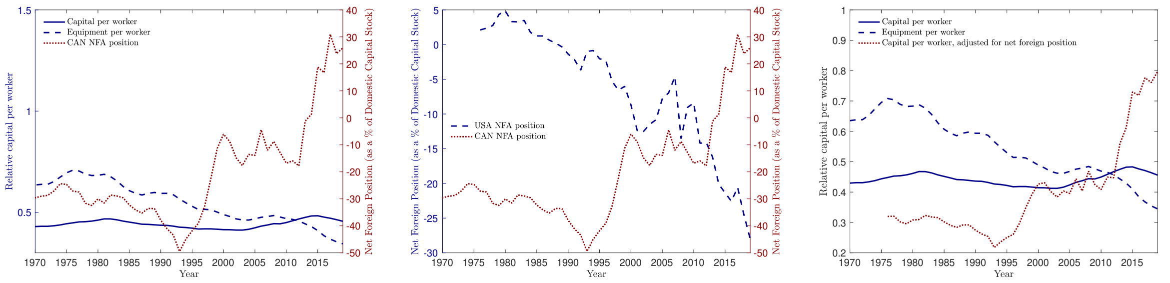
[30] Equipment includes equipment, machines, and intellectual property.

capital-output ratios in each country to back out the implied ratio of output per hour worked. Indeed, when we feed in the difference in capital intensity, $(K_t/Y_t)^{\alpha/(1-\alpha)}$ in equation (2), we find that capital can fully account for measured differences in labour productivity. However, the gap in implied human capital required to account for differences in income across the income distribution implies a different answer. If the stock of human capital in Canada is lower than that of the United States, as implied by wage differences (the relative wage efficiency unit series in panel a of Figure 7), the model suggests there is too much physical capital in Canada, not too little.

The neoclassical growth model also implies that a lack of capital cannot explain the disparate income gaps across the Canada-US relative income distribution as capital per worker shifts the entire income distribution proportionately. This implies that an increase in capital per worker that closes the Canada-US GDP gap would result in many workers in Canada having higher incomes than their US counterparts. However, as we argue below, there is suggestive evidence that the widening gap in research is correlated with changes in relative incomes in Canada and the United States.

A further factor pointing to low investment being a symptom is that there is meagre evidence that Canadians cannot generate savings. Rather, it appears that the rate at which Canadian and foreign capital owners invest in projects located in Canada has declined. The red dotted line in panel (a) of Figure 9 plots Canada's real net foreign position, assets owned by Canadians abroad less assets owned by non-Canadians in Canada. Prior to 2000, Canada's net foreign position is negative, indicating net inflows of capital into Canada. Between 2000 and 2014, Canada's net foreign position is roughly even. After 2014, substantially more Canadian capital is invested outside of Canada than foreign capital is invested in Canadian projects.

One explanation for the relative decline of investment in Canada is that opportunities abroad have improved. Panel (b) plots the net foreign position (NFP) of Canada and the United States over 1970–2019. Prior to 1994, the two series move in parallel; a decline in the Canadian NFP is met with a similar-sized decline in the United States. After 1994, the two series continue to comove one-for-one, but in opposite directions: while capital flows into the United States from around the globe, Canada's net foreign position does not move in a similar direction.



(a) Relative Capital (b) Net Foreign Position (c) Capital, Adjust for NFP

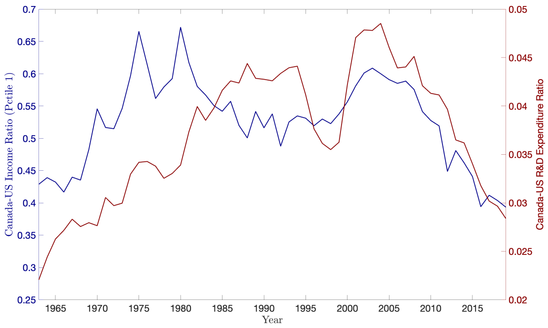
Figure 9: Low(er) Investment: A Symptom or a Cause?

Panel (a) plots relative (Canada/US) capital per worker (solid blue), relative equipment per worker (dashed blue), and Canada's net foreign position as a fraction of domestic capital stock (dotted red). Panel (b) plots net foreign position in Canada (dotted red) and the United States (dashed blue), as a percentage of their respective domestic capital stock. Panel (c) plots Canada/US capital per worker (solid blue), Canada/US equipment per worker (dashed blue), total Canadian-owned capital per worker (dotted red).

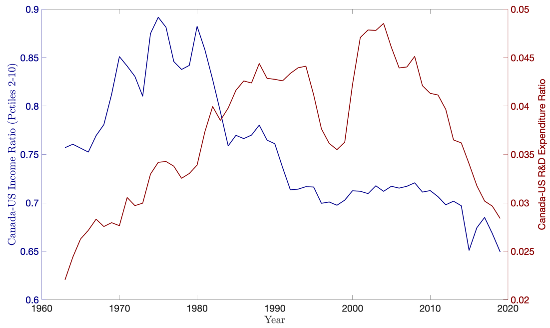
These differences are economically meaningful. Panel (c) again plots relative equipment per worker, relative capital per worker, and the relative Canada-US capital stock per worker adjusted for NFP. The NFP-adjusted capital stock measures the (net) amount of capital owned by Canadians, regardless of the location of its deployment. Prior to 2000, adjusting for NFP suggests that the amount of Canadian-employed capital per worker is larger than the amount of Canadian-owned capital per worker. This is not surprising: Panel (b) indicates that during this period, much of the capital used by Canadian workers is owned by foreign investors. After 2014, and roughly at the time that Canadian equipment investment starts to decline rapidly, we observe a sharp rise in the NFP-adjusted Canadian capital stock. By 2019, Canadian-owned capital per worker is only modestly below that of the United States. Consequently, it does not appear that Canada lacks an ability to form capital, but rather that the best investment opportunities may be abroad. In this sense, the lack of capital used by Canadian workers appears to be more of a symptom of an economic environment characterized by poor productivity and a low return on investment rather than a cause of the labour productivity problem per se.

4.3.1 Research and Development

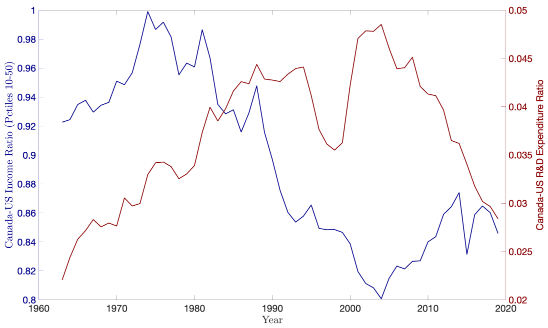
Motivated by a rise in top income shares in the United States relative to a number of other advanced economies, Acemoglu et al. (2017), Aghion et al. (2019), and Jones and Kim (2018) develop models that link innovation and inequality. Although it is beyond the scope of this paper to investigate these mechanisms in-depth, we show that research and development expenditures are differentially correlated with earnings across the income distribution.



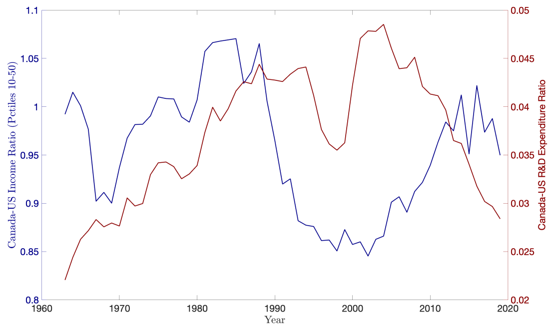
(a) Pctile 1



(b) Pctiles 2-10



(c) Pctiles 11-50



(d) Pctiles 50-100

Figure 10: R&D and Earnings Across the Income Distribution

Notes: Each panel plots the relationship between relative incomes (left axis) and relative R&D expenditures (right axis) for a particular income distribution segment: panel (a): top 1 percent; panel (b) income percentiles: top 2–10; panel (c): income percentiles: top 11-50; and panel (d): Income percentiles: bottom 50.

Panels (a)–(d) of Figure 10 plot the ratio of Canadian to US R&D expenditures against the ratio of income in each segment of the WID data. It is immediately apparent that R&D expenditures correlate strongly with incomes in the top percentile. More broadly, R&D expenditures appear to broadly correlate with relative incomes in each income group between 1963 and 1990. After 1990, the positive correlation between relative top income and relative R&D appears to strengthen, while that between relative bottom incomes and relative R&D falls.

To quantify these associations, we report the correlation coefficient for each series before 1990 (1963–1989), after 1990 (1990–2019), and for the entire sample (1963–2019). Consistent with Figure 10, relative incomes in the top percentile are strongly positively correlated with R&D expenditures, and particularly so after 1990. The same is true throughout the remaining incomes in the top 10 percentiles after 1990. In contrast, while relative incomes in the bottom 50 percentiles are positively correlated with relative R&D expenditures prior to 1990, they are negatively correlated with them thereafter.

Table 2: Correlation Between Relative R&D Expenditures and Relative Incomes

	1963-1989	1990-2019	1963-2019
Top Percentile	0.497	0.889	0.526
Percentiles 2-10	-0.011	0.760	-0.300
Percentiles 10-50	-0.009	-0.501	-0.539
Percentiles 50-100	0.700	-0.561	-0.289

Notes: The table reports the correlation between relative incomes and relative R&D expenditures for different segments of the income distribution and different subperiods between 1963 and 2019.

4.4 (Firm) Size Matters

Leung et al. (2008) and Ranasinghe (2017) emphasize that a smaller average firm size is one of the most distinctive structural features of Canadian economic landscape relative to that in the United States. This feature is particularly striking since the US economy is broadly characterized by the rise of large, highly productive, *superstar* firms in recent decades, and especially since 2000 (Autor et al. (2020), De Loecker et al. (2020)). Superstar firms are larger because they produce more efficiently, charge lower prices, and capture a higher share of industry output (De Loecker et al., 2020; De Loecker and Eeckhout, 2018). They also have higher price-cost markups and, consequently, lower labour shares (Autor et al. (2020)). Firms with higher price-cost margins potentially drive income divergence at the upper tail of the income distribution. While Leung et al. (2008) suggest that differences in the size distribution of firms across Canada and the United States plausibly account for 20 percent of the observed differences in labour productivity between 1984–1997, further changes in economic structure since that time suggest the impact of superstar firms may have only grown since then.

Autor et al. (2020) document that the rise of superstar firms in the United States is associated with a marked decline in the labour share, or the ratio of labour compensation to revenue. To understand the connection between labour share and superstar firms, consider a *firm-level* production function of a similar form to (2):

$$Y_{it} = A_{it} K_{it}^{\alpha} (H_{it} N_{it})^{1-\alpha} \tag{3}$$

where i indexes firms and we maintain the assumption that all factors are purchased in competitive markets. Profit maximization implies that the share of labour costs (wH_iN_i) in nominal value added (P_iY_i) is

$$S_i = \left(\frac{wH_iN_i}{P_iY_i} \right) = \frac{1-\alpha}{M_i} \tag{4}$$

where w is the wage and P_i is the price charged by firm i. The term M_i in equation (4) reflects the firm's markup over marginal costs (MC_i), $M_i = P_i/MC_i$.[31] Falling labour shares potentially

[31]In a perfectly competitive model, $M_i = 1$ for all firms. However, as Autor et al. (2020) argue,

reflect larger markups, greater industrial concentration, and the rise of superstar firms.

To examine the impact of superstar firms on the Canada-US labour productivity gap, we compare relative labour shares in Figure 11. The US labour share has been below that of Canada since at least 1960 (see panel (a)). Moreover, after gradually closing over four decades, the Canada-US gap in labour share has widened to nearly 8 percentage points since 2000.

Does the difference in labour shares reflect underlying changes in markups across countries? Although we do not have direct measurements of markups, De Loecker and Eeckhout (2018) estimate the average Canadian markup to be 1.04 (4 percent) in 1980, while the corresponding estimate for the United States is 1.25 (25 percent). Between 1980 and 2016, the average markup in Canada rises by 49 percentage points to 1.53. US markups grow even more, by 59 percentage points, despite starting from a higher initial markup. In this sense, the gap in the labour share plausibly reflects differential markups and the growth of superstar firms in the United States.

Using the markups in De Loecker and Eeckhout (2018) and the observed gap in the Canada-US labour share, we benchmark the approximate impact of superstar firms by correcting for differential markups and technology. Differential markups plausibly account for all of the observed difference income per capita in 1980 and two-thirds of the income difference in 2016.

On the one hand, these figures suggest potential differences in trend markups and labour share, further implying disproportionate growth in the role of capital in US production. Using equation (4), markups, and labour share to back out the implied capital elasticity, α, we find that in Canada α rises from 0.356 in 1980 to 0.568 in 2016. However, these values remain well below those of the United States, where the implied capital elasticity is 0.501 in 1980 but rises to 0.678 by 2016. These differences in technology can explain much of the observed difference in capital flows between countries. Indeed, in 1980, nearly two-thirds of the capital per unit of output gap can be explained by differences in capital elasticity across countries. By 2016, this figure jumps to 84 percent, suggesting a much smaller role for capital frictions than would otherwise be implied by a standard production framework.

On the other hand, Kaplan and Zoch (2020) highlight the importance of distinguishing production labour (consistent with equation 3) and labour, which is instead allocated to overhead or market expansion activities. Construction, extractive (natural resource), manufacturing, and agriculture workers are typical examples of production labour, commonly referred to as blue-collar labour. White-collar labour is often associated with managerial, high-tech, administrative, and service worker employment. Kaplan and Zoch (2020) document that as much as one-third of labour is employed in white-collar occupations and that rising markups have increased the relative demand for white-collar workers through overhead activities such as research and development. This, in turn, has driven an increasing wedge between the wages across employment groups.

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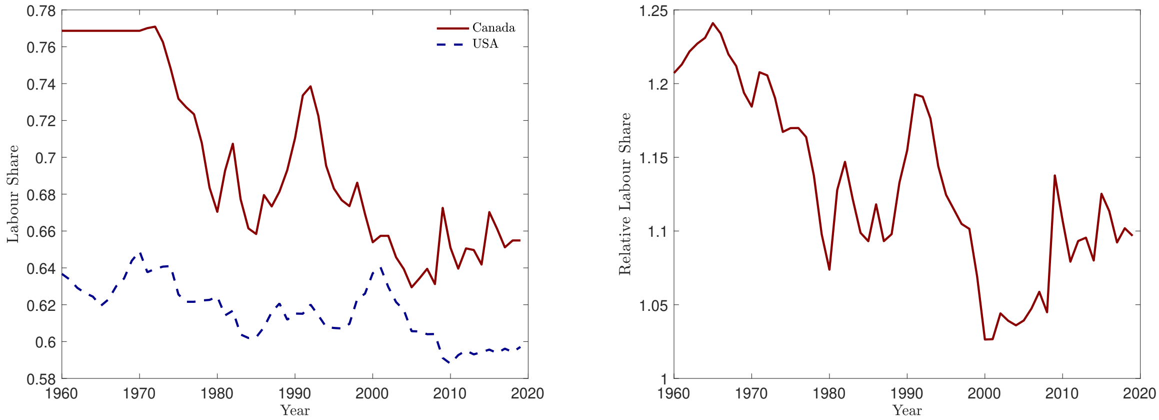
condition (4) holds in a wide set of market structures, including those where firms exert market power and charge positive markups.



(a) Labour Share

(b) Relative Labour Share

Figure 11: Labour Share Across Canada and the United States

Panel (a) plots the labour share in Canada (solid red) and the United States (dashed blue), while panel (b) plots the relative (Canada/US) labour share.

Both of these interpretations are broadly consistent with Sharpe (2003), who argues that the widening gap between Canadian GDP per worker and labour productivity (GDP per hour worked) relative to the United States between the 1980s and 2002 primarily reflects lower capital intensity, a less developed tech sector, proportionately fewer scientists and engineers, and more limited economies of scale. Further investigation is needed to pin down the contribution from each underlying source to differences in the relative income distribution across Canada and the United States.

5 Some Key Questions for Future Research

The top percentiles of earners account for the majority of the Canada-US GDP and productivity gaps. Although our analysis explores some potential explanations and implications of this fact, it also suggests that identifying why the Canada-US income gap varies systematically across the income distribution is key to understanding the puzzling persistence of large differences in GDP per adult and productivity. In this section, we outline some promising directions for future research.

Perhaps the central question is what accounts for the large income gaps for the top percentiles of the income distribution, especially for those with a university degree or business ownership. Our analysis suggests that selective emigration is a significant contributor to this gap. However, the decision of high-ability workers to emigrate is presumably driven by higher returns for certain worker characteristics in the United States. One possibility is that factors such as its large market size make the United States exceptionally attractive globally as a location for innovation and highly productive individuals. An important quantitative question is thus how much of the income gap for top earners is due to higher productivity in the United States versus the direct effects of high-ability workers migrating there. Systematic cross-country analysis on whether the United States is an exceptional magnet for global talent could help decompose the contribution of selective emigration versus higher US productivity.

A closely related question is whether productivity gains from highly productive workers spillover to others in the workforce. If there are no spillovers, then one interpretation of the income and innovation gap could be that the rents of innovation are mainly captured by workers and firms located in the United States, but the productivity of Canadian workers is not adversely impacted by the selective emigration of high-ability individuals. Such a story would be consistent with Canadians adopting innovations developed in the United States and Canadian GDP per adult lagging but tracking that of the United States. However, part of the gap in the level of GDP could be due to workers in Canada being relatively less productive than equivalent workers in the United States due to their working with less productive colleagues or managers. This suggests that quantifying whether there are productivity spill-overs would be informative about whether there are broader costs from the Canada-US innovation gap.

One (incorrect) interpretation of our analysis in Section 2 is that most Canadians do not face large income gaps compared to similar workers in the United States. The combination of upward sloping life-cycle income profiles and income volatility mean that many more than 10 percent of Canadians will spend part of their working life in the top 10 percent. More detailed work on the income gaps over the life-cycle, as well as across occupations, would help quantify differences in expected life-time income across Canadians with different individual characteristics.

Our analysis also calls for a more in-depth investigation of the quantitative importance of composition differences for measured aggregate labour productivity differences. Could systematic tracking of hours worked across the income distribution better identify fundamental shifts in labour productivity from compositional effects due to changes in hours worked? Although there is some existing work that examines trends in hours worked by age and educational attainment, further work in this vein that also looks at more detailed measures (e.g., more disaggregated measures of education) could improve our understanding of the distributional origins of the Canada-US productivity gap.

Finally, further research on what policies could make a meaningful contribution to raising Canadian GDP per adult closer to that of the United States is needed. To effectively close the gap, policies will need to target the underlying causes of gaps across the income distribution. However, fundamental research to identify the causes and the best policy responses will take time. This points to a two-track strategy of long-term research combined with the adaption of policies—even ones that mainly target symptoms rather than the cause—that are likely to improve productivity. The standard list of pro-productivity policies includes removing barriers to competition in Canadian markets and reforming poorly designed regulations that result in long lead times for the approval of investment projects and excessively high compliance costs.

Our analysis, however, cautions on the potential quantitative effects of the standard list of policy reforms since much of the gap appears to be related to innovation and large income gaps in the top percentiles of earners. This suggests that materially closing the gap in GDP per adult will require a significant narrowing of the Canada-US innovation gap. Although the design of effective policies is not clear, successful policies will need to make it more attractive for Canadian inventors to patent and develop their ideas in Canada instead of the United States (Cockburn et al. (2023)), and more high-ability workers will need to remain in Canada. This may require reforms to a range of policies, including immigration and tax policy.

6 Conclusion

The gap between Canadian and US GDP per adult is persistent and large, with Canadian GDP per adult fluctuating between 70 and 90 percent of that of the United States for over 100 years. Behind this average gap in GDP per adult are large differences across the income distribution. We show that most of the gap in GDP per adult is accounted for by the top 10 percent of the income distribution. We also find that these gaps across the income distribution play a similar role in accounting for measured differences between Canadian and American labour productivity.

The systematic differences in Canada-US income across the income distribution are not only informative in accounting for the evolution of the Canada-US GDP and productivity gaps, but can also discipline our evaluation of alternative explanations of these gaps. In addition, these differences can help identify which explanations of the difference in Canadian GDP and productivity are symptoms versus causes of the gap. Our analysis suggests that selective emigration of high-ability people could be a key factor in accounting for both persistent cross-country income differences and lower innovation in Canada compared to the United States. Our work points in several promising directions for future research to further identify the underlying causes of the gap in GDP and productivity.

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A Appendix

This appendix provides some additional details on the data.

A.1 SCF and SFS

We identify the head of the household as the main income earner (SFS) or the reference person (SCF). To construct similar measures of pre-tax household income, we use SFS *Market income*, which is total income before tax minus income from government sources. This is the sum of employment income (wages and salaries, net farm income, and net income from non-farm unincorporated business and/or professional practice), investment income, retirement pensions, superannuation and annuities (including those from RRSPs and RRIFs), and other money income. Income in the SCF is the sum of X5702 + x5704 + x5706 + x5708 + x5710 + x5712 + x5714 + x5718.

We drop households with negative income.

One difference is that social security and private pension income are reported jointly in x5722. In Canada, Canada Pension Plan payments are not included in market income as they are classified as a transfer. Since we focus on 25–65, we do not include x5722 in our US income measure.

The 2019 SFS and SCF report income for 2018. The 1998 SCF reports income for 1997, while the 1999 SFS reports income for 1998. To make the 1998 and 1999 income variables comparable, we scale the 1998 SCF income by the growth of nominal GDP growth per adult (4.4 percent in the WID data). This slightly understates the growth in top incomes as the top 1 percent share of US income grew by roughly 2 percent from 1997 to 1998.

The surveys provide questions around the ownership of business:

- SFS: PBUSIND Do you (or anyone in your family) own an incorporated or unincorporated business? Include a professional practice or farm.

  SCF: X3103 Do you (and your family living here) own or share ownership in any privately-held businesses, including farms, professional practices, limited partnerships, private equity, or any other business investments that are not publicly traded? Do not include corporations with publicly-traded stock or any partnerships that have already been recorded earlier.

Since the fraction that report yes to these questions differs between surveys, we asked whether the SFS overestimates business ownership. We use the variable PWBUSEQ, which gives the equity value of businesses operated by the family unit. [Question Text: Accumulation of equity value of all businesses operated by the family unit.]