December 2021

170 Laurier Avenue West
Suite 604
Ottawa, Ontario K1P 5V5
613-233-8891
csls@csls.ca

CENTRE FOR THE STUDY OF LIVING STANDARDS

A Strengthening Position at the Bargaining Table? Understanding the Productivity-Median Wage Gap in Canada, 1976-2019

James Ashwell

CSLS Research Report 2021-09

Report Prepared for Employment and Social Development Canada
December 2021

A Strengthening Position at the Bargaining Table? Understanding the Productivity-Median Wage Gap in Canada, 1976-2019

Table of Contents

List of Tables

List of Charts

A Strengthening Position at the Bargaining Table? Understanding the Productivity-Median Wage Gap in Canada, 1976-2019

Executive Summary

Motivation

Ensuring that the benefits of economic growth are fairly shared is an increasingly important policy goal. One useful metric for understanding progress on this issue is the gap between the growth rates of productivity and median wages. As productivity grows, workers should be able to demand higher wages for their work and benefit from that growth.

While productivity growth has been well-studied for decades, the transmission of productivity gains to workers has more recently become an important topic for researchers and policymakers, as median wage growth has grown more slowly than productivity for extended periods over the past half-century (Sharpe, Arsenault, & Harrison, 2008b). Some hypothesize that the failure to pass on gains to workers is more of an artifact of the data than it is a reflection of reality, while others believe it represents a fundamental break in how the economy functions. This report examines productivity growth and real wage growth and breaks down the gap between the two to better understand how and why productivity growth is or is not passed on to workers in Canada.

Framework

The productivity-wage gap we specify in this report is the difference in growth rates (if any) between output per hour worked and the real median hourly wage. We decompose that gap into four components which help us to understand the underlying forces which affect it.

The first component represents changes in how much of the economic value generated by productivity growth goes to labour as opposed to capital and other sources. The second component of the decomposition represents the difference between price changes in the economy as a whole and the prices of consumer goods. The third component evaluates the difference between a comprehensive labour compensation series and a more narrowly defined wage series to understand how much of the productivity-wage gap is attributable to changes in supplementary labour income (such as employer pension contributions) and self-employment income. The fourth component measures the effect that inequality has on reducing the benefits the median worker receives from productivity growth. Median wages can remain static while average wages grow if, for instance, growth is concentrated among those at the top of

the wage distribution. Therefore, we measure the difference in growth rates between mean and median wages as a proxy for overall inequality.

We use data from the Survey of Labour and Income Dynamics, the Labour Force Survey, Canada's Productivity Accounts and Canada's System of National Accounts, going back to 1976 for data availability reasons. We link series where necessary and compare the growth rates of variables between peak-to-peak years over the business cycle.

Key findings:

- From 1976-2019 median wages grew about 1 percentage point per year more slowly than productivity. However, the gap between the growth rates of the two variables was smaller in 2008-2019 than in any other period since 1976. The second-smallest gap was observed in 2000-2008, while the largest was observed in 1989-2000, indicating a "slowdown" of sorts in the productivity-median wage gap since 2000.
- Faster growth in median wages is largely responsible for this slowdown, as they grew faster in 2008-2019 than in any other period, and 2000-2008 was the second-fastest.
- Growing inequality between median and average wage levels accounts for just under 50 per cent of the overall gap, while worsening labour terms of trade and labour share of GDP each account for roughly 25 per cent. Supplementary labour income and changes in the labour income of the self-employed have only a small overall effect.
- The labour share of income has declined slightly since 1976. It declined fairly consistently from 1976 to 2005, then recovered slightly in the recession and has fluctuated around the same level since then.
- Depreciation costs as a share of GDP have risen, especially since 2005. It appears not to be the cause of lower labour share, as both labour share and depreciation share declined and rose in similar periods. Removing output-based taxes or housing does not change this story.
- After unusually strong growth in the 1989-2000 period, productivity growth has returned to the level at which it has stood in most periods since 1976 at around 1 per cent per year.

Explanations of the Gap and Future Research

Several explanations have been put forward to explain the persistence of this gap, most of which relate to workers' declining bargaining power in labour markets since the mid-1970s. Rising top wage income shares, globalization, automation, declining costs of investment goods, and changing welfare and labour market policies all relate to the capacity of workers, particularly workers in the middle and bottom of the wage distribution, to obtain higher wages. Policy approaches to address the gap must address rising wage inequality if they are to be successful, and this can be done by empowering

workers at the bargaining table. However, the extent to which these trends have each individually affected the productivity-wage gap requires further research.

A Strengthening Position at the Bargaining Table? Understanding the Productivity-Median Wage Gap in Canada, 1976-2019[1]

Introduction

Despite relatively consistent GDP growth, many Canadians do not perceive their economic situation to be improving (Russell, 2016). Productivity growth, which helped drive the large and consistent increases in living standards in the 1950s and 1960s, has slowed down across the developed world since the mid-1970s (OECD, 2018). Of equal concern has been the apparent "decoupling" of median wages from the productivity growth that has occurred. As The Economist (April 10-16, 2021) put it, "It is right to judge economic progress by the purchasing power of median wages, not profits or share prices."

The apparent failure in recent decades of productivity gains to be passed on to workers has inspired much discussion among economists. Some have hypothesized that the observed failure to pass on gains to workers is an artifact of the data more than it is a reflection of reality (Williams, 2021; Strain, 2019), while others believe it represents a fundamental break in how the economy functions (Stansbury & Summers, 2020; Mishel & Bivens, 2015). This report examines the trends in labour productivity, wages and related variables in Canada to demonstrate to what extent typical workers have benefitted from productivity growth and describe how policy affects the transmission of productivity growth to median wages.

To shed light on this issue, we use an accounting identity first laid out by Sharpe *et al*. (2008a) to decompose the difference between productivity growth and median wage growth into four components. In doing so, we show the relative importance of measurement and methodological choices, labour share changes and mean-median wage inequality in explaining the productivity-wage gap.

This report continues in section one with a review of empirical estimates of the productivity-wage gap in Canada and peer countries. In section two we present the theoretical approach which guides the empirical inquiry of this report. Section three details the measurement challenges associated with this project and how we address them through the construction of our variables. In section four we present our results. In section five we discuss possible explanations for the trends and identify key avenues for future research. In Appendixes 1 and 2 we compare our results with Uguccioni *et al.* (2016) and Williams (2021), who also study Canada. Appendix 3 compares the trends identified in this report with those of the United States identified by Mishel and

[1]This paper was written by James Ashwell, while a summer student at the Centre for the Study of Living of Standards (CSLS), under the supervision of CSLS Executive Director Andrew Sharpe. The CSLS would like to thank Employment and Social Development Canada (ESDC) for financial assistance.

Bivens (2021). The Data Appendix contains all the data used in this report along with some supplemental series pertaining to wages and productivity.

I. Review of Empirical Estimates

Findings for Canada

The productivity-wage gap has become an important object of study in economics and estimates of its magnitude have been conducted all over the world. For Canada, Sharpe *et al*. (2008a) quantify this gap and develop the decomposition accounting approach used in this paper. This report uses earnings rather than wages as the central metric for workers' income, which includes imputed labour income of the self-employed. Median earnings barely grew from 1980-2005, increasing 0.01 per cent per year, average earnings grew 0.36 per cent per year, while productivity grew 1.27 per cent per year. Mean-median inequality explained 28 per cent of the gap and the decline of the labour share explained 20 per cent. Measurement of supplementary income explained a further 20 per cent and the loss in labour's terms of trade explained 33 per cent.

Uguccioni *et al*. (2016) use the same methodology to update the numbers for productivity and wages to 2014. They find that productivity grows from 1976-2014 by 1.12 per cent per year while median earnings grew at 0.09 per cent per year, for a productivity-wage gap of 1.03. Fifty per cent of the gap can be explained by increased mean-median earnings inequality, 30 per cent by the decreasing labour share, and 20 per cent by labour's terms of trade. The overall contributions of supplementary labour income and the imputed labour income of the self-employed accounts for less than one per cent of the overall gap. The 2008-2014 period displays the highest gap of any period studied at 1.26 as median wages shrank 0.14 per cent per year while productivity grew 1.12.

Williams (2021) investigates the same essential question as the previous authors but modifies the approach slightly to account for recent debates about measurement and variable selection. Williams argues that depreciation and taxation costs must be accounted for when considering productivity and wage trends, and he develops measures of net productivity and net labour share to integrate these considerations into his analysis. Williams finds that before accounting for taxes and depreciation, labour productivity rises from 1961-2019 by 1.65 per cent per year, whereas it rises 1.47 per cent per year after including them.

Instead of median wages, Williams prefers average compensation measures to evaluate the transmission of productivity gains to workers. This allows a clearer picture of how labour overall is faring, but does not provide insight as to the distribution of those gains among workers. Deflated using the CPI, average wages grew 1.60 per cent per year, and using Williams' preferred implicit consumption deflator they grew 1.73. The labour share of GDP before accounting for depreciation and taxes decreases over

the same period by 0.19 per cent per year, but after accounting for those factors and calculating labour's share of NDP it decreases just 0.01 per cent per year. For the 2008-2019 period, Williams finds that productivity grows 0.99 per cent per year and compensation deflated with CPI grew 0.75 per cent per year.

Findings for the United States

Harrison (2009) applies the methodology from Sharpe *et al*. (2008a) to the United States to compare the situations across the two countries. He finds that from 1980-2005 productivity in the United States grew 1.73 per cent per year while median wages grew 0.33 per cent per year, for an overall gap of 1.40 points per year. This gap is 45 per cent attributable to mean-median inequality, 23 per cent attributable to labour's terms of trade, 17 per cent attributable to labour's declining share of GDP, and 12 per cent attributable to the measurement of supplementary and self-employment labour income.[2]

Mishel and Gee (2012) find that from 1973-2011 productivity in the United States rises 1.56 per cent per year while median wages rise 0.10 per year, for an overall gap of 1.46 points per year. They attribute 41 per cent of the gap to mean-median inequality, 20 per cent to labour's terms of trade, 17 per cent to the labour share and 11 per cent to supplementary and self-employment labour income.

Stansbury and Summers (2018) use an econometric approach to bring new insights into the discussion of productivity and pay. They regress compensation on productivity in a number of different specifications and find that the link between the two variables is strong. For the 1973-2016 period, the authors find that 1 percentage point higher productivity growth was associated with between 0.7 and 1 percentage point higher median and average compensation growth and with between 0.4 and 0.7 percentage points higher production/non-supervisory compensation. Overall, the authors estimate that the failure of productivity transmission accounts for 38 per cent of the observed productivity-median compensation gap, while other factors "orthogonal to productivity" account for the other 62 per cent. Stansbury and Summers (2018) also run regressions for other countries, including Canada. They find that 1 percentage point higher productivity growth is associated with a 0.95 percentage point increase in average pay in Canada for 1972-2015, higher than any country surveyed except the UK.

Stansbury and Summers (2018) also test the hypothesis that technological change is responsible for the productivity-wage breakdown. They find that unlike that hypothesis would suggest, periods of higher productivity growth are not associated with a higher divergence between productivity and pay. They find that higher productivity growth is also not correlated with mean-median inequality growth, further undermining technological explanations for the overall productivity-wage gap.

[2] Components do not sum to 100 per cent because of data availability and measurement issues, see Harrison (2009) p. 10 footnote on Summary Table 5 for more detail.

Mishel and Bivens (2021) give further evidence against technological explanations and present a case attributing labour's lost compensation to policy-related decreases in their bargaining power. These authors find that from 1979-2019, productivity grew 1.35 per cent per year and the median wage grew at 0.31 per cent per year, for an overall gap of 1.03 percentage points per year. Mean-median inequality accounted for 65 per cent of the gap, labour's terms of trade accounted for 33 per cent and labour's share of income accounted for 2 per cent. They argue that this gap is best explained by institutional changes such as macroeconomic austerity and deregulation which have empowered employers at workers' expense, reducing the latter's bargaining power. Stansbury and Summers (2020) argue that declining worker power also explains higher profitability rates, lower labour share of income, and lower unemployment and inflation.

Findings for Other Developed Countries

Pessoa and Van Reenen (2013) examine both the United States and the United Kingdom using a similar methodology to Sharpe *et al*. (2008a). They define "gross decoupling" as the difference between the growth of productivity and average compensation deflated using the GDP deflator, and define "net decoupling" as the difference between the growth of productivity and median wages deflated using a consumption deflator. They find that in the United States from 1972 to 2010, the growth rate of productivity was 63 per cent higher than the median wage growth rate. Twenty-one percentage points of this wage decoupling are attributable to mean-median inequality, while 14 points are due to labour's terms of trade and 13 per cent are due to non-wage benefits (p. 25). Putting aside other measurement issues comprising not more than a few per cent, the remaining 13 per cent of the gap constitutes a "net decoupling" of average compensation and productivity.

In the UK, gross decoupling is 43 per cent from 1972 to 2010, of which 17 percentage points are explained by inequality, 16 points are explained by non-wage benefits, 3 points are explained by labour's terms of trade, 6 points are explained by self-employed labour income (p. 4). Net decoupling is slightly less than zero, indicating that average compensation has grown more quickly than productivity over this period.

Other results have been obtained for a broad cross-section of countries. Sharpe *et al*. (2008b) find that across 18 countries, an unweighted measure of average productivity grew at 2.33 per cent per year for 1970-2006, while average wages deflated with consumer price indexes grew at 2.22 per cent per year. This broad co-movement supports the hypothesis that wages track productivity on some important level, but particularities of time and place may greatly affect these trends. Four countries experienced faster average wage growth than productivity, while 9 experienced faster productivity than wage growth (some countries were dropped for lack of data). The labour shares declined on an unweighted average basis across all 20 countries from 51.2 per cent to 50.2 per cent from 1970 to 2006.

Uguccioni *et al*. (2016) find that, in most of the 11 OECD countries studied, from the mid-nineteen eighties to around 2010, inequality tends to rise and the labour shares decline, contributing to productivity-wage gaps. Ireland, Norway and Spain are the only countries in which wage growth exceeded productivity growth, and the United States displays the highest gap of those studied at 1.47 percentage points per year

Schwellnus *et al.* (2017) find that across 24 OECD countries for 1995-2013 where a decoupling generally takes place: productivity across the countries rose at 1.57 per cent per year while median compensation grew at 1.17 per cent per year, for an overall gap of 0.40 percentage points per year. Price changes were not examined in this study as the authors simply used GDP deflators for all numbers; compensation was used rather than wages, so SLI and self-employment labour income were already included in their wage measures. At the overall level, mean-median inequality therefore accounts for 55 per cent of the observed gap, while the decline in labour share accounts for the other 45 per cent. Among the G7 countries, productivity and median compensation grew 0.69 and 0.48 per cent per year respectively, much more slowly than for the OECD overall.

II. Theoretical Approach

Intuitive Explanation

Basic models of the labour market predict that workers overall will be paid an amount roughly equal to the marginal economic value that they provide to employers. As workers generate more value, their compensation should therefore rise accordingly. "Productivity" measures the amount of value that workers provide their employers, in terms of dollars per hour worked. Workers are generally paid on a per hour basis, so growth in productivity should be equal to growth in hourly pay. We measure the growth of productivity in per cent change per year for a given period and measure the growth in hourly pay over the same period. Subtracting the rate of growth in wages from the rate of growth in productivity, we obtain the gap between the two variables in percentage points. To understand this gap, we break it down into four components, also given in percentage points, which add up to the overall productivity-wage gap.

The first component is the labour share. When productivity goes up, part of the benefits of that increase goes to workers, but part of it goes to capital. Roughly speaking, capital is anything used in production other than the labour of workers. Examples of capital may include equipment, technology, or financial capital (i.e. money which was loaned to the business to allow it to grow). The proportion of economic benefits going to labour has historically remained steadily around 50-60 per cent in Canada, with the other 40-50 per cent going to capital. These proportions are referred to as the labour share and the capital share, and while they have historically remained at similar levels, these shares do change over time. If a higher proportion of the benefits of productivity growth go to capital, then the labour share becomes smaller, and workers get less than they normally would from the increased productivity, generating a productivity-pay

gap. In the empirical section below, we describe how each variable and measure is constructed in detail.

The second component of the gap is called "labour's terms of trade", and it relates to price changes. Because of inflation, "real wages" and productivity must be calculated using constant dollar amounts which account for the differences in price changes over time. However, the prices of goods and services consumed by workers may not rise at the same speed as the prices of goods and services produced by workers. The adjustment of nominal wages must therefore be done either on the basis of consumer prices or producer prices.

The factor by which we multiply the nominal wage series in order to adjust for price changes is called a deflator. The deflator can be derived from the price levels in the economy as a whole, or from the price levels of goods and services consumed by workers. The first type of deflator is called a GDP deflator, and the second is called a consumer price deflator, the most widely used example of which is the Consumer Price Index (CPI).[3] To understand how workers' living standards are changing, we deflate their wages using the CPI since that deflator reflects the costs of living as experienced by workers. To deflate the output of the economy as a whole, we use the GDP deflator, because that deflator includes the prices of everything that is produced, rather than just the prices of things that are consumed domestically. If the prices of consumer goods change at a different rate than prices overall, there will be a gap between the growth of real wages from the point of view of workers and the point of view of their employers. This difference can contribute to the overall gap between productivity and median real wages. The term we use for this component of the gap is "labour's terms of trade".

The third contributor to the productivity-wage gap is called the SLI/Self-employment component. This component is essentially the difference between the rates of growth of average compensation and average wages. The compensation measure is more exhaustive, as it includes supplementary labour income (SLI) and an estimate of labour income for the self-employed, in addition to wages. SLI refers to compensation that employees receive from their employers beyond their regular wages, salaries and commissions, such as contributions to pension plans and employment insurance. The labour component of self-employment income is estimated ("imputed") because there is no way of directly measuring how much of the income of the self-employed can be characterized as labour income as opposed to capital income since these workers tend to invest both their time and their capital into their endeavours. We discuss this imputation in detail in the "Empirical approach" section.

The final component is wage inequality, as proxied by the difference in growth rates of average and median wages. The average hourly wage is obtained by adding up the wage income of all workers and dividing it by the number of total hours

(8)

[3] There are alternative measures of consumer prices, which we discuss in the Empirical Approach- Variables section.

worked in a year. The median hourly wage is the wage received by the worker in the very middle of the wage distribution. Put another way, the median wage is the wage of the worker for whom the number of people who earn more is equal to the number of workers who earn less. If workers at the top of the distribution enjoy faster wage growth than everyone else, then the average wage will rise faster than the median wage.[4] The inequality component measures the difference between the rates of growth between median and average wages. With this fourth component in place, we can fully explain the gap between productivity and median hourly wages, as the reproduced equation (8) shows below:

$$\Delta\%\ Gap = \Delta\%\ SLI(incl.\,self employment) - \Delta\%\ Inequality - \Delta\%\ Labour's\ Share - \ \Delta\%\ Labour's\ Terms\ of\ Trade$$

The technical details of how these variables relate to one another and how they are put together from Statistics Canada data are explained in the Mathematical Decomposition and Variables sections below.

Mathematical Decomposition

Following Sharpe *et al*. (2008), our theoretical model starts from the following accounting identity:

$$\frac{Y_L}{P_C \times L} = \frac{Y}{P_Y \times L} \times \frac{Y_L}{Y} \times \frac{P_Y}{P_C}$$

Y_L represents the total nominal income of labour, P_C is the price level of consumer goods as measured by CPI, and L is labour input as measured by total hours worked. Y represents the nominal income of the total economy, P_Y is the price level of the total economy, as measured by the GDP deflator.

The left side of the equation is therefore the real hourly compensation of workers when calculated using consumer prices: $\frac{Y_L}{P_C \times L}$. On the right-hand side, $\frac{Y}{P_Y \times L}$ represents labour productivity, $\frac{Y_L}{Y}$ is labour's share of income, and $\frac{P_Y}{P_C}$ is the ratio of total prices to consumer prices, known as "labour's terms of trade".

We next differentiate logarithmically with respect to time to derive the following statement:

$$\Delta\%\ Hourly\ Real\ Compensation = \Delta\%\ Labour\ Productivity + \ \Delta\%\ Labour's\ Share + \Delta\%\ Labour's\ Terms\ of\ Trade \quad (1)$$

[4] It is worth noting that if the poorest workers benefit faster than everyone else, then the same phenomenon is observed: faster growth in the average than in the median. For this reason it is important to dig deeper into how the benefits of productivity are distributed among workers, as we do in the "Inequality" sub-section of our results

This equation shows the relationship between the percentage changes in each variable over time.

Our goal is to understand the gap between median real wages and productivity, not merely the gap between average compensation and productivity. Formally, we want to find:

$$\Delta\%\ Gap = \Delta\%\ Labour\ Productivity - \Delta\%\ Median\ Real\ Annual\ Wage\ Income \quad (2)$$

Rearranging (2) to isolate labour productivity and substituting into (1) we obtain:

$$\Delta\%\ Average\ Hourly\ Real\ Compensation = \Delta\%\ Gap + \Delta\%\ Median\ Real\ Annual\ Wage\ Income + \Delta\%\ Labour's\ Share + \Delta\%\ Labour's\ Terms\ of\ Trade \quad (3)$$

Rearranging (3) to isolate the $\Delta\%\ Gap$ we obtain:

$$\Delta\%\ Gap = \Delta\%\ Average\ Hourly\ Real\ Compensation - \Delta\%\ Median\ Real\ Annual\ Wage\ Income - \Delta\%\ Labour's\ Share - \Delta\%\ Labour's\ Terms\ of\ Trade \quad (4)$$

To understand the importance of employer social contributions and self-employed labour income in explaining the gap, we evaluate how average compensation (including employer contributions and labour income of self-employed) differs from average wages (excluding employer contributions and labour income of self-employed).

$$\Delta\%\ Employer\ Contributions = \Delta\%\ Average\ Hourly\ Real\ Compensation - \Delta\%\ Average\ Annual\ Real\ Wage\ Income \quad (5)$$

Rearranging (5) to isolate average hourly real compensation, and substituting in to (4) we obtain:

$$\Delta\%\ Gap = \Delta\%\ Employer\ Contributions - \Delta\%\ Average\ Annual\ Real\ Wage\ Income - \Delta\%\ Median\ Annual\ Real\ Wage\ Income - \Delta\%\ Labour's\ Share - \Delta\%\ Labour's\ Terms\ of\ Trade \quad (6)$$

To understand the role that inequality plays in contributing to the gap, we use the difference between average and median wage income:

$$\Delta\%\ Inequality = \Delta\%\ Average\ Annual\ Real\ Wage\ Income - \Delta\%\ Median\ Annual\ Real\ Wage\ Income \quad (7)$$

Substituting (7) into (6) we obtain:

$$\Delta\%\ Gap = \Delta\%\ SLI - \Delta\%\ Inequality - \Delta\%\ Labour's\ Share - \Delta\%\ Labour's\ Terms\ of\ Trade \quad (8)$$

Therefore, in our empirical section, we will construct variables for the growth rates of each component outlined in (8), which will show the origins of the gap between the growth in productivity and the growth rate in median hourly wages.

III. Empirical Approach

Data Sources

All data used in this report are freely available on the Statistics Canada website. Most of our data come from the Productivity Accounts, which we supplement with data from the Survey of Labour and Income Dynamics, the Labour Force Survey, and Canada's National Accounts. Not all sources provide wage or earnings series which cover all sectors, or which include supplementary labour income and self-employed labour income. The table below (from Williams, 2021) summarizes these data sources and the Variables section below it explains how each variable that we use in the decomposition is constructed.

Data source	Includes supplementary labour income?	Includes compensation of self-employed?	Includes business and non-business sectors?
Productivity accounts (PA)	Yes	Yes	Yes
National accounts (NA)	Yes	No	Yes
Survey of labour and income dynamics (SLID)[5]	No	Yes	Yes
Labour force survey (LFS)	No	No[6]	Yes

Source: Williams, 2021, information from Statistics Canada

A deeper discussion of measurement and variable choice issues around productivity has been well documented by Stigler (1961), Baily and Gordon (1988), Ahmad and Schreyer (2016), and others.[7] Ross and Murray (2010) outline aggregate income and output measures and discuss their implications for the study of productivity, while Mućk *et al.* (2018) outline the issues associated with measuring the labour share.

Not infrequently, Statistics Canada will discontinue and replace statistical surveys or will update definitions of variables to conform with new international

[5] SLID data is supplemented by Statistics Canada with earlier data from the Survey of Consumer Finance (SCF), and in 2011 SLID was replaced by the Canadian Income Survey (CIS)

[6] In March 2020, Statistics Canada (2020, p26) added questions to the LFS about compensation for the self-employed. The data is not yet public, however.

[7] For an accessible introduction to these issues, see Sharpe (2002) "Productivity Concepts, Trends and Prospects: An Overview"

standards and emerging best practices. In these cases, we sometimes observe a difference in levels of a variable across surveys. To link these series, we use the longer or most recent series available and apply the growth rates of the older or shorter series to a base year value from the main series. We refer to this approach as "backcasting" for the remainder of this report.

For example, our nominal GDP series links two series in the year 1981. The main series used is from Table 36-10-0221-01 for 1981-2019, and growth rates for the pre-1981 period are taken from Table 36-10-02550-01. The value of the main series in 1981 in millions of dollars is 368,358. The values of the older series are 360,471 in 1981 and 314,390 in 1980. Therefore, the growth rate for 1980-1981 is 14.7 per cent. We multiply the value of the base year of our main series (368,358) by a factor expressing the growth rate of the earlier series for 1980-1981 (314,390/360,471) yielding a value for 1980 in the linked series of 321,269. The resulting value is then multiplied by a factor expressing the growth rate from the earlier series.

Variables

Nominal Output

Our measures of nominal output at market prices come from two tables from Statistics Canada's Productivity Accounts. Table 36-10-0220-01 is used for 1981-2019, and Table 36-10-0225-01 is used to backcast to 1976. Output in our main analysis is measured as real gross value added (GVA), which we multiply by the GDP deflator to obtain a measure of nominal GVA. A direct measure of nominal value added is provided by Statistics Canada only for 1997 to 2017, so to ensure consistency over the entire 1976-2019 period we use the deflated real value series for our main analysis. The SNA nominal GDP annual growth rate for 1976-2019 is 5.80 and the deflated GVA series growth rate for the same period is 5.82. GVA is denominated in basic prices and excludes intermediate output.[8]

We opt to study the total economy rather than just the business sector. Workers can and do switch between public and private sector employment, so wages are determined at an equilibrium level reflective of the productivity of both sectors. Excluding the public sector from our calculations would therefore skew our results.

Total Nominal Labour Compensation

Total labour compensation for our main analysis is taken from Table 36-10-0480-01 for 1981-2019 and Table 36-10-0303-01 for 1976-1981. Total compensation includes supplementary labour income (SLI) as well as the imputed labour income of the self-employed. SLI, also known as employer social contributions, is defined by Statistics Canada (2016) as:

[8]For more information, see https://www150.statcan.gc.ca/n1/pub/13-606-g/2016001/article/14619-eng.htm.

> … actual or imputed contributions that employers make on behalf of their employees to both government-sponsored social security schemes […] and employer-sponsored health and disability insurance, pensions, maternity, dental, life insurance and other benefit schemes (p. 127)

Self-employed workers input their labour and capital into their enterprises. To avoid counting capital income when adding self-employed income to a worker compensation measure, it is necessary to impute their labour income distinctly from their capital income. To do this, Statistics Canada assumes that before 1990 "the self-employed essentially earned incomes similar to the employed" (Baldwin, Gu, & Yan, 2007, p. 26). After 1990, census data indicated that self-employed workers generally earned less than their paid employee counterparts. Statistics Canada now assumes that:

> … the hourly earnings of self-employed workers is proportional to that of paid workers with the same level of education and experience. The proportional or scaling factor is based on the relative hourly earnings of paid and self-employed workers from the Census of Population. (Baldwin, Gu, & Yan, 2007, p. 26)

To break down GDP shares in more detail as described below, we supplement this compensation series with one from the SNA which excludes self-employed labour incomes. This series is sourced from Statistics Canada Table 36-10-0221-01 for 1981-2019 and Table 36-10-0254-01 for 1976-1981.

The wage measure used later in the decomposition excludes both self-employed labour income and SLI, making it a simpler, though a less comprehensive measure of worker pay.

Labour Share

Several conceptual issues have been raised with regard to calculating labour shares effectively. Williams (2021), Pessoa and Van Reenen (2013) and others have argued that a better measure of the labour share excludes depreciation and output-based taxes from the output, generating a "net labour share" measure. However, in this paper, our primary interest is in understanding the change in workers' incomes, whether that be attributable to depreciation, taxes, higher profits or any other factor. Therefore, we first report the labour share using Productivity Accounts data and then in a second step examine the extent to which different factors such as taxes and depreciation explain the trends over time using SNA data. We calculate the depreciation as nominal consumption of fixed capital among corporations, unincorporated businesses, governments, and non-profit institutions serving households, divided by total nominal GDP. The tax share consists of taxes less subsidies on production, products and imports, divided by nominal GDP. The capital share is then calculated as the remaining GDP not going to labour, depreciation costs, or taxes.

Rognlie (2015) and Gutierrez and Piton (2020) argue that the inclusion of housing in productivity and labour share calculations is problematic, because the growth

in value of owner-occupied housing accrues solely or primarily to capital. But this is only a problem in so far as housing's share of GDP increases significantly. By our calculations, rents from owner-occupied dwellings as imputed by Statistics Canada accounted for 8.03 per cent of Canada's GDP in 1997 and 8.14 per cent in 2017.[9] This increase of just 0.11 percentage points is small enough that we can confidently set aside this component in our analysis.

Labour share is calculated by dividing total nominal labour compensation by nominal gross value added (GVA) or nominal GDP. GDP and GVA measures differ slightly, as do the corresponding measure of labour compensation from the productivity accounts and SNA. We use GVA for productivity because that is the approach used by Statistics Canada productivity accounts. In order to avoid introducing discrepancies in our decomposition which would arise from switching to GDP, we also calculate the labour share using GVA in our main analysis. To remain consistent, we therefore also use the measure of labour compensation from the productivity accounts, which includes an imputed measure of labour income for the self-employed.

Nominal GDP, depreciation, output-based taxes, and compensation excluding self-employed, are taken from SNA Table 36-10-0221-01 for 1981-2019 and Table 36-10-0254-01 to backcast to 1976. Nominal GVA and compensation including imputed self-employment labour income are taken from Table 36-10-0480-01 for 1997-2019 and backcast to 1976 using Table 36-10-0303-01. These series are provided in Appendix Table 9.

Real Total Output

Real output comes from the same two tables as nominal output and is denominated in chained 2012 dollars. Table 36-10-0220-01 is used for 1981-2019, and Table 36-10-0225-01 is used to backcast to 1976. The conversion from current dollars to chained dollars is done by Statistics Canada and is based on prices in the total economy, and the ratio between the two is expressed as the GDP deflator.

Labour Productivity

Labour productivity is calculated as real output divided by total hours worked. The hours worked series uses Table 36-10-0480-01 for 1997-2019, and growth rates from Table 36-10-0303-01 to backcast the series for 1976-1996. As mentioned above, the productivity series is deflated using chained dollars which represent price changes across the total economy. Our productivity series is denominated in real output per hour worked.

Real Average Hourly Compensation

To compute real hourly compensation, we divide our nominal total compensation series by our average hours worked, which are taken from Table 36-10-0480-01 for 1997-2019, and Table 36-0303-01 for 1976-1997, the same tables used to

[9] Data are from Statistics Canada GDP estimates by industry from Table 36-10-0402-01

calculate productivity. We then deflate our hourly nominal compensation series using the GDP deflator from Table 36-10-0130-01 and the CPI from Table 18-10-0005-01 to obtain our two compensation series, which can be referred to as producer wage and consumer wage. The difference in growth rates of these two series constitutes our "labour terms of trade" gap component.

Although there are some biases in the CPI, it remains the standard measure of the cost of living in Canada, used by the Government of Canada, Bank of Canada and widely in the private sector.[10] Williams (2021) prefers the consumption expenditure deflator, which weights items differently and has a slightly different scope, but which broadly tracks the CPI measure. We do deflate by the consumption expenditure deflator recommended by Williams (2021) as a robustness check and can confirm that real compensation grows slightly faster when deflated in that manner (0.71 per cent per year for 1976-2019 versus 0.61 per year for CPI and 0.85 for GDP-deflated compensation).

Real Average Hourly Wages

Wages, as mentioned above, are distinct from compensation because they exclude both SLI and imputed self-employment labour income. The series does however include salaries and commissions. Wage income on an annual basis is taken from Statistics Canada Table 11-10-0159-01 which combines Survey of Labour and Income Dynamics (SLID), Survey of Consumer Finance (SCF), and Consumer Income Survey (CIS) data for the years 1976 to 2019. We then divide this annual series (which is already denominated in constant 2019 dollars) by average hours worked as documented in the Productivity Accounts Table 36-10-0480-01 for 1997-2019, and Table 36-0303-01 for 1976-1996, to obtain an hourly wage income series for each of those years.

Real Median Hourly Wages

Annual median wage income, denominated in 2019 constant dollars, is taken from Table 11-10-0159-01, which combines data from SLID, SCF and CIS. We assume the median hours worked is 40 hours per week, 50 weeks per year, for an annual median hours count of 2000. Although Stansbury *et al*. (forthcoming) show that median hours may drop below the 2000 mark starting in 2012, we prefer to maintain a constant hours assumption because the median number of hours worked may not reflect the hours worked by the earner of the median annual wage income. If we were to use the series from Stansbury, our post-2011 trend of faster median wage growth becomes stronger, supporting the overall narrative that our data show. For the years in which LFS and SLID median wage series overlap, the LFS series grows at 0.53 per cent per year while the SLID series grew at 0.66 per cent per year.[11]

[10] See Sabourin (2012) for a discussion of the potential issues with CPI

[11] Median and average wages are both lower in the LFS series, but the difference between the average wage measures is much greater than that between median measures. If we use the LFS series for 1997-2019 and backcast using the growth rates from the SLID series for 1976-1997, then we find that the productivity-wage gap is 0.04 points smaller for 1976-2019, the inequality component is 0.14 points smaller, and the SLI/Self-employment

Possible Improvements in Data Availability

Numerous data challenges arise in studying productivity and wages over this timescale. Some of these challenges have been resolved and others have been worked around in this paper, but it is worth identifying several ways in which the data can be improved.

Linking series

- Virtually all the important data series used in this report combined data from both current and archived Statistics Canada tables. If Statistics Canada provided linked series for longer-term periods, researchers would have a common foundation of data to build upon. The SLID/SCF/CIS series is exemplary in this regard. Unfortunately, it is the exception, as basic series such as total compensation, nominal GDP, and labour share must be linked by researchers.
- Current series and archived for the same variables often overlap for a period of a few years, during which we observe level differences and differences in growth rates for variables which are ostensibly the same. We have sought to explain these differences where possible based on Statistics Canada User Guides and literature, but clear explanations for these differences should be more easily available.
- Some series are only available as quarterly or monthly series prior to a certain point in time. Some historical series were only made available to researchers upon request and have not been published on the Statistics Canada website (Williams, 2021). Compiling annual series and ensuring that historical data is easily accessible to the public on the Statistics Canada website should be a priority.

Self-employment

- The imputation of self-employed income is not clearly described in the Productivity Accounts documentation. We include a quote from the User Guide explaining the general procedure, but this explanation lacks detail and makes it difficult to know exactly how the imputation is done.
- While the SLID/SCF/CIS series breaks down self-employment income explicitly apart from paid employee income, Productivity Accounts and SNA data do not provide such a breakdown, so we must infer the magnitude of self-employed income
- Greater transparency and clarity in this area would allow us to better understand whether self-employed workers increase or decrease productivity, how they affect the labour share of GDP, and what impact they have on wage inequality.

component is 0.23 points larger. As for the sub-periods, the productivity-wage gap is 0.40 points smaller for 1989-2000, 0.27 points larger for 2000-2008 and 0.05 points larger for 2008-2019. Mean-median inequality is lower for 1989-2000, 2000-2008 and slightly higher in 2008-2019, while the SLI/Self-employment component is larger for all relevant periods. Labour's share of income and terms of trade are of course unaffected.

As non-traditional work arrangements become more common (Jeon, Liu, & Ostrovsky, 2019) monitoring the changing nature of self-employment will only become more important.

Median wages and hours

- Median hours worked are not available from Statistics Canada unless one can access and program public-use microdata files.
- The median and average hourly wage series provided in the LFS is only available calculated for an employee's "main job" and therefore fails to capture wage trends in workers' secondary jobs.
- Income inequality data are not disaggregated into wage income and capital income, so distributional changes within wage income are difficult to discern.

Price measures

- Implicit price deflators are not available for GVA, for GDP excluding taxes or for GDP net of depreciation. Access to these deflators would allow more precise calculation of the labour share.
- Some series are made available only in constant dollars, while others are only posted in current dollars. Enabling users of online Statistics Canada tables to select the denomination of the series would allow quicker and more reliable comparisons across data sets.

In the next section, we lay out the main results of our decomposition.

IV. Results

Tables of Key Results

Table 1: Basic Trends (per cent annual growth)

	1976-1981	1981-1989	1989-2000	2000-2008	2008-2019	1976-2000	2000-2019	2008-2013	2013-2019	1976-2019
A. Labour productivity	0.51	1.07	1.58	0.92	1.04	1.19	0.99	1.05	1.03	1.10
B. Labour share of nominal GDP	-0.31	-0.32	-0.50	-0.25	0.08	-0.40	-0.06	0.22	-0.04	-0.25
C. Average real hourly compensation (GDP deflator)	0.20	0.75	1.08	0.67	1.12	0.78	0.93	1.27	0.99	0.85
D. Average real hourly compensation (CPI deflator)	-0.69	0.28	0.82	1.20	0.81	0.32	0.98	1.10	0.57	0.61
E. Average real hourly wages	-0.24	0.30	0.73	0.94	0.75	0.39	0.83	1.10	0.46	0.58
F. Median real hourly wages	-0.66	0.18	-0.20	0.35	0.66	-0.17	0.53	0.55	0.75	0.14
G. Productivity–median wage gap	**1.18**	**0.90**	**1.79**	**0.57**	**0.38**	**1.36**	**0.46**	**0.50**	**0.28**	**0.96**
A. Real output per hour worked, constant 2012 dollars. Source: Statistics Canada, see Data Appendix T1 for details										
B. Total nominal labour compensation divided by total nominal GDP. Growth rate here shows changes in that fraction. Total labour compensation includes imputed labour income for the self-employed. Source: Statistics Canada, see Data Appendix T5 for details										
C. Total labour compensation (including imputed labour income of self-employed and SLI) divided by total hours worked, deflated with implicit GDP deflator. Source: Statistics Canada, see Data Appendix T6 for details										

D. Total labour compensation (including imputed labour income of self-employed and SLI) divided by total hours worked, deflated with CPI. Source: Statistics Canada, see Data Appendix T6 for details
E. Average annual income from wages, salaries and commissions (excl. self-employed), divided by average hours worked (PA, incl. self-employed), deflated with CPI. Source: Statistics Canada, see Data Appendix T10 for details
F. Median annual income from wages, salaries and commissions (excl. self-employed), divided by median hours worked, deflated with CPI. Source: Statistics Canada, see Data Appendix T10 for details
G. Labour productivity (A) minus median hourly wages (E)

Table 2: Explanatory Factors for Productivity Gap (percentage points)

	1976-1981	1981-1989	1989-2000	2000-2008	2008-2019	1976-2000	2000-2019	2008-2013	2013-2019	1976-2019
A. Inequality	0.42	0.13	0.94	0.59	0.09	0.56	0.30	0.55	-0.29	0.45
B. Labour's share of income	0.31	0.32	0.50	0.25	-0.08	0.40	0.06	-0.22	0.04	0.25
C. Labour's terms of trade	0.90	0.46	0.26	-0.53	0.30	0.46	-0.05	0.17	0.41	0.24
D. SLI/Self-employment	-0.45	-0.02	0.09	0.26	0.06	-0.06	0.14	0.00	0.11	0.03
E. Sum of positive factors	1.63	0.92	1.69	1.10	0.40	1.02	0.25	0.73	0.13	0.93
F. Sum of negative factors	0.45	0.02	-0.09	0.53	0.02	-0.34	-0.20	0.22	-0.15	-0.03
G. Sum of factors	**1.17**	**0.89**	**1.78**	**0.57**	**0.38**	**1.36**	**0.46**	**0.50**	**0.28**	**0.96**

A. Average real hourly wages (E) minus Median real hourly wages (F)
B. Total nominal labour compensation divided by total nominal GDP (C)
C. Average real hourly compensation deflated with GDP deflator (C) minus Average real hourly compensation deflated using CPI (D)

D. Average real hourly compensation (D) minus average real hourly wage (E)
E. Sum of factors which worsen the productivity-wage gap
F. Sum of factors which make the gap smaller
G Sum of all factors

Table 3: Explanatory Factors for Productivity Gap (percentages)

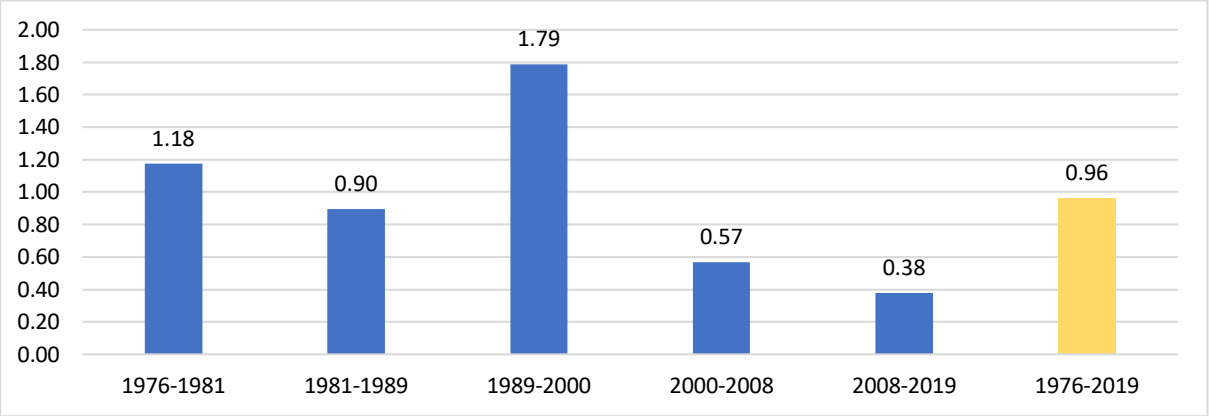
	1976-1981	1981-1989	1989-2000	2000-2008	2008-2019	1976-2000	2000-2019	2008-2013	2013-2019	1976-2019
Inequality	35.9	14.5	52.7	103.9	24.7	41.3	65.9	110.1	-102.7	46.5
Labour's share of income	26.1	36.1	28.1	44.0	-20.3	29.5	13.2	-44.0	15.1	26.0
Labour's terms of trade	76.5	52.0	14.4	-93.6	79.6	33.9	-10.4	34.2	147.4	24.6
SLI/Self-employment	-38.5	-2.6	4.8	45.7	16.0	-4.7	31.4	-0.3	40.2	2.9

Contributions to the overall gap from Table 2 rows A-D are divided by the overall productivity-wage gap, listed in row G. The percentages in this table sum to 100 per cent in each column.

The Productivity-Wage Gap, 1976-2019

For the 1976-2019 period, we observe a gap between growth in productivity and growth in median wages of 0.96 percentage points. Growing inequality between average and median worker wages accounts for 48 per cent of this gap, while a decrease in labour's terms of trade and the labour share of GDP each account for roughly 25 per cent. Measurement differences accounting for supplementary labour income and self-employed workers account for the remaining per cent overall.

Chart 1: Productivity-median Hourly Wage Gap, 1976-2019 and Sub-periods



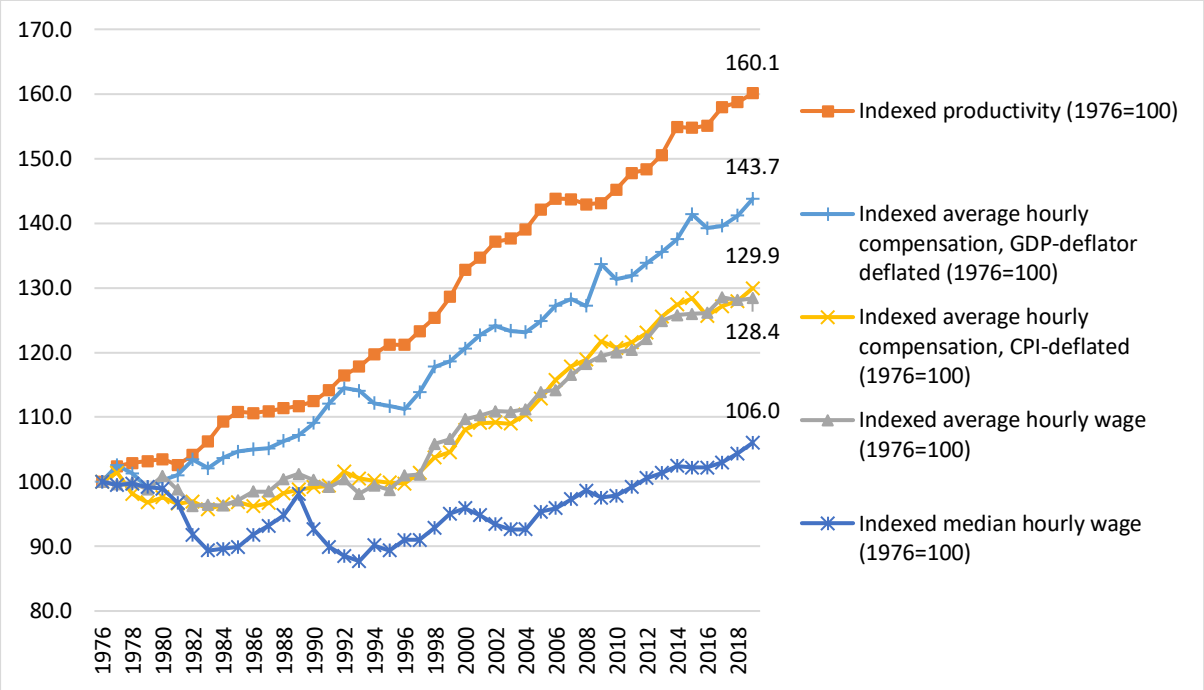
Source: Statistics Canada, see Data Appendix T3 for details

As shown in Table 1, productivity and wages have diverged in Canada since 1976, although the divergence has slowed in each of the most recent periods since 2000. The factors driving divergence have differed greatly across periods, as shown in Table 2. In the late 1970s and throughout the 1980s, deteriorating terms of trade were most important in driving divergence. In the 1990s, labour terms of trade were less important than inequality and labour share, with the former taking on nearly twice the importance of the latter in explaining the gap. Inequality continued to grow significantly in the 2000s, while the labour share continued to shrink, albeit less dramatically. In this period labour's terms of trade made a large contribution to improving workers' wages for the first time on record. Since 2008 that component has returned to its previous trend and has contributed to the continued widening of the productivity-wage gap. However, slower increases in inequality and improvements in the labour share of income made the growth of the productivity-wage gap smaller since 2008 than in any previous period.

Chart 2 shows that the average wage has tracked productivity much more closely than the median wage, reflecting the fact that the mean-median inequality component in the productivity-wage gap is responsible for roughly half of the overall productivity-wage gap. The closeness of the average compensation and average wage series reflects how small an effect the addition of SLI and self-employed workers has on the overall story. In contrast, the gap between the two series for average compensation, as deflated by the CPI and GDP deflator, reflects the importance of labour's terms of trade, which makes up roughly 25 per cent of the gap. The gap between average compensation and

productivity reflects labour's lost share of GDP over time, amounting to about a quarter of the overall gap.

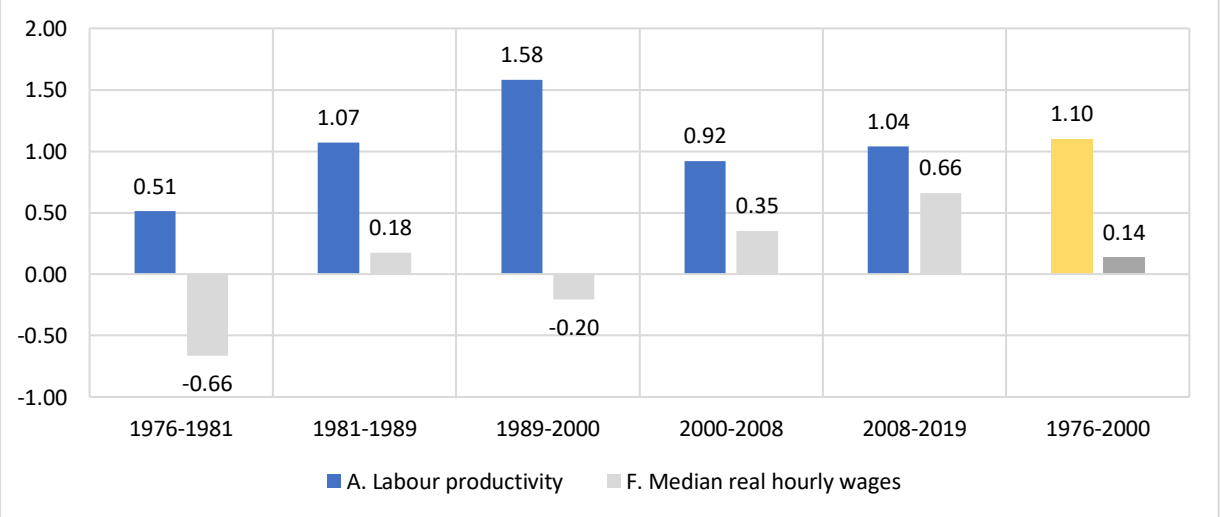
Chart 2: Indexed Productivity, Wages and Compensation, 1976=100



Source: Statistics Canada, see Data Appendix for details

The trend in the median wage can be divided into two main periods. From 1976-2004, the median wage grew and shrank over time, without ever surpassing its starting value of 18.3 constant 2019 dollars. Beginning in 2004, median wages trend consistently upward, surpassing the 1976 level in 2011, and remaining above it since then.

Chart 3: Annual Growth in Productivity and Median Wages, 1976-2019



Source: Statistics Canada, see Data Appendix for details

Detailed descriptions of the trends in the two most recent time periods are provided below, followed by descriptions of the long-term trends in our fundamental variables: productivity, compensation and wages, and the labour share.

Developments Since 2008

While the productivity-wage gap continues to grow, the 2008-2019 gap was just 0.38 percentage points, the lowest of any period since 1976. Productivity growth, at 1.04 per cent per year, was slightly below the 1976-2019 overall trend of 1.10 points per year, but on par with the growth in 1976-1981 (0.51) and 2000-2008 (0.92). Median wage growth was well above the 1976-2019 average of 0.14 per cent per year during this period, as it grew 0.66 per cent annually.

The smaller divergence between these variables can primarily be explained by a slowing of mean-median wage inequality growth and an exceptional improvement in the labour share of GDP. Inequality grew by 0.09 percentage points per year over this period, down from 0.94 and 0.59 percentage points per year in the preceding two periods, and well below the long term (1976-2019) rate of 0.45 percentage points per year.

The labour share of GDP increased from 2008 to 2019 by 0.08 percentage points per year, rising from 61.9 per cent to 62.4 per cent. However, a closer look shows that the labour share has fluctuated significantly year to year, and had already risen to 64.9 per cent of GDP in 2009, before falling immediately to 62.0 by 2011, the level around which the share fluctuates for the remainder of the period. The slight increase in the labour's share between the first and last years of the period is therefore not indicative of a significant trend towards higher labour share, but a reflection of the annual volatility of the variable.

The SLI/self-employment component contributed to the worsening of the gap, albeit only by 0.06 percentage points per year in this period. This represents a continuation of the post-1989 trend reversing the contribution that this component makes to the productivity-pay gap, as it had reduced the gap in pre-1989 periods. This indicates that the decline in self-employment income has been greater than the increase in SLI which has continued to take place, a trend we discuss in the "Trends in Compensation and Wages" section below.

Upon breaking down the period even further, we see similar trends occurring across the 2008-2013 and 2013-2019 sub-periods. Mean-median inequality in 2008-2013 is closer to its 2000-2008 level as it contributes 0.55 points per year to the productivity-wage gap. For 2013-2019 however, inequality actually decreases as median wage growth outstrips the average measure, and the gap for that period is reduced by the inequality component by 0.29 points per year. In contrast, labour's share of income increases by 0.22 points per year from 2008-2013 and decreases by 0.04

points per year thereafter. Labour's terms of trade continue to worsen, worsening by 0.17 points per year in 2008-2014 and by 0.41 points per year in 2013-2019. The SLI/Self-employment component remains small, as it grew 0.11 points per year from 2013-2019 and not at all in 2008-2013

The 2000-2008 Period

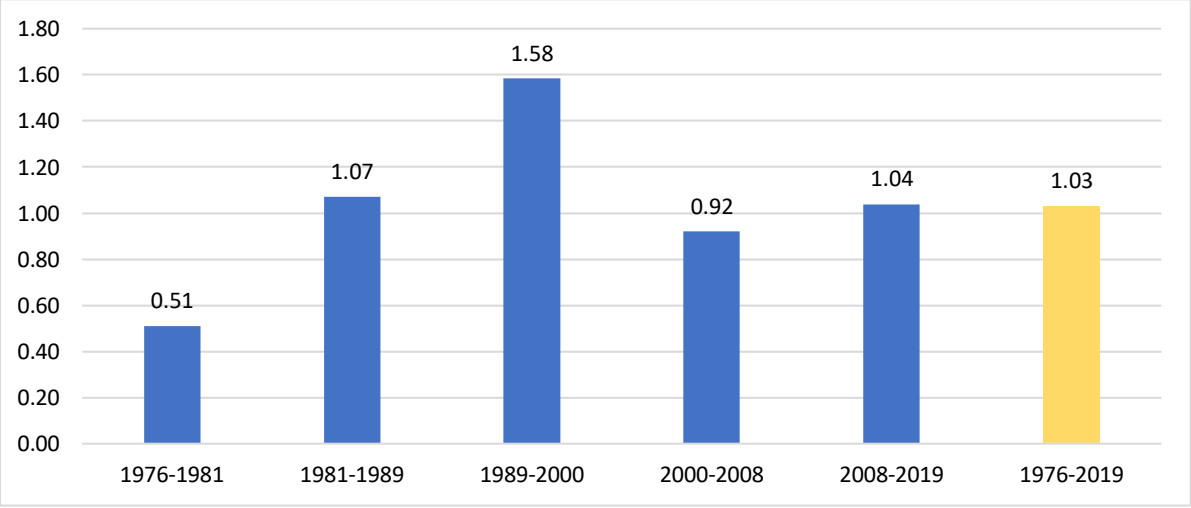
The 2000-2008 period was unusual because during those years labour's terms of trade reduced the size of the productivity-wage gap, the only period in which it did so. Its contribution to the gap amounted to -0.53 percentage points per year.

In contrast, a declining labour share of income increased the size of the gap by 0.25 percentage points per year in the 2008-2019 period, exactly equal to the long-term contribution of that component to the gap. Inequality grew during this period at 0.59 points per year, down from 0.94 points in 1989-2000, but above the 1976-2019 rate of 0.45 points. SLI and self-employment contributed 0.09 percentage points per year, worsening the gap for the first time since 1976.

Trends in Productivity, 1976-2019

Productivity growth in Canada peaked in the 1989-2000 period when it grew at 1.54 per cent per year. The lowest period of growth in our dataset is the 1976-1981 period, in which growth was at 0.51 per cent per year. The growth rate hovers around 1 per cent per year in the other periods, reaching 1.07 in 1981-1989, 0.92 in 2000-2008, and 1.04 in 2008-2019. We characterize the finding for 2008-2019 as largely a continuation of the post-1970s norm, rather than an exacerbation of the productivity slowdown.

Chart 4: Productivity Growth by Cyclical Period, 1976-2019



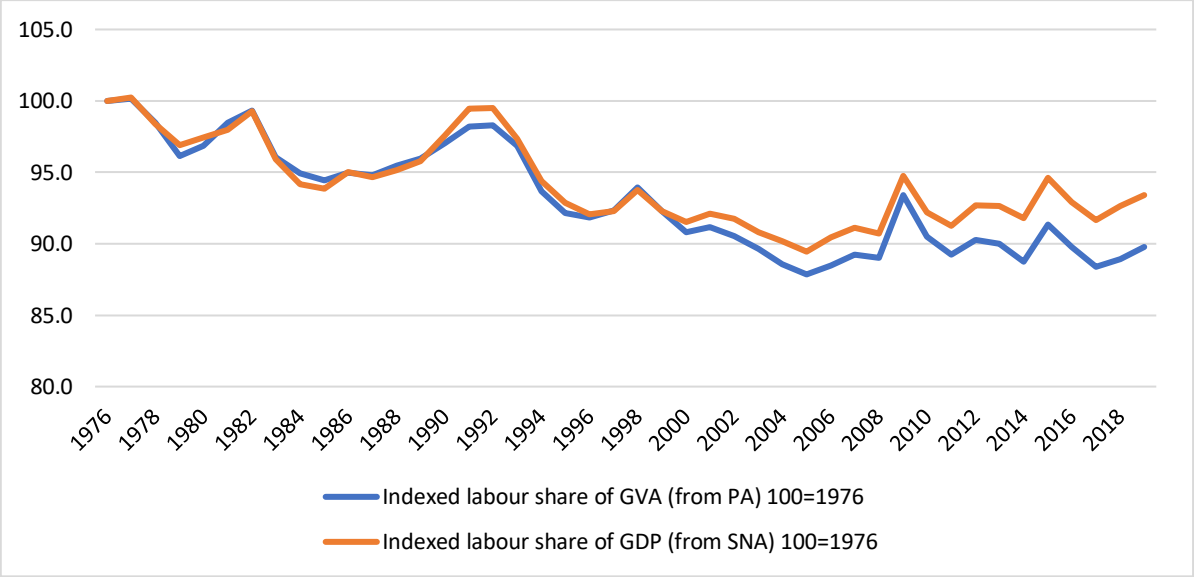
Source: Source: Statistics Canada, see Data Appendix T3 for details

Trends in Labour Share, 1976-2019

From 1976 to 2019, the Productivity Accounts show that labour's share of gross value added (which includes imputed labour income of the self-employed) declined annually by 0.25 per cent per year, from 63.2 per cent to 56.8 per cent. The labour share of GDP based on SNA data (which excludes self-employed labour income) declined at an annual rate of 0.16 per cent per year, dropping from 54.5 to 50.9 per cent of GDP.

From 1976 to 2000, the labour share of GVA decreased from 63.2 per cent to 57.4 per cent, comprising the vast majority of the overall decline. After 2000, the labour share dropped further to its nadir of 55.6 per cent in 2005. It rebounded quickly to 59.1 per cent in 2009, before largely stabilizing around the 56 per cent mark for the remainder of the post-recession period. The 2008-2019 period is the only one to demonstrate growth in the labour share of GDP, but this fact conceals the reality that the 2019 level of 56.8 per cent is lower than its levels in years 2009 (59.1) and 2015 (57.8), indicating no clear trend of growth or decline since the recession. As chart 5 shows, the trends in labour share as measured using the two datasets track quite closely, although the PA data shows a greater overall decline.

Chart 5: Labour shares from PA and SNA Data, Indexed to 1976



Source: Statistics Canada, see Data Appendix T9 for details

Depreciation has been identified as a possible culprit for the declining labour share (Manyika, et al., 2019; Williams, 2021). Since the GVA and GDP series differ, and no depreciation data is available from the Productivity accounts which contain GVA, we exclusively refer to the labour share as a percentage of GDP from SNA data throughout the following discussion.

The depreciation share was 14.8 per cent in 1976 and reached its pre-2000 peak in 1982 at 16.7 per cent of GDP. The share then underwent a secular decline, reaching

a nadir of 14.4 per cent in 2005. Since then, it rose rapidly to reach its all-time high of 17.4 per cent in 2016, before levelling out at 16.6 per cent in 2019.

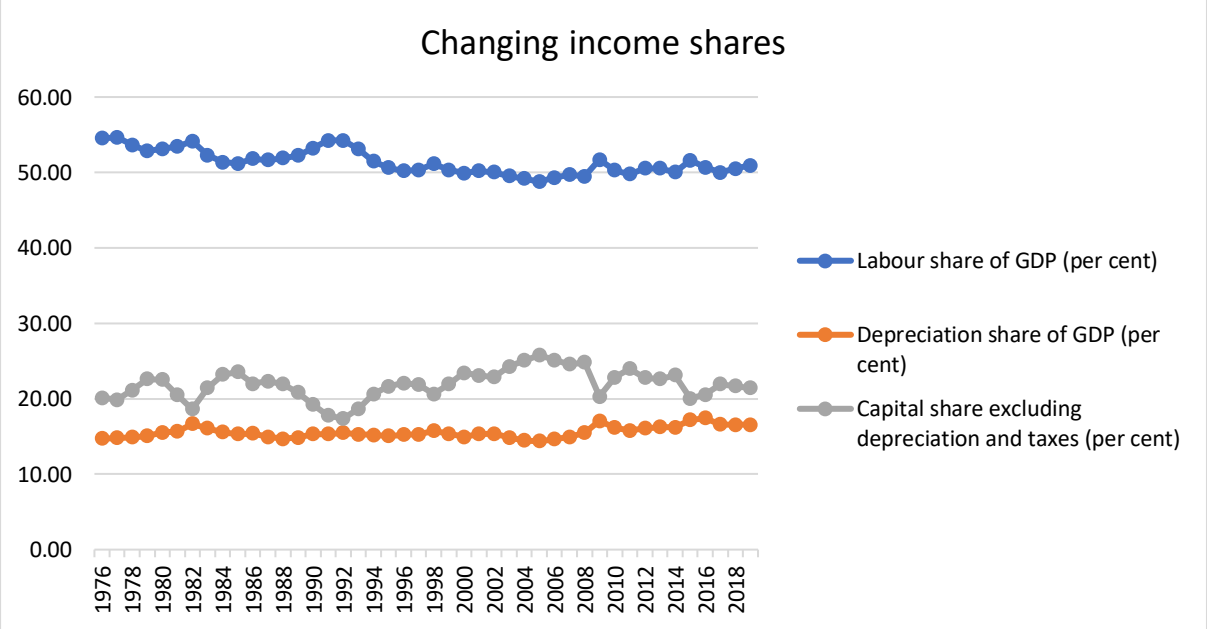
This evidence unambiguously supports the thesis that depreciation costs have risen. However, those costs were declining for many years during which the labour share also declined and rising in the years when labour share was rising. In fact, both the labour share and the depreciation share reached their lowest points in the same year, 2005. The hypothesis that depreciation is to blame for declining labour shares would predict that periods of rising depreciation would correspond with periods of decreasing labour shares, and we observe the opposite.

Williams (2021) also argues that taxes should be accounted for when calculating the labour share. The taxation share of GDP was 10.6 per cent in 1976 and rose to its peak of 13.0 per cent in 1993, before declining to 10.2 per cent in 2008 and then rising slightly to 11.1 per cent in 2019. Although there are some fluctuations in the tax share of GDP, they do not appear to correspond with changes in the labour share.

We calculate a capital share based on the GDP not accounted for by labour compensation, depreciation, and output-based taxes. This capital share decreased from 22.0 per cent of GDP in 1976 to its nadir of 17.4 per cent in 1992, and then grew to its peak of 25.8 per cent in 2005. Since then, it has declined to a 2019 share of 21.4 per cent.

Overall, the picture of GDP shares is similar to our picture of the productivity-pay gap: workers have lost ground over time, but different factors appear to be at play in different periods. Moreover, the labour share after 2000 appears unchanged despite short-term fluctuations and has even gained some ground since 2008.

Chart 6: Shares of GDP, 1976-2019



Source: Statistics Canada, see Data Appendix T9 for details

Table 4: GDP Shares in Key Years

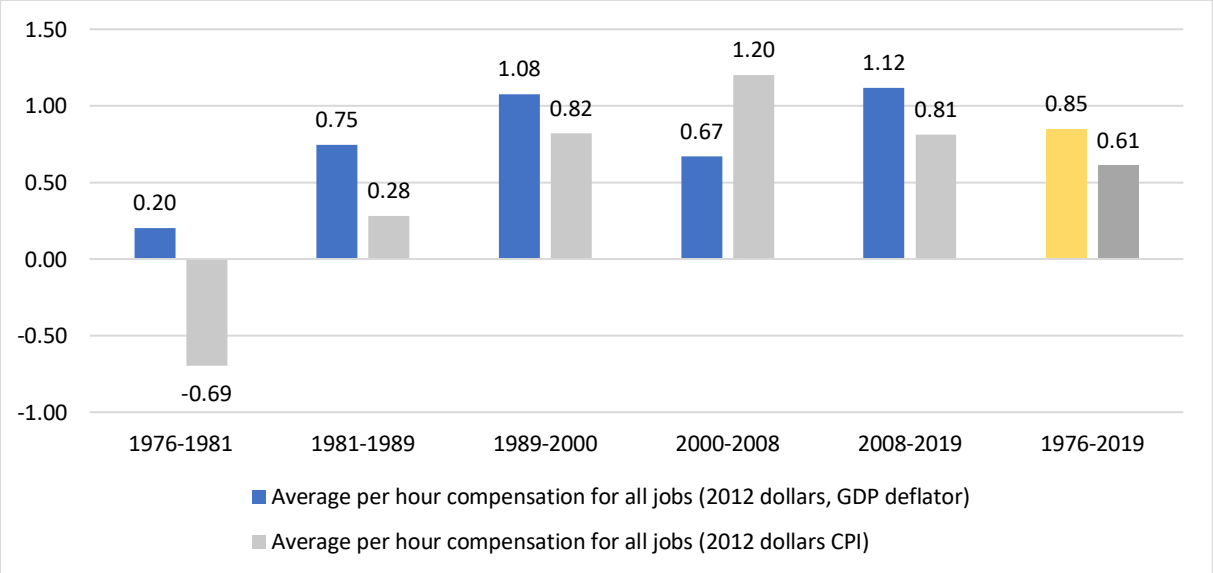
	1976	1981	1989	2000	2008	2019	Definitions
Labour share of GVA (PA)	69.5	68.4	66.7	63.1	61.9	62.4	Total compensation/GVA
Non-labour share of GVA	30.5	31.6	33.3	36.9	38.1	37.6	100-labour share
Labour share of GDP (SNA)	54.5	53.4	52.2	49.9	49.5	50.9	Total compensation/GDP
Depreciation Share	14.7	15.7	14.9	14.9	15.5	16.5	Capital consumption/GDP
Tax share	10.6	10.4	12.1	11.7	10.2	11.1	Taxes less subsidies on products, imports and production/GDP
Capital Share Excluding Depreciation and taxes	20.1	20.5	20.8	23.4	24.8	21.4	100-labour share-depreciation share-tax share

Source: Statistics Canada, see Data Appendix T9 for details

Trends in Compensation and Wages, 1976-2019

Compensation has grown in real terms at an annual rate of 0.61 per cent per year from 1976-2019 when using the CPI to deflate the nominal series. When the GDP deflator is used, the series grows much faster at 0.85 points per year, thus 0.24 points of the productivity-wage gap are attributable to the divergence of prices, which is shown in Chart 3 below. As previously noted, the only period in which the CPI grew more quickly than did the GDP deflator was for the 2000-2008 period, and the 2008-2019 period appears to show a return to normal for this component.

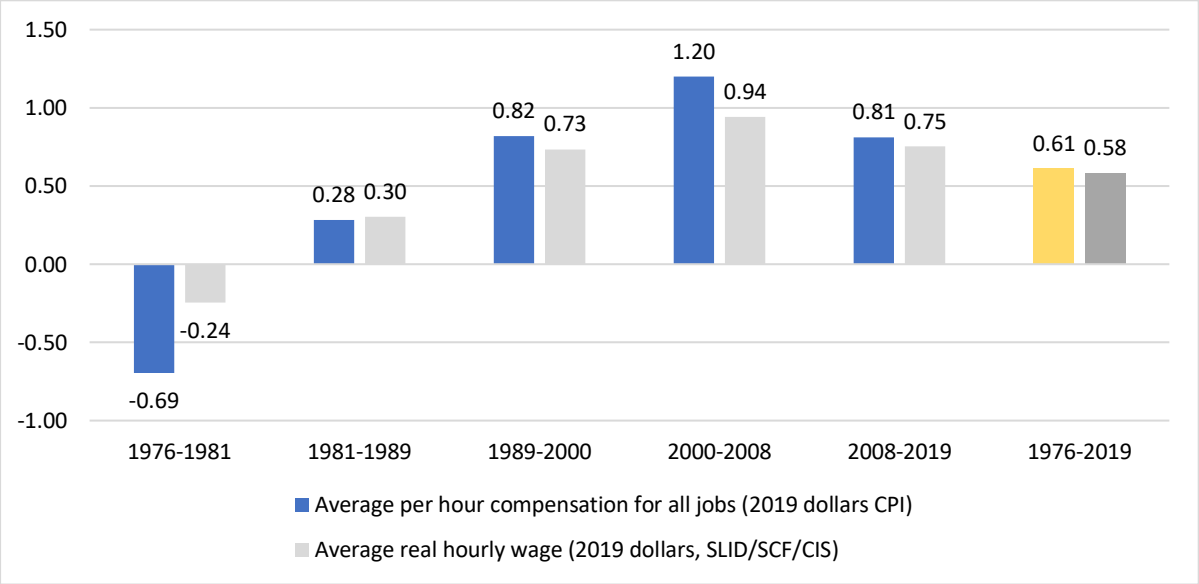
Chart 7: Real Hourly Compensation Growth, 1976-2019



Source: Statistics Canada, see Data Appendix T5, T6 and T10 for details

Average real hourly compensation has grown at 0.61 per cent per year, while average real hourly wages have grown at a similar pace, 0.58 per cent per year. Wages have therefore grown slightly more slowly than overall compensation, meaning that the contribution of the "SLI/Self-employment" component contributes to widening the gap between productivity and median wages, although its contribution is very small. The small magnitude of this contribution is somewhat puzzling given that, as Table 5 makes clear, SLI has grown much more quickly than compensation overall. However, this component also contains the imputed labour income of the self-employed. We can therefore conclude that the imputed real hourly incomes of the self-employed have declined. Baldwin, Gu and Yan (2007) confirm this trend occurred at least in the 1990s (p. 26).

Chart 8: Real Average Hourly Compensation and Wage Growth, 1976-2019



Source: Statistics Canada, see Data Appendix T5, T6 and T10 for details

As shown in Table 5, SLI increased significantly as a share of compensation, reaching 13.7 per cent in 2019 after beginning at 8.7 per cent in 1981.[12] In contrast, self-employment income shrank as a share of compensation starting after 1989, reaching its lowest level of 4.8 per cent in 2019. Data from SLID/SCF/CIS further confirms this trend, as the average annual income of a self-employed worker drops in real terms from $39,800 in 1976 to $17,500 in 2019 and the median drops from $18,100 to $7,000 (Data Appendix 7). This indicates that the decline in self-employment incomes is a real phenomenon and not a mere artifice of the imputation process.

[12] SLI data are only available starting in 1981. The SLI/Self-employment component for 1976-2019 is calculated as the difference between compensation and wages, but the component cannot be further disaggregated into SLI and self-employment.

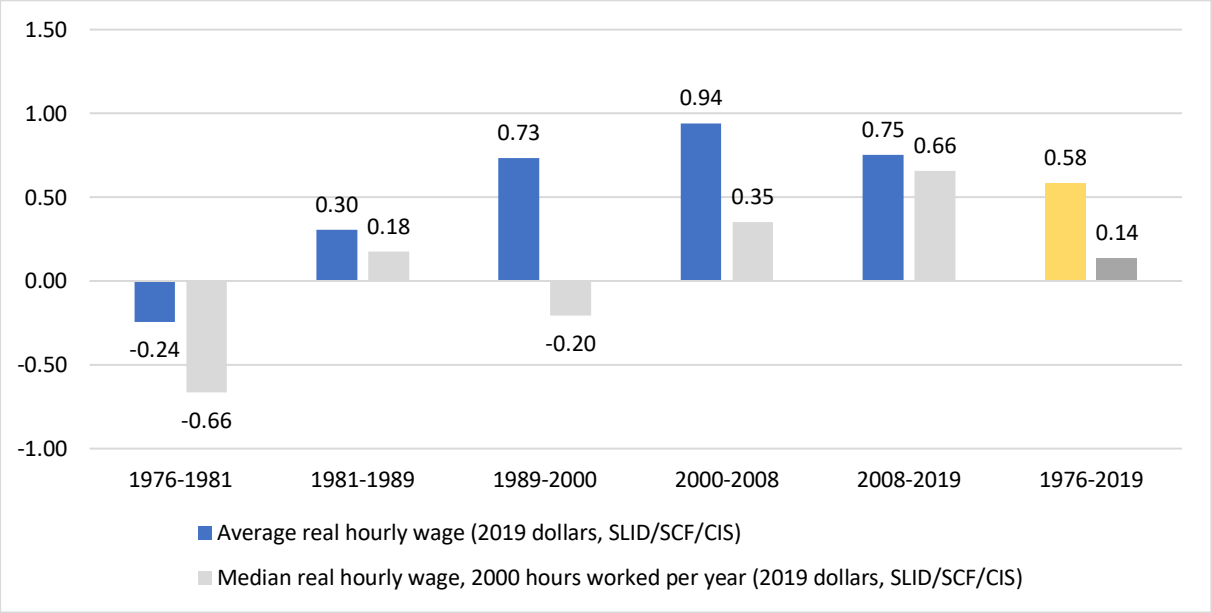
Table 5: Percentage Shares of Total Nominal Compensation, SLI and Imputed Self-employment Labour Income, Key Years

	SLI	Self-employment
1981	8.7	6.3
1989	9.1	7.0
2000	12.0	6.5
2008	12.6	5.6
2019	13.7	4.8

Source: Statistics Canada, see Data Appendix T7, T8 for details

When comparing mean wage growth and median wage growth, the important role of inequality in producing the productivity-wage gap becomes clear, as was shown in Chart 2.

Chart 9: Real Median and Average Hourly Wage Growth, 1976-2019



Source: Statistics Canada, see Data Appendix T10 for details

Average wages have grown in all periods except 1976-1981, and between 1989 and 2008 growth outstripped that of median wages by a significant margin (see Table 1). The period in which the gap between median and mean wages was the highest was 1989-2000, when the difference in growth rates reached 0.94 percentage points. The gap in 2000-2008 is lower but still relatively large at 0.59 points. This component decreases dramatically in the 2008-2019 period, mostly due to the historically high level of median wage growth at 0.66 per cent per year.

Inequality

The mean-median inequality metric only provides a narrow conception of how the wage distribution has changed in the past decades. In Table 5 below, we show the growth rates in different periods of average market income for each income decile. Market income includes investment and retirement income and is therefore not perfectly analogous to our wage series. Breakdowns of wage income by decile are only available through analysis of LFS microdata. Nonetheless, the table shows some stark differences across time and deciles, showing a clear overarching trend in the long term.

Table 6: Average Income Growth in Canada by Decile, 1976-2019

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1976-1981	3.13	1.19	0.80	0.89	0.86	0.83	0.96	0.99	0.97	-1.02
1981-1989	-1.91	-0.74	0.05	0.45	0.68	0.83	0.79	0.75	0.88	1.55
1989-2000	-4.38	-2.08	-1.26	-0.70	-0.24	-0.06	0.19	0.33	0.46	1.81
2000-2008	7.07	2.53	1.59	1.45	1.36	1.36	1.35	1.52	1.64	1.00
2008-2019	0.00	1.34	1.09	0.87	0.81	0.84	0.84	0.86	0.77	0.48
1976-2019	0.13	0.27	0.35	0.50	0.62	0.70	0.77	0.84	0.89	0.94

Source: Statistics Canada, see Data Appendix T11 for details

From 1976 to 2019, every decile grows positively but more slowly than the decile above it, meaning inequality increased across the board. The top decile grows fastest at 0.94 per cent per year while the bottom decile grows slowest at 0.13 per cent per year. Average income growth was 0.83 per cent per year for those at the top of the distribution, and 0.37 per cent for the bottom half.

The late 1970s are a good time for the bottom decile which grows 3.13 per cent per year, and a poor period for the top decile which actually shrinks for the only period we observe. Deciles 3 to 9 all enjoy comparable modest growth of around 0.85 per cent per year. Growth in the 1980s and 1990s have very similar distributional shapes, in that the bottom deciles shrank, the upper half of deciles grew, and the top decile grew much faster than any other. This trend reverses very abruptly in the 2000-2008 period, in which the bottom decile grows much faster than any other, deciles 3 to 9 enjoy similar modest growth rates, and the top decile grows more slowly than any other.

The post-recession period is perhaps the most puzzling. Growth rates are lower on average than in the preceding periods, although no decile sees negative growth. The lowest decile's income is the same at the start and the end of the periods, so its growth rate is zero. In contrast, the second decile grows faster than any other in the period at

1.34 per cent per year. Deciles 4 to 10 grow at modest rates, with the 9th and 10th deciles having the third- and second-lowest growth of all deciles.

The story these numbers tell is largely in line with that told by other researchers studying the topic in more depth. Beach (2017) examines the income distribution to understand the extent to which concerns about the "declining middle-class" are reflected in data. Beach defines the middle class as those workers earning between 50 and 150 per cent of median annual earnings. Beach finds that the number of workers within that segment has declined from 74.3 per cent in 1970 to 62.8 per cent in 2005 for full-time full-year (FTFY) male workers, and from 76.5 to 63.0 per cent of FTFY female workers. A higher proportion of those exiting this middle-class bracket entered the lower-earning bracket than entered the higher-earning bracket, as the former bracket grew by 5.1 percentage points for men and 5.7 points for women, while the latter bracket grew 3.4 points for men and 4.9 points for women.

The declines in the share of wage income going to middle-class earners have been even starker than the declines in the share of workers in the category. Among male FTFY workers, the earnings share going to middle-class workers declined from 64.1 per cent in 1970 to 47.3 per cent in 2005, and from 69.3 to 51.5 per cent among women. Those losses went predominantly to higher earners, who saw their share of wage income grow 13.5 percentage points among FTFY male and female workers.

These findings are supported by similar findings from Green and Sand (2015), who examine the "labour polarization" hypothesis put forward by Autor *et al*. (2006) in a Canadian context. This hypothesis proposes that wages have grown faster at both the top and the bottom of the wage distribution and that the slowest increases have accrued to those in the middle of the distribution. Green and Sand show that labour polarization does not occur in Canada in the long term, although in certain sub-periods a degree of polarization does take place. Across all periods the upper percentiles of earners enjoy the highest gains, while workers at the bottom of the distribution tend to benefit the least. Among male workers, those at the 90th percentile enjoyed wage growth of 15 per cent from 1981-2006, while those at the 10th percentile saw their wages shrink by roughly 10 per cent. Similar patterns are observed for female workers, although those at the bottom of the distribution enjoyed positive wage growth. Inequality has therefore grown since 1981, although it is worth noting that this growth appears to be decelerating, as inequality grows most in the 1980s and least in the 2000s. In fact, from 2000-2006 all workers below the median wage level enjoyed growth at roughly the same pace, although the upper half of the distribution continued to grow faster. From 2006 to 2011, the bottom percentile grows faster than all others and the top of the distribution grows at a similar pace to that of the middle percentiles. This pattern of slowing inequality growth is also observed in the United States for the 1990s, and the authors point out that Canada's slowdown could reflect a lagged technology effect diffusing into Canada. However, they note that research by Fortin and Lemieux (2015) indicates other forces at work.

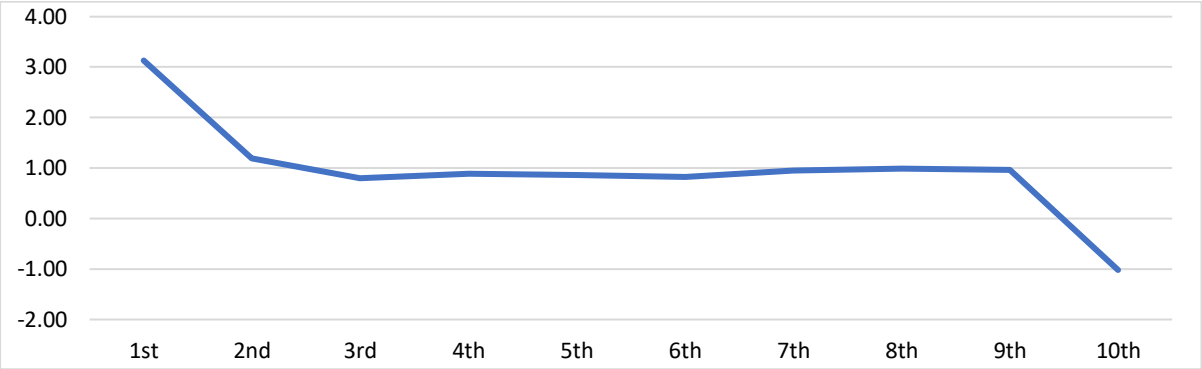
Fortin and Lemieux (2015) break down patterns in wages across provinces and find that minimum wage laws and resource booms have been driving forces affecting wage distributions in Canada. They find that the bottom percentile of earners tended to grow faster than the other percentiles in the 2006-2010 period, especially in provinces that raised the minimum wage. At the same time, the gap between the 100th percentile and 50th percentile also grew significantly, as upper-end wage dispersion grew significantly. The authors also note that between-group inequality declined over time in the provinces, even as overall inequality grew or remained constant. This means that the inequalities driven by formal education, age, and gender were reduced, even as inequalities among those with the same characteristics increased. This pattern was especially notable in the resource-boom provinces of Alberta, Saskatchewan and Newfoundland and Labrador.

Further insight into the trends affecting resource provinces is provided by Marchand (2012), who breaks down Western provinces by census division according to the proportion of economic activity attributable to energy extraction and compares the wage trends among them. He finds that in those divisions with the most energy extraction, the growth at the bottom of the distribution is differentially greater than in the divisions with less extraction, yet at the top of the distribution he also finds higher dispersion as the very top of the distribution grows even faster than the other deciles. Overall, Marchand finds slightly higher differential growth of the Gini coefficient in resource-heavy census divisions than in control divisions, and that measures which weight higher-end inequality more grow more quickly, while those which weight lower-end inequality more grow more slowly.

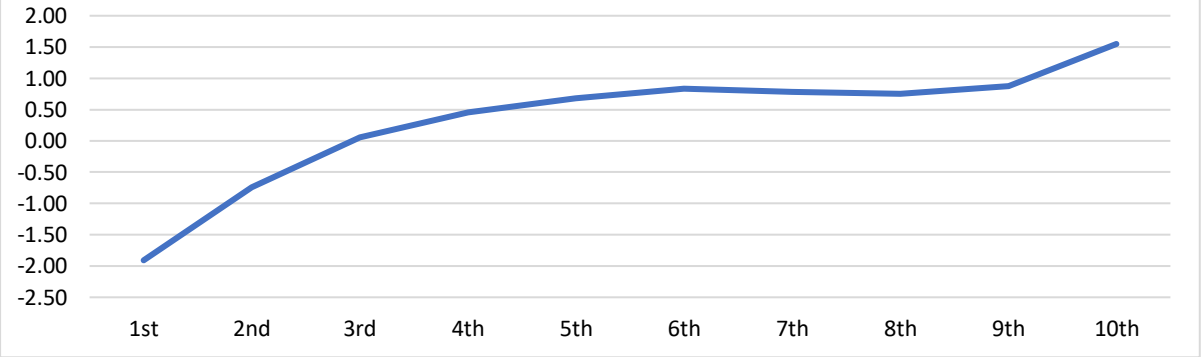
To understand inequality, we must understand the changes that have taken place at the top of the income distribution. The incomes of "the 1 percent" or the top percentile of earners have attracted much media attention in recent years (Healing, 2020; Belmonte, 2020). Veall (2012) uses tax data to understand how top incomes have evolved and what policy options may be used to address their surging share of income. Chart 10 plots income growth (y-axis) by income decile (x-axis), to show which deciles have grown more quickly in which periods. "Wage polarization" would appear as a U-shaped curve, while a linear curve from the bottom left to top right corner would display a straightforward increase in inequality all along the distribution.

Chart 10: Distribution of Growth in Incomes Among Earner Deciles, Various Time Periods

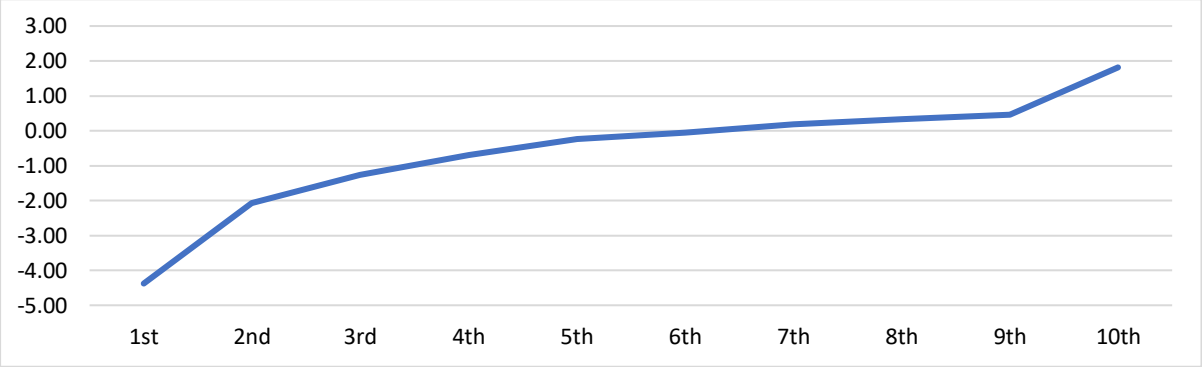
Panel A: 1976-1981



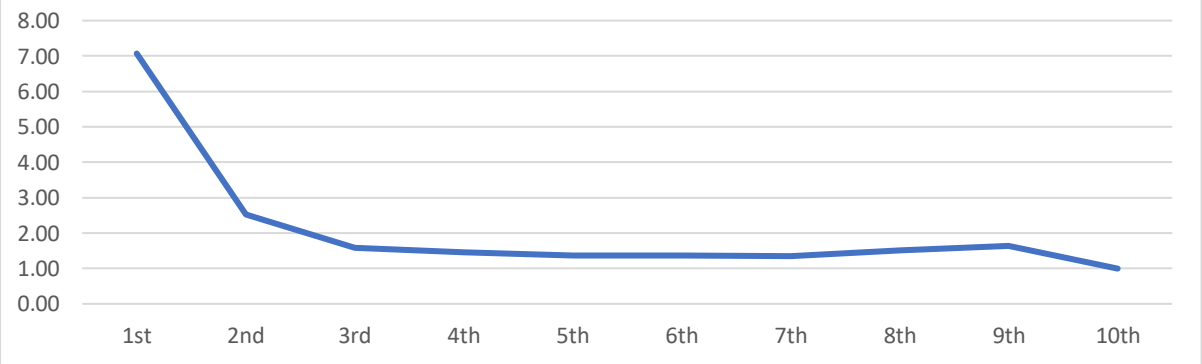
Panel B: 1981-1989



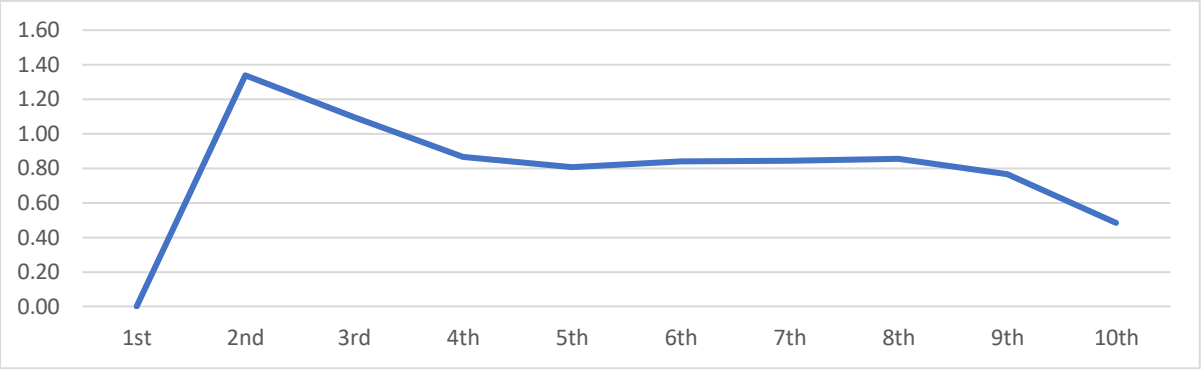
Panel C: 1981-1989



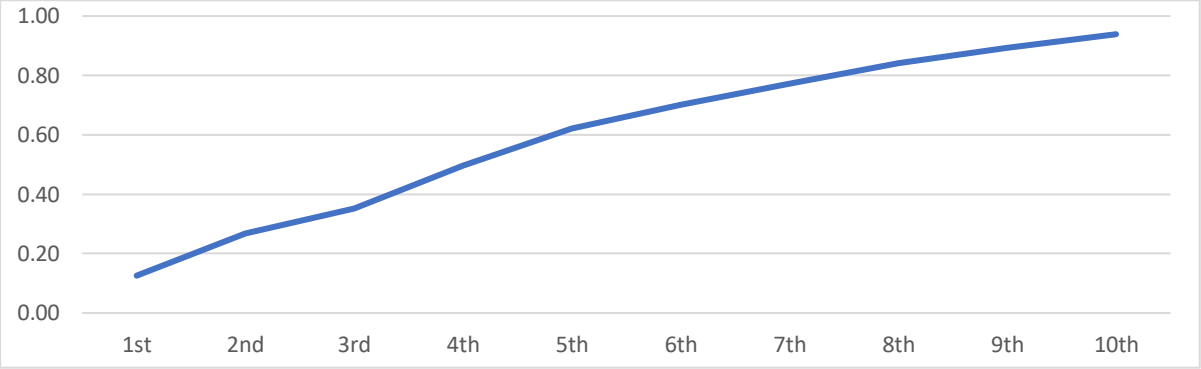
Panel D: 2000-2008



Panel E: 2008-2019



Panel F: 1976-2019



Source: Statistics Canada, See Data Appendix T11 for more details

The income share of the top 1 per cent, 0.1 per cent and 0.01 per cent of earners declined in Canada from the mid-1930s until the mid-1970s, then increased significantly through to its peak in 2007. Veall's data, which ends in 2009 shows a slight decline in these groups' income shares for 2007-2009 as it had in previous recessions. The growth of these high earners' income shares reflects increases in their wage and salary income rather than capital income or business income (from self-employment and partnerships), which grow more slowly and make up a shrinking share of high earners' total income.

Using Statistics Canada Table 11-10-0055-01, we confirm Veall's findings for the pre-2009 period, and also examine trends for 2009-2018. Somewhat surprisingly, the top income shares did not recover after the 2008 recession and have shrunk as a percentage of total income since that time. The income share of the 1 per cent was 12.0 per cent in 2007 and 10.0 per cent in 2018, the top 0.1 percenters claimed 4.7 per cent in 2007 and 3.4 in 2018 and the 0.01 percenters earned 1.6 per cent in 2007 and 1.1 per cent in 2018[13]. However, Wolfson *et al*. (2016) show that this apparent flattening of top income shares excludes income from Canadian-controlled private corporations

[13] There is a large spike in income listed for 2015 and a subsequent large drop in 2016. However, this is likely an aberration attributable to the tax planning measures taken in advance of higher top marginal income tax rates introduced for 2016. Since 2016 income shares have increased slightly, but it is unclear if this has merely been a tax planning rebound or a return to the broader trend of growing top income shares.

(CCPCs) and that their inclusion shows that top income shares rebound as of 2010. They find that when CCPC income is included, the income share of the top percentile in 2011 is 3.3 percentage points higher, that of the top 0.1 per cent is 1.5 points higher and that of the 0.01 per cent is 0.8 points higher. Top incomes earners appear to continue to grow their share of total income in the economy.

V. Explanations of the Gap and Avenues for Future Research

The results of this decomposition show that, measurement issues aside, a real productivity-wage gap persists in Canada and that inequality, the slightly lower labour share of GDP, and changing labour terms of trade can explain it. In order to ensure the gains of future productivity growth are transmitted to workers, these underlying issues which cause these trends must be addressed. We outline possible explanations for these underlying phenomena in the following section and identify where more detailed research is needed to ensure policy responses are well-informed.

Before addressing specific policies, it is important to understand how workers' wages are determined. Essentially, the classical theory holds that workers earn in wages the amount of value that they provide to the firm. However, every wage-setting decision made by a firm is shaped both by the supply and demand of labour, and by market imperfections which prevent the theoretically efficient allocation of resources.

All firms and workers must negotiate in setting wages.[14] Workers want to obtain the best terms of employment, while profit-maximizing employers seek to minimize their labour costs. The ability of employers or workers to dictate terms to the other party constitutes their bargaining power (Dufour & Russell, 2015), and policy changes may affect that bargaining power either directly by altering the balance of power among the parties or indirectly by supporting economic, social, or technological phenomena which affect that balance. We expect changes in bargaining power to impact both the labour share of GDP and inequality, though these effects may differ across time, geography, and industry.

Unionization

Mishel and Bivens (2021) argue that policy-driven erosions of bargaining power are the primary causes of workers' inability to capture the full gains of productivity. The decline in unionization is chief among the issues they identify. When workers bargain collectively, they are generally able to extract better terms from their employers, and employers are more likely to provide better salaries to their workers as a means to prevent them from forming a union. Dufour and Russell (2015) find union membership to be positively correlated with the productivity-wage transmission in Canada at the 10 per cent significance level, and Card *et al*. (2004) show evidence that the decline in unionization in the United States and the UK has contributed to higher income inequality in those countries.

Unionization rates appear to have declined fairly consistently over time, dropping from around 38 per cent in 1981 to 30 per cent in 2000 (Morissette,

[14] When wages for a particular position are set in advance, it may seem false to claim negotiation occurs. However, in determining what level of compensation to set for that position, the firm has already engaged in an implicit cost-benefit analysis which it accounts for workers' alternative uses of time, including choosing to leave the labour force or remain unemployed. In this way, we can say that at a high level, all wages are determined to an extent by bargaining power exercised through this mechanism.

Schellenberg, & Johnson, 2005) and down to 28 per cent in 2019 (See Data Appendix T12). Data on this issue are difficult to compare across long time periods, but if we take the growth rates of these numbers, we can see that from 1981-2001 unionization rates shrink 1.09 per cent per year, whereas they shrink 0.32 per cent per year from 2000-2019, indicating there may be a link between the slowing decline in unionization and the reduction in the productivity-wage gap.

A more in-depth assessment of the various data sources on unionization rates and union coverage could be coupled with regression analysis such as that completed by Dufour and Russell (2015)**, to determine more precisely the importance in of unions in passing down productivity gains to workers.**

Business Practices and Labour Abuses

Minimum wage levels may also contribute to workers' bargaining positions, by increasing the wages of workers in such positions and pushing employers to make higher offers to those just above the minimum level. Dufour and Russell (2015) find a correlation at the 10 per cent level for minimum wage levels and productivity transmission, and Mishel and Bivens (2021) recommend higher minimum wages to close the gap in the United States.

Mishel and Bivens (2021) also find the weakening of labour protections and the failure to properly enforce existing standards have put American workers in worse positions. When instances of wage theft, uncompensated overtime, underpayment of undocumented workers, and misclassification of employees go unchecked by regulators, workers become increasingly vulnerable to exploitation by their employers and less able to exert bargaining power over them.

Other changes in how businesses are run have also changed worker-employer power dynamics. Non-compete clauses, no-poaching agreements, and forced arbitration clauses have all become commonplace and reduced workers' ability to turn down bad employer offers in favour of alternatives (Mishel & Bivens, 2021). Businesses have increasingly contracted out much of the work that was formerly done in-house, reducing employers' accountability to the workforce employed in their supply chain (Weil, 2014). Increasing shareholder pressure and the rise of shareholder activism have likely encouraged such practices, as businesses seek to cut costs and focus on high-profit core competencies (Stansbury & Summers, 2020; Weil, 2014).

The proper enforcement of labour standards and implementation of regulations against certain emerging business practices will likely improve labour's bargaining power and push up median wages in Canada, if these problems are widespread. However, the extent to which these problems are present in Canada has not been closely studied. Future research should identify the extent to which these business practices and abuses are occurring in Canada, and determine how best to reduce them.

Globalization, Firm Size and Executive Compensation

These transformations have taken place alongside globalization and rapid technological change. As Autor *et al*. (2020) and Schwellnus *et al.* (2017) have documented, globalization has allowed successful firms to become dominant at a previously impossible scale and become so-called "superstar firms". This dominance can translate into monopsony power, meaning that large firms responsible for employing large shares of employees in a particular market have disproportionate power in that market. The scale of these firms can also translate into monopoly power in the product market, meaning they can raise consumer prices and obtain higher profits for capital in the form of monopoly rents, and thus reduce the labour share in that industry (Autor, Katz, & Kearney, 2006). Bivens, Mishel and Schmitt (2018) review the relevant literature on these issues and find that market power tends to reduce average wages, as this theory predicts. Superstar effects can also occur on an individual level, meaning that those in charge of large companies can demand higher compensation because they exert a greater influence over the performance of the company overall (Rosen, 1981; Giaricano & Rossi-Hansberg, 2006).

Autor *et al.* (2006) and Goldin and Katz (2007) propose variations of the "skills-biased technological change" theory. This theory holds that technological changes and automation have led to higher demand for highly skilled labour and lower demand for workers in the middle and bottom of the earnings distribution, thus increasing inequality. The increasing globalization of production in general and manufacturing in particular has also been proposed as a contributor to rising within-country inequality (Katz & Murphy, 1992). Helpman (2016) summarizes the relevant literature on this hypothesis and finds that globalization and trade have had a "significant, yet modest" (p. 34) impact on wage inequality.

Merchandise imports have grown as a share of total GDP in Canada from 17.9 per cent in 1976 to 26.5 per cent in 2019. They grew most rapidly from 1989 to 2000, when their share increased from 20.7 per cent to 32.8 per cent. The share then decreased 2.5 per cent per year to its 2008 level of 26.8. These trends indicate that faster trade integration may correspond with lower bargaining power for workers.

More research is needed to understand whether or not monopsony effects play any role in Canada, and the extent to which superstar effects apply to Canadian companies. A preliminary look at import penetration indicates that globalization may play an important role in determining the productivity-wage relationship, but a closer look at the many variables which relate to globalization is necessary to guide an informed policy agenda.

Top Income Shares

These globalization and technological trends have been proposed as explanations for the contentious issue of executive compensation. Bebchuk *et al*. (2002) and Bivens and Mishel (2013) argue that corporate structures create inefficiencies which are exploited by CEOs to secure compensation levels above optimal levels. However, Kaplan and Rauh (2013) and Lemieux and Riddell (2015) note that top incomes have grown across professions, indicating broader trends at play. Both of these latter studies draw attention to the increasing representation of finance industry actors among top earners, indicating that finance's increased role in the economy may also be helping drive up the top incomes. Macdonald (2021) provides a critical overview of CEO compensation in Canada, while Geloso (2020) provides a more favourable interpretation.

Veall (2012) finds some support for the theory that globalization and worker mobility have allowed top talent to find higher compensation by using data regarding top income tax filers in Quebec. Top Quebecois earners who file income taxes in English have increased their income shares more than those who file in French, indicating that links with the broader English-speaking corporate world may increase the level of top earner compensation. Piketty and Saez (2006) also note the largest increases specifically occur in English-speaking countries, although they leave open the question of why this has occurred.[15] Veall also notes that large differences in top income share growth across countries indicate that technological explanations such as the skills-biased technical change hypothesis put forward by Katz and Murphy (1992) can at best provide a partial explanation of these trends.

Policies which reduce income inequality by fostering growth in the middle and bottom of the wage distribution will by definition reduce the gap between productivity growth and that of median wages. However, more research is needed to determine the extent to which top incomes are the result of market inefficiencies or a necessary part of operating in a globally integrated economy.

[15] See Atkinson and Piketty (2007) for an extensive international comparison of top income shares

Automation, Depreciation and Capital Accumulation

Other theories for understanding labour share's decline and inequality's rise have been put forward. Acemoglu and Restrepo (2018) argue that automation reduces the comparative advantage of labour, while Karabarbounis and Neiman (2014) similarly argue that the declining relative cost of investment goods has improved the attractiveness of capital investment and eroded labour's share of GDP. Piketty and Zucman (2014) argue that capital accumulation is a driving force of the declining labour share, and theorize that continued low growth and moderate savings level among the wealthy will continue to erode the labour share, although Rognlie (2015) argues this theory requires an unrealistic level of labour-capital substitution elasticity.

While depreciation costs are not likely responsive to policy action, policies which affect the speed and shape of automation may be actionable. However, these markets are complex, and automation has historically been a driver of higher productivity (Autor D. , 2015)**, so policy interventions must be approached with caution. To address the accumulation theory, Piketty and Zucman** (2014) **argue that wealth taxation will be crucial.**

Unemployment

A final key component of bargaining power which has not yet been mentioned is the unemployment rate. The unemployment rate reflects a worker's capacity to turn down unfavourable offers and find alternatives. The average unemployment rates were 9.6 per cent and 9.2 per cent for the 1981-1989 and 1989-2000 periods respectively, whereas they were 6.9 and 7.0 for the 2000-2008 and 2008-2019 periods. Stansbury and Summers (2018) and Dufour and Russell (2015) use a regression approach to show clear correlations between the unemployment rate and the productivity-pay gap. Unemployment is a central determinant of worker bargaining power. These findings indicate that an employment-oriented growth strategy may be most effective at ensuring the transmission of productivity gains to workers. This is especially relevant in the area of monetary policy. In periods of tighter monetary policy such as the early 1980s in the United States and the early 1990s in Canada, we observe much higher unemployment rates, which puts workers in a worse bargaining position. Mishel and Bivens (2021) argue that macroeconomic policy has been too focused on avoiding inflation risks, and has pushed unemployment rates too high and harmed workers.

The low interest rates and relatively low rates of unemployment which have persisted throughout most of the 2000s may have significantly improved workers' capacity to harness the benefits of productivity gains. More research which looks more comprehensively at the labour market is needed to reveal the extent to which monetary policy and jobs growth affects median wages, but it appears based on current evidence that enhancing job-creation and ensuring unemployment remains low may be the most straightforward way of ensuring workers benefit from productivity in the years to come.

Final Note

As Stansbury and Summers (2018), Williams (2021) point out, the link between productivity and wages remains significant, despite the transmission issues outlined in this report and elsewhere. When devising solutions, it therefore remains important to find policies which increase productivity while also supporting the transmission of productivity gains to the workforce.

VI. Conclusion

Despite the continued growth of productivity in Canada, median workers have not enjoyed the full benefit of those gains. Worsening labour terms of trade and a declining labour share have been partly to blame, but rising mean-median inequality is the most important factor. Recent decades have shown promise, as the median worker has benefitted more in the last two business cycles than those before 2000. However, the gap persists, and policy responses can still improve workers' situations.

Globalization, automation, tight monetary policy and a significant recession may have all contributed to making the 1990s the period in which we observe the largest productivity-wage gap. However, more research is needed in order to understand how these factors contribute to the growth or suppression of median wages, and how they should be managed to benefit workers going forward.

Appendix 1: Comparison of Results from CSLS (2021) with Uguccioni *et al.* (2016)

Two key differences in methodology create differences in the final results in this report vis à vis previous Uguccioni *et al.* (2016) and Sharpe *et al.* (2008). Firstly, self-employment income is treated slightly differently in this study, and secondly, we use a different hours series for calculating the median hourly wage.

The self-employed are excluded from the median and average hourly wage series used in our main analysis, whereas they were included in the hourly earnings series used in 2016. The series is otherwise the same. We replace median earnings with median wage for two reasons. Firstly, because the measurement issues associated with the imputation of labour income among the self-employed risk biasing our main results in unforeseen ways, and secondly because the self-employed often have very different characteristics than the median paid worker, such as longer average hours worked.

Table 7 shows that earnings grow slightly slower than wages do for all periods except 1981-1989. This tells us that the incomes of the self-employed grew more slowly on an annual basis than the incomes of salaried and wage workers. Inequality, as measured by the gap between median and average measures, is slightly lower for wages than for earnings for all periods except 1989, implying that inequality among the self-employed grew faster than among the salaried and wage workers. The component of our decomposition previously labelled as "Employer social contributions" is now labelled "SLI/Self-Employment" to reflect the inclusion of these two effects in that component.

Another implication of exchanging wages for earnings is that we can extend our SLID series beyond 2011 without access to microdata files. Statistics Canada publishes median hourly wage statistics from the LFS starting in 1997, whereas the "earnings" variable has not been collected since the end of SLID. Uguccioni *et al.* (2016) construct a median earnings series from microdata to resolve this problem, whereas we can simply apply the growth rates in median hourly wages to our series.

Table 7: Real Earnings vs Real Wage Growth, SLID

	Average earnings	Average wages	Median earnings	Median wages	Earnings inequality	Wages inequality
1976-1981	-1.31	-0.89	-0.90	-0.57	-0.41	-0.32
1981-1989	0.32	0.32	0.16	0.16	0.15	0.16
1989-2000	0.56	0.71	-0.36	-0.06	0.92	0.77
2000-2011	0.49	0.55	0.15	0.29	0.33	0.26
1976-2011	0.21	0.34	-0.16	0.03	0.37	0.31

The second methodological change pertains to the measures of hours worked. Previous editions of this decomposition divided annual median earnings by average hours worked to create an hourly median earnings measure. However, the median hours worked per worker likely corresponds better with the median per worker earnings than an overall average. Average hours worked have declined steadily since 1976, but median hours worked remained constant for all years up to 2011, when we switch to the LFS median wage series (Stansbury, Summers and Greenspon, forthcoming).[16]

The consequence of these changes is our new median per hour wage measure grows faster than the old measure. This is because the old measure's denominator was decreasing with time, whereas the new denominator remains constant.

The results of these methodological changes lead to changes in the inequality and the SLI/Self-employment components. Inequality rises faster in the new series for the 1976-1981 and 2000-2008 periods, but rises more slowly for 2008-2014. The SLI/Self-employment component (formerly "employer social contributions") grows more slowly or at the same pace in the first three periods and then rises more quickly in the last two periods. Labour's terms of trade and the labour share measures are essentially unchanged, and the inequality adjustments have a much greater impact on the overall productivity-wage gap than the SLI adjustments. As a result, the overall gap is larger in 1976-1981 and 2000-2008 periods, smaller in the 1989-2000 and 2008-2014 periods, and unchanged in 1981-1989.

Table 8: Comparison of Results of this Report to Uguccioni *et al*. (2016), 1976-2014

	This report	Uguccioni *et al.* 2016	Difference
Inequality	0.56	0.53	0.03
Labour's share of income	0.31	0.31	0.00
Labour's terms of trade	0.20	0.20	0.00
SLI/Self-Employment	0.04	0.00	0.04
Total gap	1.11	1.03	0.08

[16] The implication of this trend is that more people are working part time and fewer hours, but at the same time more people are working longer hours. The number of people working more has been close to the number working less, but the degree to which those who work less have decreased their hours is stronger than the degree to which those who work more have increased their hours.

Table 9: Comparison of Results of this Report to Uguccioni *et al.* (2016), Sub-periods

Factors contributions to productivity-wage gap, calculated in this report (percentage points per year)					
	1976-1981	**1981-1989**	**1989-2000**	**2000-2008**	**2008-2014**
Inequality	0.27	0.15	0.88	0.83	0.39
Labour's share of income	0.76	0.19	0.46	0.23	-0.08
Labour's terms of trade	0.90	0.46	0.26	-0.53	0.14
SLI/Self-employment	-0.39	-0.03	0.00	0.09	0.52
Productivity-wage gap	1.53	0.78	1.60	0.62	0.98
Component contributions to productivity-wage gap, calculated in Uguccioni et al (percentage points per year)					
	1976-1981	**1981-1989**	**1989-2000**	**2000-2008**	**2008-2014**
Inequality	-0.41	0.15	0.92	0.20	1.52
Labour Share	0.76	0.19	0.48	0.29	-0.20
Labour's Terms of Trade	0.92	0.48	0.24	-0.55	0.18
SLI	0.03	-0.03	0.14	0.01	-0.24
Productivity-wage gap	**1.21**	**0.78**	**1.79**	**-0.05**	**1.26**
Differences between component contributions (this report minus Uguccioni numbers, percentage points per year)					
	1976-1981	**1981-1989**	**1989-2000**	**2000-2008**	**2008-2014**
Inequality	0.68	0.00	-0.04	0.63	-1.13
Labour Share	0.00	0.00	-0.02	-0.06	0.12
Labour's Terms of Trade	-0.02	-0.02	0.02	0.02	-0.04
SLI/Self-employment	-0.42	0.00	-0.14	0.08	0.76
Productivity-wage gap	0.32	0.00	-0.19	0.67	-0.28

Appendix 2: Comparison of Results from CSLS (2021) with Williams (2021)

Williams (2021) uses a similar methodology to study these issues and comes to slightly different conclusions. Williams' main conclusion is that average compensation has kept up with net productivity. Net productivity is defined as net domestic product at basic prices divided by hours worked, meaning it removes taxes and depreciation from GDP. Several data differences lead our two studies to come up with different results. See Table 14 for a detailed description and comparison of sources.

Williams uses average compensation as the measure for his main analyses rather than median wage, because his central aim is to investigate the transmission of productivity gains by firms to workers in general. Our study aims to understand the overall transmission of productivity to the median worker while taking note of trends in SLI and self-employment which might affect the perception of the transmission.

Williams also studies a longer time range, 1961-2019, and uses historical data obtained by special request from Statistics Canada to study the pre-1997 periods. Consequently, results for those periods differ slightly between our studies, as laid out in Tables 10 and 11 below.

Table 10: Comparison of Results of this Report to Williams (2021), 1976-2019

	CSLS 2021	Williams (2021)	Differences
Gross Productivity	1.08	1.18	-0.10
Net productivity	1.02	0.98	0.03
Avg comp (GDP)	0.85	0.90	-0.05
Avg comp (consumer)	0.61	0.92	-0.31
Labour share change	-0.24	-0.28	0.04

Williams' "hours worked" series for 1961-1997 is obtained by special request from Statistics Canada and grows more slowly than ours. This means both of his productivity series (net and gross) grow more quickly than ours do for the pre-1997 periods. It is also one reason his pre-1997 per hour compensation series grows more slowly, the other reason being that he uses a total compensation series from a special request that grows more quickly than ours does.

Williams uses the same tables for total and average labour compensation as we do for the 1997-2019 periods so those results are mostly the same. However, the data in these tables for 2016-2019 were revised after Williams accessed them such that his average compensation series grow more slowly than ours in the last years of the 2008-2019 period. This is not enough to offset the faster growth in the pre-1997 series, which

is why our long-term compensation growth remains smaller. Deflators used throughout are identical.

Returning to productivity, Williams uses CPA tables for calculating GDP and gross productivity, while we use SNA tables for those calculations. Output grows faster in the CPA than in the SNA for all periods, so Williams' gross productivity series grows more quickly than ours in all periods, even when we use the same "hours worked" series for the post-1997 period.

Interestingly, Williams doesn't use CPA tables to calculate NDP, but rather uses SNA tables, consistent with our approach. The only differences in our net productivity series are those which occur in the pre-1997 series and can be attributed to the use of different "hours worked" series.

In short, we have very similar results for the post-1997 period, but before then Williams uses different sources which make our results differ.

Table 11: Comparison of Results of this Report to Williams (2021), 1976-2019

	This report	Williams (2021)	Difference
Gross Productivity	1.08	1.18	-0.10
Net productivity	1.02	0.98	0.03
Avg comp (GDP)	0.85	0.90	-0.05
Avg comp (consumer)	0.61	0.92	-0.31
Labour share change	-0.24	-0.28	0.04

Table 12: Difference in Growth Rates for Sub-periods (percentage points, Williams rates minus our rates)

	1981-1989	1989-2000	2000-2008	2008-2019		Legend:
Gross Productivity	**0.15**	**0.02**	0.01	0.07		Orange= CPA output series used by Williams instead of SNA output
Net productivity	**0.07**	**0.07**	-0.01	0.00		**Bold= Different hours series (pre-97)**
Avg comp (GDP)	**0.08**	**0.15**	0.00	-0.06		Green= Revised 2016-2019 data for compensation and hours from CPA
Avg comp (CPI)	**0.09**	**0.15**	-0.01	-0.06		Purple= Different compensation series (pre-97)
Labour share	-0.06	0.13	-0.02	-0.12		

Table 13: Growth Rates for Periods with Differing Sources

	Period	CSLS 2021	Williams 2021
Nominal output	1961-1981	11.46	11.40
Real output	1961-2019	3.11	3.21
Total nominal labour compensation	1961-1997	8.70	8.81
Net domestic product (nominal)	1961-1981	11.56	11.32
Hours worked	1961-1997	1.79	1.71
Productivity	1961-2019	1.52	1.65
Net productivity	1961-2019	1.51	1.47

Table 14: Differences in Sourcing and Growth Rates, Williams (2021) vs CSLS 2021 report

	Williams	CSLS 2021	Comparison	Growth rates
Nominal Output	For 1981-2019 is from SNA Table 36-10-0221-01 (formerly CANSIM 384-0037) and backcast using annualized growth rates from quarterly SNA series in table: 36-10-0103-01 (formerly CANSIM 380-0063)	For 1981-2019, data is from SNA, Table 36-10-0221-01 (formerly 384-0037). Series is backcast for 1961-1981 data using data from SNA, Table 36-10-0254-01 (formerly 380-0016). Series overlap from 1981-2011, the CAGR of Table 36-10-0221-01 in that time is 5.38 and the CAGR of Table 36-10-0254-01 is 5.35	Same series used for 1981-2019, different series are used prior	Williams CAGR 1961-1981: 11.40 CSLS 2021 CAGR 1961-1981: 11.46
Real output	For 1997-2019, chained 2012 dollar amounts CPA Table: 36-10-0480-01 (formerly CANSIM 383-0033). Series is then backcast to 1961 using a real GDP index from special request to Statistics Canada	For 1981-2019, data is from SNA, Table 36-10-0222-01 (formerly 384-0038). Series is backcast for 1961-1981 data using data from SNA, Table 36-10-02550-01 (formerly 380-0017). Series overlap from 1981-2011, the CAGR of Table 36-10-0222-01 in that time is 2.44 and Table 36-10-02550-01 series CAGR is 2.50	We use SNA and Williams uses CPA for real output	Williams CAGR 1961-1997: 3.71 ("PA_historical" tab) CSLS 2021 CAGR 1961-1997: 3.57 Williams CAGR 1997-2019: 2.40 ("PA_annual" tab) CSLS 2021 CAGR 1997-2019: 2.36 Williams CAGR 1961-2019: 3.21 ("PA_historical" tab) CSLS 2021 CAGR 1961-2019: 3.11
Total nominal labour compensation	For 1997-2019, data is from CPA Table 36-10-0480-01 (formerly CANSIM 383-0033). Series is backcast to 1961 using labour compensation series from special request to Statistics Canada	For 1997-2019, data is from CPA, Table 36-10-0480-01 (formerly 383-0033). Series is backcast to 1961 using data from CPA, Table 36-10-0303-01 (formerly 383-0003). Series overlap from 1997-2001, the CAGR of Table 36-10-0480 in that time is 5.61 and the CAGR of Table 36-10-0303-01 is 5.76	We use the same CPA series for 1997-2019, different series are used prior	Williams CAGR 1961-1997: 8.81 CSLS 2021 CAGR 1961-1997: 8.70
Net domestic product (nominal)	Series is constructed by removing capital consumption and output taxes from GDP. For	Series is constructed by removing capital consumption and output taxes from GDP. For 1981-2019 data is from	Same series for 1981-2019,	Williams CAGR 1961-1981: 11.32 CSLS 2021 CAGR 1961-1981: 11.56

	1981-2019 is from SNA Table 36-10-0221-01 (formerly CANSIM 384-0037) and backcast using annualized growth rates from quarterly SNA series in table: 36-10-0103-01 (formerly CANSIM 380-0063)	SNA Table 36-10-0221-01 (formerly CANSIM 384-0037). Series is backcast for 1961-1981 using Table: 36-10-0254-01 (formerly CANSIM 380-0016)	different series are used prior	
Hours worked	For 1997-2019 is from CPA Table: 36-10-0480-01 (formerly CANSIM 383-0033) and backcast to 1961 using growth rates from a specially requested series from Statistics Canada	For 1997-2019 data is from CPA, Table 36-10-0480-01 (formerly 383-0033). Series is backcast to 1961 using growth rates from CPA, Table 36-10-0303-01 (formerly 383-0003). Series overlap from 1997-2001, the CAGR of Table 36-10-0480 in that time is 1.68 and the Table 36-10-0303-01 series CAGR is 1.95	Same series for 1997-2019, different series are used prior	Williams CAGR 1961-1997: 1.71 CSLS 2021 CAGR 1961-1997: 1.79
Productivity	"Gross" productivity is chained dollar output (CPA) divided by hours worked (CPA, including specially requested series)	"Gross" productivity is chained dollar output (SNA) divided by hours worked (CPA).	Differences due to hours and output differences	Williams CAGR 1961-1997: 1.97 CSLS 2021 CAGR 1961-1997: 1.75 Williams CAGR 1997-2019: 1.18 CSLS 2021 CAGR 1997-2019: 1.13 Williams CAGR 1961-2019: 1.65 CSLS 2021 CAGR, 1961-2019: 1.52
Net productivity	Net productivity is nominal NDP (using CPA output) deflated using the GDP deflator divided by hours worked (CPA, including specially requested series)	Net productivity is nominal NDP (using SNA output and CPA hours) deflated using the GDP deflator divided by hours worked (CPA)	Differences due to hours and output differences	Williams CAGR 1961-1981: 2.24 CSLS 2021 CAGR 1961-1981: 2.39 Williams CAGR 1981-2019: 1.09 CSLS 2021 CAGR 1981-2019: 1.05 Williams CAGR 1961-2019: 1.47 CSLS 2021 CAGR 1961-2019: 1.51

Average compensation in his study grows at 0.09 percentage points per year faster from 1981-1989 than in our report, and 0.15 points per year faster in 1989-2000. Labour productivity ("gross" or not net of depreciation and taxes) is also higher by 0.15 points per year for 1981-1989 and 0.02 points per year for 1989-2000. Net productivity grows 0.07 percentage points faster in Williams' data than in ours for each of the pre-2000 periods.

Gross and net labour productivity and compensation grow at effectively identical rates for 2000-2008, but the results for 2008-2016 differ slightly. Gross productivity grows 0.07 points faster while compensation grows 0.06 points slower, while net productivity grows equally fast in both data sets. The reason for these post-2008 differences is that hours and compensation data from Table 36-10-0480-01 were updated for the years 2016-2019 after being accessed by Williams in 2020. Hours worked were revised upwards in 2016, 2017, and 2018, and revised slightly downwards in 2019. Total compensation was revised downwards for all four years. Consequently, our labour share growth rate for the post-recession period is lower, as are our average compensation growth rates.

While we don't calculate net labour share or net productivity growth for our central analyses, we have the data to do so. We find that net productivity from 1976-2019 grew 1.02 per cent per year, while average real hourly compensation deflated with CPI grew 0.61 per cent per year. Williams finds that for 1961-2019 net productivity grows 1.47 per cent while CPI-deflated average real hourly compensation grows at 1.59 per cent. This difference mostly reflects the difference in time scales, since the pre-1976 period saw much higher growth in both wages and productivity.

Appendix 3: Comparison of Results from CSLS (2021) with Mishel and Bivens (2021)

Mishel and Bivens (2021) analyze wages and productivity in the United States with a methodology similar to this report. Although different dates are used to break up time periods, we can report on analogous periods, as indicated in Table 6. Other methodological and data collection differences mean that these results should be interpreted with a significant degree of wariness.

Productivity growth and all measures of compensation and wages have grown more slowly in Canada than in the United States over the long term. The gap between productivity and wages has grown only slightly more slowly in Canada based on these figures. Mean-median inequality accounts for 65 per cent of the gap measured in the United States from the late 1970s to 2019, whereas in Canada it accounts for 50 per cent. Labour's terms of trade account for 32 per cent of the gap in the United States but only 25 per cent of the gap in Canada. Meanwhile, the decline in labour share only accounts for 2 per cent of the gap in the United States compared to 25 per cent in Canada. Measurement differences between compensation measures and wage measures

make a small but positive contribution to the gap in the United States, whereas it makes a small but negative contribution to it in Canada.

Table 15: Growth Rate of Key Variables, United States

	1979–1995	1995–2000	2000–2007	2007–2019	1979–2019
Productivity	1.06	1.38	2.32	2.19	1.49
Average compensation- GDP Deflator	0.88	1.21	2.93	1.48	1.05
Average compensation- CPI	0.68	0.82	2.26	1.24	0.86
Median hourly wages	-0.47	-0.04	1.41	0.46	0.41
Productivity-wage gap	1.33	1.22	1.57	0.75	1.03

Table 16: Comparison of Results of this Report to Mishel and Bivens (2021), 1976-2019

	This report	Mishel and Bivens (2021)	Difference
Gross productivity	1.08	1.35	-0.27
Net productivity	1.02	1.18	-0.16
Average compensation (GDP)	0.85	1.17	-0.32
Average compensation (CPI)	0.61	0.89	-0.28
Labour share change	-0.24	0.01	-0.25
Median real hourly wages	0.15	0.31	-0.16
Productivity-wage gap	0.93	1.03	-0.10

Table 17: Difference in Rates, Canada and United States

	"The Eighties"	"The Nineties"	"Early 2000s"	"Post-recession"	"Main analysis"
Mishel & Bivens start and end dates	*1979-1995*	*1995-2000*	*2000-2007*	*2007-2019*	*1979-2019*
Current report start and end dates	*1981-1989*	*1989-2000*	*2000-2008*	*2008-2019*	*1976-2019*
Difference in annual growth rates, key variables, (percentage points, Canada less United States)					
Productivity	-0.44	-0.78	-1.29	-0.16	-0.26
Average compensation-GDP Deflator	-0.46	-1.85	-0.81	0.32	-0.32
Average compensation-CPI	-0.54	-1.44	-0.04	0.17	-0.28
Median hourly wages	0.20	-1.47	-0.18	0.22	-0.16
Productivity-wage gap	-0.55	0.38	-0.95	-0.42	-0.09
Difference in explanatory factors' contribution (percentage points, Canada less United States)					
Inequality	-0.63	-0.28	0.2	-0.16	-0.1
Labour share	0.21	1.26	-0.23	-0.32	0.23
Labour's terms of trade	0.07	-0.41	-0.77	0.15	-0.04

Bibliography

Acemoglu, D. a. (2018, May). Modeling Automation. *AEA Papers and Proceedings, 108*, 2018.

Ahmad, N., & Schreyer, P. (2016). Are GDP and Productivity Measures Up to the Challenges of the Digital Economy? *International Productivity Monitor, 30*, 4-27.

Alberta. (2021). *Oil Prices*. Retrieved 06 15, 2021, from Alberta Economic Dashboard: https://economicdashboard.alberta.ca/oilprice

Atkinson, A., & Piketty, T. (Eds.). (2007). *Top Incomes Over the Twentieth Century: A Contrast Between Continental European and English-Speaking Countries.* Oxford: Oxford University Press.

Autor, D. (2015). Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, *29*(3), 3-30.

Autor, D. H., Katz, L. F., & Kearney, M. F. (2006). The Polarization of the US Labour Market. *American Economic Review, 96*(2), 198-194. doi:10.1257/000282806777212620

Autor, D., Dorn, D., Katz, L. F., Patterson, C., & Van Reenen, J. (2020, May). The Fall of the Labor Share and the Rise of Superstar Firms. *The Quarterly Journal of Economics, 135*(2), 645-709. Retrieved from https://doi.org/10.1093/qje/qjaa004

Baily, M. N., & Gordon, R. J. (1988). The Productivity Slowdown, Measurement Issues, and the Explosion of Computer Power. *Brookings Papers on Economic Activity, 2*, 347-431.

Baldwin, J. R., Gu, W., & Yan, B. (2007). *User Guide for Statistics Canada's Annual Multifactor Productivity Program.* Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/15-206-x/15-206-x2007014-eng.pdf?st=6vqR5tZY

Baldwin, J., Gu, W., & Yan, B. (2007). *User Guide for Statistics Canada's annual Multifactor Productivity Program.* Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/15-206-x/15-206-x2007014-eng.pdf?st=6vqR5tZY

Bank of Canada. (2021). *Commodity Price Index*. Retrieved 06 15, 2021, from Bank of Canada Price Indexes: https://www.bankofcanada.ca/rates/price-indexes/bcpi/

Beach, C. M. (2017). What Happened to Middle-Class Earnings in Canada. In D. A. Green, W. C. Riddell, & F. St-Hilaire (Eds.), *Income Inequality: The Canadian Story* (pp. 83-102).

Bebchuk, L. A., Fried, J. M., & Walker, D. I. (2002). Managerial power and rent extraction in the design of executive compensation. *The University of Chicago Law Review, 69*, 751-846.

Belmonte, L. (2020, September 17). *Canada's Billionaires Have Actually Gotten Richer Throughout the Pandemic*. Retrieved from Narcity: https://www.narcity.com/richest-canadians-actually-saw-their-wealth-increase-throughout-the-pandemic

Bivens, J., & Mishel, L. (2013). The pay of corporate executives and financial professionals as evidence of rents in top 1 percent incomes. *Journal of Economic Perspectives, 27*(3), 57-78. doi:DOI: 10.1257/jep.27.3.57

Bivens, J., Mishel, L., & Schmitt, J. (2018). *It's not just monopoly and monopsony: How market power has affected American wages.* Economic Policy Institute. Retrieved from https://files.epi.org/pdf/145564.pdf

Bowlus, A., Gouin-Bonenfant, É., Liu, H., Lochner, L., & Park, Y. (2021, April). *Four Decades of Canadian Earnings Inequality and Dynamics Across Workers and Firms.* Bank of Canada Working Paper.

Card, D., Lemieux, T., & Riddell, W. C. (2004). Unions and Wage Inequality. *Journal of Labour Research, 25*(4), 519-562. doi:10.1007/s12122-004-1011-z

Dufour, M., & Russell, E. (2015). Why isn't Productivity More Popular? A Bargaining Power Approach to the Pay/Productivity Linkage in Canada. *International Productivity Monitor, 28*(Spring), 47-62.

Eavis, P. (2021, June 11). *Meager rewards for workers, exceptionally rich pay for CEOs*. Retrieved from The New York Times: https://www.nytimes.com/2021/06/11/business/ceo-pay-compensation-stock.html?smid=em-share

Eisfeldt, A., Falato, A., & Xioalan, M. (2021). *Human Capitalists.* Cambridge, MA: National Bureau of Economic Research. doi:DOI 10.3386/w28815

Elsby, M. W., Hobijn, B., & Şahi, A. (2013). The Decline of the US Labor Share. In D. H. Romer, & J. Wolfers (Eds.), *Brookings Papers on Economic Activity: Fall 2013* (pp. 1-63). Brookings Institution Press. Retrieved from https://www.brookings.edu/wp-content/uploads/2016/07/2013b_elsby_labor_share.pdf

Feldstein, M. S. (2008). *Did wages reflect growth in productivity.* National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w13953

Fortin, N. M., & Lemieux, T. (2015, May). Changes in wage inequality in Canada: An interprovincial perspective. *The Canadian Journal of Economics, 48*(2), 682-713.

Geloso, V. (2020). *The Truth About CEO and Worker Compensation.* Fraser Institute.

Giaricano, L., & Rossi-Hansberg, E. (2006). Organization and inequality in a knowledge economy. *Quarterly Journal of Economics, 121,* 1383-1435.

Goldin, C., & Katz, L. (2007). *The Race Between Education and Technology: The Evolution of US Educational Wage Differentials,1890 to 2005.* National Bureau for Economic Research. Retrieved from https://www.nber.org/papers/w12984

Green, D. A., & Sand, B. M. (2015, May). Has the Canadian Labour Market Polarized? *The Canadian Journal of Economics, 48*(2), 612-646.

Gutiérrez, G., & Piton, S. (2020). Revisiting the Global Decline of the (Non-Housing) Labor Share. *American Economic Review: Insights, 2*(3), 321-338. doi:10.1257/aeri.20190285

Harrison, P. (2009). *Median Wages and Productivity Growth in Canada and the United States.* Centre for the Study of Living Standards.

Healing, D. (2020, June 17). *Canada's wealthiest one per cent hold 25.6% of riches, new PBO report says*. Retrieved from Toronto Star: https://www.thestar.com/business/2020/06/17/canadas-wealthiest-one-per-cent-hold-256-of-riches-new-pbo-report-says.html

Helpmann, E. (2016). *Globalization and Wage Inequality*. National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w22944

ILO. (2013). *Global Wage Report 2012/2013.* Geneva: International Labour Office. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_194843.pdf

Irwin, N. (2021, May 5). *Can the Biden Agenda Fix Middle America's Deepest Problem?* Retrieved from The New York TImes: https://www.nytimes.com/2021/05/05/upshot/biden-agenda-middle-america.html

Jeon, S.-H., Liu, H., & Ostrovsky, Y. (2019, December). Measuring the Gig Economy in Canada Using Administrative Data. *Analytical Studies Branch Research Paper Series, Catalogue no. 11F0019M, no. 437*.

Johnson, S. (2002). Canadian Union Density 1980 to 1998 and Prospects for the Future: An Empirical Investigation. *Canadian Public Policy*, 333-349.

Kaldor, N. (1957). A Model of Economic Growth. *Economic Journal, 67*(268), 591-624.

Kaplan, S. N., & Rauh, J. (2013). It's the market: The broad-based rise in the return to top talent. *Journal of Economic Perspectives, 27*(3), 35-56. doi:DOI: 10.1257/jep.27.3.35

Karabarbounis, L., & Neiman, B. (2014). The Global Decline in the Labour Share. *Quarterly Journal of Economics, 129*(1), 61-104.

Katz, L. F., & Murphy, K. M. (1992). Changes in Relative Wages, 1963–1987: Supply and Demand Factors. *Quarterly Journal of Economics, 107*, 35-78.

Lemieux, T., & Riddell, W. C. (2015). Who Are Canada's Top 1 Percent? In D. A. Green, W. C. Riddell, & F. St-Hilaire (Eds.), *Income Inequality: The Canadian Story* (pp. 103-157). Institute for Research on Public Policy. Retrieved from https://irpp.org/wp-content/uploads/2016/01/aots5-riddell-lemieux.pdf

Macdonald, D. (2021). *The golden cushion: CEO compensation in Canada.* Canadian Centre for Policy Alternatives. Retrieved from https://www.policyalternatives.ca/sites/default/files/uploads/publications/National%20Office/2021/01/Golden%20cushion.pdf

Manyika, J., Mischke, J., Bughin, J., Woetzel, J., Krishnan, M., & Cudre, S. (2019). *A New Look at the Declining Labor Share of Income in the United States.* McKinsey Global Institute. Retrieved from https://www.mckinsey.com/featured-insights/employment-and-growth/a-new-look-at-the-declining-labor-share-of-income-in-the-united-states#

Mishel, L., & Bivens, J. (2015). *Understanding the Historic Divergence Between Productivity and a Typical Worker's Pay: Why It Matters and Why It's Real.* Economic Policy Institute. Retrieved from https://files.epi.org/2015/understanding-productivity-pay-divergence-final.pdf

Mishel, L., & Bivens, J. (2021). *Identifying the Policy Levers Generating Wage Suppression and Wage Inequality.* Washington, D.C.: Economic Policy Institute.

Mishel, L., & Gee, K.-F. (2012). Why Aren't Workers Benefiting from Labour Productivity Growth in the United States? *International Productivity Monitor, 23*(Spring), 31-43.

Morissette, R., Schellenberg, G., & Johnson, A. (2005, April). Diverging Trends in Unionization. *Statistics Canada Perspectives, Catalogue no. 75-001-XIE*.

Mućk, J., McAdam, P., & Growiec, J. (2018). Will the True Labor Share Stand Up? An Applied Survey on Labor Share Measures. *Journal of Economic Surveys, 32*(4), 961-984. Retrieved from https://doi.org/10.1111/joes.12252

OECD. (2015). *The Future of Productivity.* Paris: OECD Publishing. doi:https://doi.org/10.1787/9789264248533-en.

OECD. (2018). Decoupling of Wages from Productivity: What Implications for Public Policies? *OECD Economic Outlook, 2018*(2), 51-65. Retrieved from https://www.oecd.org/economy/outlook/Decoupling-of-wages-from-productivity-november-2018-OECD-economic-outlook-chapter.pdf

Pessoa, J. P., & Van Reenen, J. (2013). *Decoupling of Wage Growth and Productivity Growth? Myth and Reality.* Centre for Economic Performance. Retrieved from https://cep.lse.ac.uk/pubs/download/dp1246.pdf

Piketty, T., & Saez, E. (2006). The evolution of top incomes: A historical and international perspective. *American Economic Review, 96*, 200-205.

Piketty, T., & Zucman, G. (2014, August). Capital is Back: Wealth-Income Ratios in Rich Countries 1700-2010. *The Quarterly Journal of Economics, 129*(3), 1255-1310.

Riddell, C. (1993). Unionization in Canada and the United States: A Tale of Two Countries. In D. Card, & R. B. Freeman, *Small Differences That Matter: Labor Markets and Income Maintenance in Canada and the United States* (pp. 109-148). University of Chicago Press. Retrieved from http://www.nber.org/chapters/c11147

Rognlie, M. (2015). Deciphering the fall and rise in the net capital share: Accumulation or scarcity. In D. H. Romer, & J. Wolfers (Eds.), *Brookings Papers on Economic Activity, Spring 2015* (pp. 1-69).

Rosen, S. (1981). The economics of superstars. *American Economic Review, 71*, 845-858.

Ross, C., & Murray, A. (2010). Aggregate Measures of Income and Output in Canada and the United States: Implications for Productivity and Living Standards. *International Productivity Monitor, 19*(Spring), 20-39.

Russell, A. (2016, January 13). *4 in 10 Canadians believe they are 'worse off' than their parents: Ipsos poll*. Retrieved from Global News: https://globalnews.ca/news/2451943/4-in-10-canadians-believe-they-are-worse-off-than-their-parents-ipsos-poll/

Saez, E., & Veall, M. R. (2005). The Evolution of High Incomes in Northern America: Lessons from Canadian Evidence. *American Economic Review, 95*(3), 831-849.

Schwellnus, C., Kappeler, A., & Pionnier, P.-A. (2017). The Decoupling of Median Wages from Productivity in OECD Countries. *International Productivity Monitor, 32*(Spring), 44-60.

Schwellnus, C., Pak, M., Pionnier, P.-A., & Crivellaro, E. (2018). *Labour Share Developments Over the Last Two Decades: The Role of Technological Progress, Globalisation and "Winner-Takes-Most" Dynamics.* OECD. Retrieved from https://dx.doi.org/10.1787/3eb9f9ed-en

Sharpe, A. (2002). Productivity Concepts, Trends And Prospects: An Overview. In K. Banting, F. St.-Hilaire, & A. Sharpe (Eds.), *The Review of Economic Performance and Social Progress* (Vol. 2, pp. 31-56). Centre for the Study of

Living Standards and the Institute for Research on Public Policy. Retrieved from http://www.csls.ca/repsp/2/andrewsharpe.pdf

Sharpe, A., Arsenault, J.-F., & Harrison, P. (2008a). Why Have Real Wages Lagged Labour Productivity Growth in Canada? *International Productivity Monitor, 17*(Fall), 16-27.

Sharpe, A., Arsenault, J.-F., & Harrison, P. (2008b). *The Relationship Between Labour Productivity and Real Wage Growth in Canada and OECD Countries.* Centre for the Study of Living Standards. Retrieved from http://www.csls.ca/reports/csls2008-8.pdf

Stansbury, A., & Summers, L. (2018). *Productivity and Pay: Is the Link Broken?* Washington, DC: Peterson Institute for International Economics. Retrieved from https://www.piie.com/system/files/documents/wp18-5.pdf

Stansbury, A., & Summers, L. H. (2020). *The Declining Worker Power Hypothesis: An Explanation for the Recent Evolution of the American Economy.* Cambridge, MA: National Bureau of Economic Research. doi:10.3386/w27193

Statistics Canada. (2016). *User Guide: Canadian System of Macroeconomic Accounts.* Retrieved from https://www150.statcan.gc.ca/n1/pub/13-606-g/13-606-g2016001-eng.pdf

Stigler, G. (1961). Economic Problems in Measuring Changes in Productivity. In T. C. Wealth, *Output, Input, and Productivity Measurement* (pp. 47-78). Princeton University Press. Retrieved from http://www.nber.org/chapters/c2219

Strain, M. R. (2019). The link between wages and productivity is strong. *Expanding Economic Opportunity for More Americans*. Retrieved from https://www.aspeninstitute.org/longform/expanding-economic-opportunity-for-more-americans/the-link-between-wages-and-productivity-is-strong/

Trudeau, J. (2013, 04 13). *Why It's Vital We Support the Middle Class.* Retrieved from The Globe and Mail: https://www.theglobeandmail.com/news/politics/justin-trudeau-why-its-vital-we-support-the-middle-class/article11209063/

Uguccioni, J., & Sharpe, A. (2016). *Decomposing the Productivity-Wage Nexus in Selected OECD Countries, 1986-2013.* Centre for the Study of Living Standards. Retrieved from http://www.csls.ca/reports/csls2016-16.pdf

Uguccioni, J., Sharpe, A., & Murray, A. (2016). *Labour Productivity and the Distribution of Real Earnings in Canada, 1976-2014.* Centre for the Study of Living Standard. Retrieved from http://www.csls.ca/reports/csls2016-15.pdf

Veall, M. R. (2012). Top income shares in Canada: Recent trends and policy implications. *Canadian Hournal of Economics, 45*(4), 1247-1272. Retrieved from https://doi.org/10.1111/j.1540-5982.2012.01744.x

Weil, D. (2014). *The Fissured Workplace: Why Work Became So Bad for So Many and What Can Be Done to Improve It.* Cambridge, MA: Harvard University Press.

Williams, D. M. (2021). Pay and Productivity in Canada: Growing Together Only Slower Than Ever. *International Productivity Monitor*.

Wolfson, M., Veall, M., Brooks, N., & Murphy, B. (2016). Piercing the veil: Private corporations and the income of the affluent. *Canadian Tax Journal, 64*(1), 1-30.