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Accumulation of Human Capital in Canada, 1970 to 2020: An Analysis by Gender and the Role of Immigration

by Wulong Gu

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Abstract

Human capital is an important determinant of the well-being of individuals and long-term economic and societal progress. This paper finds that human capital among women is lower than that among men. This gender gap has declined over time. From 1970 to 2020, the average human capital of women relative to that of men increased from 35% to 70%. The gender gap in human capital existed for all age groups and all education levels and narrowed over time for all because of large increases in the labour force participation, education and average earnings of women compared with those of men. The gender gap in human capital was larger for immigrant women compared with that for Canadian-born women. As a result of rapid growth in the human capital of women, the share of total human capital accounted for by women rose from 30% in 1970 to 41% in 2020; women accounted for about half of the growth in human capital over that period. Both immigrant women and immigrant men increased their contribution to human capital growth over time. After 1995, immigrants accounted for about 40% of the growth in human capital (56% for men, 44% for women). This share is much larger than immigrants' share of the working age population, which represents less than 20% of human capital.

Executive summary

Human capital is the most important component of total wealth, where total wealth is defined as the sum of produced capital (both tangible physical capital and intangible knowledge capital), natural capital and human capital. Total wealth represents the capacity to generate and increase a future income level that is sustainable. For example, an increase in total wealth per capita arising from an increase in female labour force participation, an increase in the education level of women or an increase in the earnings of women signals a high level of future income for a nation. On the other hand, a decline in total wealth per capita arising from a decline in human capital because of aging signals that the current income level may not be sustainable if that decline is not accompanied by an increase in other forms of assets, such as physical capital or knowledge capital.

This paper provides a gender analysis of human capital and examines the contribution of women to the level and growth of human capital in Canada from 1970 to 2020. While the estimates cover 1970 to 2020, the 2020 estimates will be presented separately to examine the impact of the COVID-19 pandemic on human capital. Human capital is estimated using the income-based approach of Jorgenson and Fraumeni (1989, 1992), and it is calculated as the present discounted value of future labour income of individuals over their working life.

The average human capital of women was lower than that of men. However, the gender gap in human capital declined over time as a result of the relatively faster growth of human capital among women, which arose from large increases in the labour force participation, education level and earnings of women compared with those of men. In 1970, there was a large gap in human capital between women and men, and the average human capital of women was 35% of that of men. This large gap reflects lower labour force participation, fewer hours worked and lower hourly earnings for women. By 2020, the average human capital of women reached 70% of that of men.

Gender gaps in the average human capital between men and women existed among all age groups and education levels. All the gaps have narrowed significantly—especially for prime working age women, aged 35 to 54 years old—since 1970.

The gender gap in human capital was larger for immigrant women than for Canadian-born women. In 1970, the average human capital for immigrant women was about 31% of that of immigrant men, while the average human capital of Canadian-born women was about 36% of that of Canadian-born men. Over time, the gender gap narrowed at a similar pace for both immigrant and Canadian-born women. By 2020, the average human capital of immigrant women was 66% of that of immigrant men, while the average human capital of Canadian-born women was about 71% of that of Canadian-born men.

Relatively large gender gaps among immigrants existed for almost all age groups and education levels, especially for immigrant women with a high school education or below. The gender gap narrowed at a similar pace for both immigrants and Canadian-born individuals. Before the mid-1990s, its decline was faster among the immigrant population when compared with the Canadian-born population; its decline was slower after the mid-1990s.

As a result of rapid growth in human capital among women, the share of total human capital accounted for by women rose from 30% in 1970 to 41% in 2020. The increase in that share was much faster before the mid-1990s because of large increases in women's labour force participation. From 1970 to 1995, the share of human capital of women rose from 30% to 39%. From 1995 to 2020, the share increased from 39% to 41%.

Women accounted for a disproportionately large portion of the growth in human capital over time. However, women's contribution to aggregate growth in human capital declined after the mid-1990s because of a decline in the relative growth in human capital for women during the same

period. Before 1995, women accounted for about 58% of the growth in human capital, which was larger than their share of human capital (33%) during that period. From 1995 to 2020, women accounted for 45% of the growth in human capital, while their share of human capital was 40%.

Both immigrant women and immigrant men have increased their contribution to human capital growth over time. After 1995, immigrants accounted for about 40% of the growth in human capital—56% of which may be attributed to immigrant men and 44% to immigrant women. Before 1995, immigrants accounted for about 18% of the growth in human capital.

1 Introduction

Human capital contributes to current income through its effect on economic growth. It contributes to future income through its effect on total wealth, which forms the asset base for maintaining and increasing income in the future. A good estimate of human capital is required for a better understanding of the sources of economic growth and whether income is sustainable in the future. In 2016, Statistics Canada contributed to the United Nations Economic Commission for Europe's (UNECE) guide on measuring human capital within a national accounts framework (UNECE, 2016). The preferred methodology for measuring human capital adopted by that guide was developed by Jorgenson and Fraumeni (1989, 1992) and estimates human capital as the present discounted value of future earnings of an individual.[1] That approach will be applied in this paper to examine human capital and the contribution to the level and growth of human capital by gender.

The objective of this paper is to provide a gender analysis of human capital and examine the contribution of women to the level and growth of human capital in Canada from 1970 to 2020. While the estimates cover 1970 to 2020, the 2020 estimates will be presented separately to examine the impact of the COVID-19 pandemic on human capital. The pandemic is found to have a disproportionately large impact on the employment and earnings of women and immigrants (Statistics Canada, 2022). As such, human capital—which is estimated as the present value of future labour income projected based on current labour income—will decline more for women and immigrants during the pandemic. However, the effect is expected to be transitory as the labour market recovers from the pandemic.

The gender analysis on human capital in this study complements the literature on gender gaps in annual earnings (Drolet, 2011; Pelletier et al., 2019). As gender gaps affect individuals throughout their working life, the gender difference in this paper is estimated as the difference in the present discounted value of future earnings of the individuals over their remaining working life, or the difference in human capital.

The gender analysis on human capital stock addresses the issue of the sustainability of the current income level that the flow-based analysis on current earnings does not answer. The trend of comprehensive wealth per capita of an economy is often used to tell whether current income is sustainable, when comprehensive wealth is defined as the sum of produced capital (both tangible physical capital and intangible knowledge capital), natural capital and human capital. A decline in total wealth per capita arising from a decline in human capital because of aging signals a lower income level in the future or a current income level that may not be sustainable if that decline is not accompanied by an increase in other forms of assets, such as physical capital or knowledge capital. Conversely, an increase in total wealth per capita arising from increases in female labour force participation, the education level of women or the earnings of women signals a high level of future income for a nation.

Immigrants are often considered important for the growth of human capital and sustainability. By 2036, immigrants are projected to account for over one-quarter of the Canadian population (Statistics Canada, 2017). Therefore, this paper also examines the contribution of immigrants and Canadian-born people to human capital by gender.

A recent World Bank study on the changing wealth of nations (Lange et al., 2018) used the Jorgenson and Fraumeni approach to estimate human capital and comprehensive wealth in 141 countries, including Canada, and to examine the gender gap in human capital in those countries for a more recent period, starting in 1995. It found that human capital is the most important component of total wealth in those countries. The average human capital of women is lower than that of men because of lower earnings, lower labour force participation, lower investment in

1. An alternative approach is to estimate human capital as the accumulated expenditures on the development of human capital such as education, training and health improvement.

education for women and the larger share of unpaid household work done by women, whose value is not included in the World Bank study. The study concluded that the gender gap represents a significant loss to the output and income potential.

Fraumeni and Christian (2019) provided a gender analysis on human capital for the United States from 1975 to 2012. The study differs from that of Lange et al. (2018) as it included both market and non-market components of human capital, such as the value of unpaid household work. In contrast, Lange et al. (2018) included the market component of human capital but excluded the value of non-market income in estimating human capital. The gender analysis of Fraumeni and Christian (2019) for the United States concluded that although changes in male human capital have occurred, the changes in female human capital arising from increases in labour force participation, educational attainment, relative wages and time use have been even greater.

The approach in this paper complements the studies on the contribution of women to gross domestic product (GDP) and current income and production (Dabla-Norris & Kochhar, 2019; Faryaar, Macdonald & Watt, 2022). Dabla-Norris and Kochhar (2019) found that closing gender inequality gaps represents huge potential for future growth and could increase GDP by more than 10% in advanced economies. Faryaar, Macdonald and Watt (2022) found that women's contribution to Canadian GDP increased from 25.7% to 28.5% from 2008 to 2018.

To the knowledge of the author, this is one of few papers to examine long-term trends in the gender gap in human capital over the last 50 years. It answers the following questions:

- What is the gender gap in human capital per capita in Canada?
- To what extent does the gender gap change over time?
- What is the gender gap in human capital among the immigrant population and the Canadian-born population?
- What is women's share of human capital and the contribution of women to growth in human capital?
- What is the contribution of immigrants and Canadian-born individuals to human capital growth by gender?

The rest of the paper is organized as follows. Section 2 outlines the methodology for estimating human capital. Section 3 presents the data sources used to estimate human capital stock. Section 4 presents the estimates and main findings of the paper, and Section 5 concludes.

2 Methodology

Gu and Wong (2010) estimated human capital stock for Canada and found that it is the most important component of Canada's total wealth, which includes produced capital, natural capital and human capital. The presentation of the methodology in this paper closely follows the work of Gu and Wong (2010).

The estimation of human capital follows the approach developed by Jorgenson and Fraumeni (1989, 1992), which was adopted by UNECE as a preferred approach for estimating human capital stock (UNECE, 2016). This approach estimates the human capital stock of an individual as the present discounted value of their future earnings.

Jorgenson and Fraumeni's approach estimates the stock of human capital of an individual using the income approach that is often used to value other assets, such as natural capital. The human capital of an individual is estimated as the present discounted value of their future earnings. This differs from the cost-based approach, which estimates human capital stock as the accumulated value of expenditures related to human capital that leads to an increase in future earnings, such

as expenditures on education and training, the value of student time, and expenditures on improving individual health (Kendrick, 1976).

The income-based approach treats individuals as entities that embody capital with an earning potential that is derived from market activities and assigns a "price" to their lifetime labour using their actual earnings profile. In general, the value of an asset can be estimated either from the stream of earnings it produces or the costs of producing or buying it. For human capital, the income-based approach is often preferred as the expenditure data related to human capital accumulation tend to be incomplete and more difficult to estimate.

To construct the lifetime labour income and human capital of the Canadian population, this paper will exclude the value of non-market work and focus on the human capital of the working age population, aged 15 to 74. This is done to focus on the contribution of human capital to market production.[2] While this aligns with the System of National Accounts framework that focuses on market activities, this paper will underestimate the relative value of the human capital of women, as women are more likely to engage in unpaid household work such as caring for children and elders.

Market lifetime income for all individuals aged 15 to 74 during the remainder of their working life is estimated using cross-sectional data on individuals. The expected income in future periods is assumed to equal the income of individuals of the same gender and education, with the age that the individuals will have in the future time period, adjusted for increases in real income. Lifetime income can be calculated by a backward recursion, starting with age 74, which is assumed to be the oldest age before retirement. The expected income for a person of a given age is their current labour income plus their expected lifetime income in the next period multiplied by survival probabilities. For example, the present discounted value of lifetime income of 74-year-olds is their current labour income. The lifetime income of 73-year-olds is equal to their current labour income plus the present discounted value of lifetime income of 74-year-olds, adjusted for increases in real income. Formally, the following equation is used to estimate average human capital per capita for a cohort of individuals with gender (s), age (a) and educational attainment (e):

$$\begin{aligned} h_{s,a,e} = {} & p^1_{s,a,e} y^1_{s,a,e} + p^2_{s,a,e} y^2_{s,a,e} + (1 - senr_{s,a,e}) sr^{a+1}_{s,a} h_{s,a+1,e} (1+g)/(1+r) \\ & + \sum_{m=1}^{M_e} \left(senr_{s,a,e} / M_e \right) sr^{a+m}_{s,a} h_{s,a+m,e+1} (1+g)^m / (1+r)^m \end{aligned} \tag{1}$$

where

e = educational attainment level (1 to 5): 1 = 0 to 13 years of schooling, non-graduate; 2 = completed high school education; 3 = some postsecondary education below bachelor's degree; 4 = bachelor's degree; 5 = master's degree or above.

a = age: 15 to 74.

$h_{s,a,e}$ = average human capital or average present discounted value of lifetime labour income per capita for individuals with gender (s), age (a) and education level (e).

$p^1_{s,a,e}$ = probability of engaging in paid employment for individuals with gender (s), age (a) and education level (e), defined as the number of paid workers over the population for that cohort.

2. Gu (2022) extends a measure of production to include non-market production that can be used to measure a broad measure of human capital that captures non-market production.

$y^1_{s,a,e}$ = annual labour compensation of paid workers with gender (s), age (a) and education level (e).

$p^2_{s,a,e}$ = probability of engaging in self-employment for individuals with gender (s), age (a) and education level (e), defined as the number of self-employed workers over the population for that cohort.

$y^2_{s,a,e}$ = annual labour compensation of self-employed workers with gender (s), age (a) and education level (e).

$sr^{a+1}_{s,a}$ = probability of surviving one more year from age (a) for individuals with gender (s).

$senr_{s,a,e}$ = school enrolment rate, which is defined as the proportion of individuals with gender (s), age (a) and education level (e) who are studying for a higher education level ($e+1$).

M_e = number of years that the individuals with education level (e) spend to complete a higher education level ($e+1$).

g = real income growth rate.

r = discount rate.

This formula is applied to each cohort of individuals at a point in time—assuming that each individual progresses through time using the relative income of other cohorts and the relevant probabilities of moving to different states of education and employment status that are applicable at that point in time.

During school years, individuals may pursue further studies to increase their earnings. When individuals are enrolled in schools and pursue further studies, they face two possible earnings streams: one with the current education level (e), and the other with the higher education level ($e+1$) with a delay because of schooling. Average human capital per capita among a cohort of individuals is a weighted sum of these two earnings streams, with weights being the probability of school enrolment.

In Equation (1), it is assumed that students enrolled in an education level are evenly distributed across different study years, except for certain young ages. For example, 22-year-old students with a bachelor's degree studying for a master's degree are assumed to be in their first year.

The equation is estimated separately for immigrants and non-immigrants. This formula requires estimates of the future growth rate of real income. Here it is assumed to equal labour productivity growth in the Canadian business sector, which was about 1.7% per year for the estimation period from 1970 to 2020. Real income growth in the past follows the growth in productivity closely over long periods of time (Baldwin & Gu, 2007). The real discount rate will be set to 5.1%, which is the weighted average of real rates of return to equity and debt (Baldwin & Gu, 2007).

To estimate human capital for Canada, the individuals are classified into five education levels: 0 to 13 years of schooling without a high school diploma, completed high school education, some postsecondary education below a bachelor's degree, bachelor's degree, and master's degree or above. It is assumed that individuals with some high school education or those who have completed high school take two years to complete some postsecondary education, that individuals with some postsecondary education take two years to complete a bachelor's degree

and that individuals with a bachelor's degree take two years to complete a master's degree or above.[3] The grades that younger individuals were enrolled in are inferred from their ages.

The nominal value of human capital is just the sum across all individuals in the population being counted (in this case, 15- to 74-year-olds). The change in the nominal value of human capital may reflect changes in the volume or price of human capital. For many purposes, the nominal value of human capital needs to be decomposed into movements in prices or volumes. A volume estimate provides a measure that abstracts from changing prices and can be considered as a measure of human capital in efficiency units.

The decomposition of human capital into the price and volume change has been a major challenge. Several ways have been proposed to deflate the nominal value of human capital to derive the volume index of human capital. Jorgenson and Fraumeni (1989, 1992) constructed the volume of human capital using the Tornqvist aggregation method. For that method, the growth rate of the volume index of aggregate human capital stock is calculated as the weighted sum of the growth rates of the number of individuals across different categories of the population (gender, age and education) using their share of the nominal value of human capital stock as weights. This index of human capital volume will increase if the number of individuals increases over time or there are shifts in the composition of the population toward those who have large average lifetime earnings, such as younger and more educated individuals. Gu and Wong (2010) adopted that deflation method.

This approach assumes that the human capital of individuals with the same demographic characteristics, such as age, gender and education, is at the same level and does not change over time. Therefore, the changes in the nominal value of human capital of an individual with the same age, gender and education over time reflect changes in the price—not the quantity—of the human capital of that individual. The issue has been debated in the literature on the quality of education and the efficiency unit of human capital. For example, Atkinson (2005) and Diewert (2011) both argued that there is a need to account for the changes in quality of education and efficiency of human capital and proposed methods to account for those changes. Bowlus and Robinson (2012) proposed a model-based approach for accounting for these changes in quality of human capital and found that an increase in earnings and human capital partly, if not mostly, reflects an increase in the efficiency unit of human capital.

This paper starts with the assumption that there are changes in the quality or efficiency unit of human capital over time and the changes in earnings over time can be partially attributed to the changes in the quality of human capital. The paper deflates the nominal value of human capital by the Consumer Price Index (CPI) to derive human capital in constant dollars. Essentially, the paper assumes that any changes in earnings and nominal values of human capital of an individual with the same age, gender and education level above the changes in the CPI reflect the changes in the quantity of human capital. The deflation method is adopted by Wei (2007, 2008) in his estimate of human capital for Australia.

The GDP deflator has also been used to deflate nominal human capital stock in previous studies, such as those by Lange et al. (2018)—for their estimates of human capital and total wealth for 141 countries—and Liu (2014) in his estimates of human capital in a number of Organisation for Economic Co-operation and Development countries.

3. There are students with some university education below a bachelor's degree. It is assumed they are already halfway through their university education and will need to spend an additional two years to obtain a bachelor's degree.

3 Data sources

Human capital is estimated using data tables on population counts, paid employment, self-employment, school enrolment, annual labour compensation and annual hours worked for different types of individuals, who are cross-classified by two genders, 60 ages (15 to 74), five education levels (below high school graduation, high school graduate, some postsecondary education below bachelor's degree, bachelor's degree, and master's degree or above), and immigrants and Canadian-born people, for a total of 1,200 groups of individuals.

The data tables on the different types of populations are derived from the Census of Population, conducted every five years from 1971 to 2016 (for the purpose of this study). The 1976 Census is not used as the microdata for that census year are not available. Immigrant status is collected in all censuses of population. The data between census years are derived using straight-line interpolation.

Since 2006, the monthly Labour Force Survey (LFS) also collects individuals' immigrant status. Therefore, the monthly LFS is used to derive data on different types of individuals for the years from 2006 to 2020. The census is used for the years before 2006.

Regarding self-employed individuals, only the data on hours worked and employment are available. Their earnings are not available from the LFS and or the census. The annual earnings of self-employed workers are estimated using the assumption that the hourly earnings of self-employed workers are equal to those of paid workers with the same gender, level of education and experience, and immigrant status.

The earnings from the LFS and census do not capture the full labour compensation to workers as supplementary benefits are not included. To ensure the concept of earnings reflects total compensation to individuals, the data on hours worked and earnings are then benchmarked to total labour compensation and hours worked at the national level from Statistics Canada's National Accounts.

The classification of education has undergone changes over time in the LFS and the census. There was one change in 1989 in the LFS and one in the 2006 Census. These introduced a break in the data on education levels. To ensure consistency of education levels over time, five education levels are used to classify individuals: less than high school graduation, high school graduation, some postsecondary education below bachelor's degree, bachelor's degree and graduate degrees (master's or doctoral degrees).

The changes in education classification in the 2006 Census of Population resulted in an increase in the number of individuals with some postsecondary education and corresponding decrease in the number of those with a high school diploma. They caused a break in the data for 2005 and from 2001 to 2004 as the data for those years are derived using straight-line interpolation between the 2001 and 2006 censuses. The data from the LFS are used from 2006 to 2020, during which the classification of education did not change.[4]

The data on school enrolment are from the LFS and census. The studies by Jorgenson and Fraumeni (1989, 1992) and the World Bank wealth report (Lange et al., 2018) assumed that individuals attend school only before they have reached a certain age (35 years). The paper does not make that distinction, but there is little effect on human capital estimates if that restriction is imposed.

For younger individuals attending primary and secondary education, the grades in which they are enrolled are inferred based on their ages. For older adults, it is assumed that individuals with less

4. A change in classification was made in the LFS in 1989.

than a high school education will get a high school diploma in two years. The individuals with some postsecondary education will obtain a bachelor's degree in two years if they are enrolled. The individuals with a bachelor's degree will obtain their graduate degree in two years if they are enrolled.

The data on school enrolment distinguish between full-time and part-time education. The estimates of human capital in this paper do not make that distinction and assume that all individuals attend school full time. This is a reasonable approximation for primary and secondary education. However, it may introduce biased estimates of human capital for individuals attending postsecondary education. To account for the impact of part-time studies, information is required on the number of years individuals will need to enroll in school part time to move on to the next education level. Those data are currently not available but are required to provide an accurate estimate of human capital and to examine the full extent of bias from the assumption adopted in this paper on school attendance.

Finally, the data on survival rates are obtained from *Life Tables, Canada, Provinces and Territories* by Statistics Canada. While education tends to increase survival rates, no data on this tendency exist for Canada. It is assumed that the survival rates do not vary across education levels and depend only on age and gender (Statistics Canada, 2022 and various years).

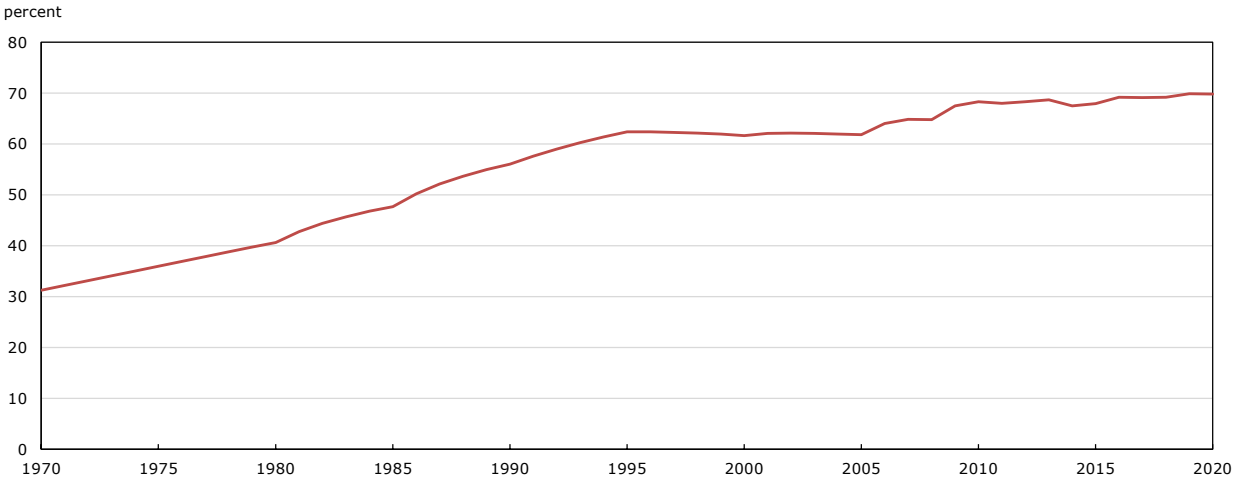
4 Main findings

The estimates of human capital in the paper cover the period from 1970 to 2020, but the main discussion will cover the period from 1970 to 2019. The estimates for 2020 will be discussed in the last part of this section to examine the impact of the COVID-19 pandemic on human capital and determine which segment of the population was most affected by the pandemic in terms of annual earnings and human capital. The effect on human capital is expected to be transitory as the labour market recovers from the pandemic.

4.1 Long-term trend in the gender gap in average human capital per capita

Chart 1 shows the ratio of the average human capital of the female population to that of the male population from 1970 to 2020. Significant progress has been made toward closing the gender gap in human capital since 1970. Average human capital per capita among the female population was about 30% that of the male population in 1970. By 2019, the average human capital per capita of women was 70% of the average human capital of men. In 2020, the average human capital of women relative to that of men declined slightly as the COVID-19 pandemic affected the employment and labour income of women more than those of men. However, the overall difference between men and women in the pandemic's effect on human capital is small.

Chart 1
Average human capital per capita of women over that of men, 1970 to 2020



Source: Statistics Canada, author's estimation.

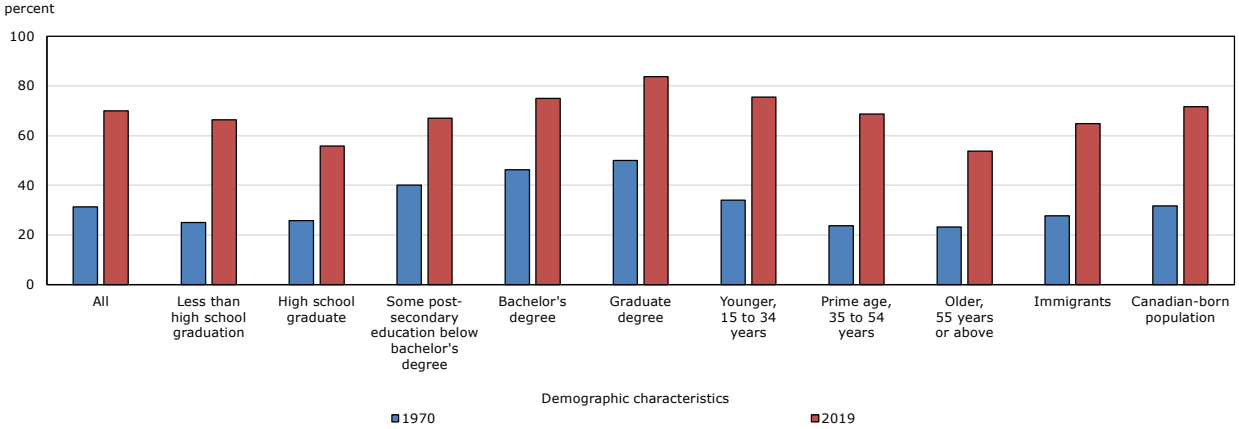
The large decline in the gender gap in human capital over that period is attributable to the increase in the labour force participation of women, the increase in the education level of women relative to that of men, and the decline in earnings gaps between male and female workers (Gu and Wong, 2010).

The decline in the gender gap in human capital was much faster in the period before 1995; it slowed after 1995. From 1970 to 1995, the ratio of female to male human capital per capita increased from 30% to 62%. That ratio rose from 62% to 70% from 1995 to 2020.

4.2 The gender gap in average human capital per capita by education level and age group in 2019

The gender gap declined in all education levels and all age groups after 1970 (Chart 2). Despite this decline, there is still a gender gap in human capital. Table 1 presents average lifetime labour income, or human capital per capita, in 2012 dollars across types of individuals in the working age population in 2019.

Chart 2
Ratio of women's human capital to men's human capital per capita, 1970 and 2019



Source: Statistics Canada, author's estimation.

Table 1
Average human capital per capita, 2019

	All	Male	Female	Ratio of female to male human capital
	thousands of dollars			ratio
All	780	919	642	0.70
Less than high school graduation	618	731	485	0.66
High school graduate	631	801	447	0.56
Some postsecondary education below bachelor's degree	776	929	623	0.67
Bachelor's degree	955	1,107	830	0.75
Graduate degree	998	1,088	912	0.84
Younger, 15 to 34 years	1,321	1,500	1,134	0.76
Prime working age, 35 to 54 years	825	980	673	0.69
Older, 55 years or above	145	191	102	0.54
Immigrants	697	853	552	0.65
Canadian-born population	808	940	674	0.72

Source: Statistics Canada, author's estimation.

In 2019, average human capital per capita among the population aged 15 to 74 (which will be called the working age population) was $780,000 in 2012 prices. There are large differences in human capital across the types of population.

The average future lifetime income, or human capital, tends to increase with education level. This is because of the combined effect of an increase in earnings from education that is only partially reduced by a decline in the working life from the greater time those individuals spend in schooling. For example, an individual with less than high school graduation can expect a lifetime income of $618,000 in 2019, which is about 65% of the lifetime earnings that an individual with a bachelor's degree can expect to have ($995,000).

The human capital of younger individuals (aged 15 to 34) was higher than that of older individuals because of the younger individuals' longer working life. A person aged 15 to 34 in 2019 could expect to have a lifetime income of $1,321,000 in 2012 prices. A prime age individual (aged 35 to 54) in 2019 could expect to have a lifetime income of $825,000 during their remaining working life.

The relatively high human capital stock of a younger individual, or the youth advantage in human capital, is larger for women than for men. While the average human capital of a younger individual was about 60% higher than that of a prime age individual in 2019 ($1,321,000 versus $825,000), this youth advantage was 67% for women ($1,130,000 versus $673,000) and 53% for men ($1,500,000 versus $980,000).

There was a 30% gap in human capital, or average lifetime income, between women and men in 2019. That gap reflects the relatively lower earnings, number of hours worked and employment rates for women (Gu and Wong, 2010). In 2019, the average human capital of women was $642,000 in 2012 prices, which is about 30% lower than that of men in that year ($919,000).

This gender gap in human capital was especially large for high school graduates and older women (55 or older). The human capital of women who are older or with a high school diploma was about 55% of that of men with the same age and education level.

The gender gap in human capital was smallest for women with a graduate degree, whose human capital was about 15% lower than that of men with a graduate degree.

The gender gap in human capital was lower for younger women than for older women. Younger women in 2019 could expect to have a future lifetime income that was 24% lower than that of younger men. This gap is lower than the overall 30% human capital gap between men and women. The lower gender gap in human capital in the younger population may reflect an increase in education and relative earnings among younger women.

4.3 The gender gap in average human capital per capita by immigrant status in 2019

On average, the immigrant population has lower average human capital (86%) than the Canadian-born population; this is particularly the case for immigrant women (Table 2). In 2019, the average human capital of immigrant women was 82% of that of Canadian-born women. The average human capital of immigrant men was 91% of the human capital of Canadian-born men.

Table 2
Average human capital per capita for immigrants and Canadian-born population, 2019

	All	Male	Female	Ratio of female to male human capital
	thousands of dollars			ratio
Immigrants				
All	697	853	552	0.65
Less than high school graduation	453	610	316	0.52
High school graduate	505	670	353	0.53
Some postsecondary education below bachelor's degree	667	809	538	0.66
Bachelor's degree	844	1,015	691	0.68
Graduate degree	911	1,039	767	0.74
Younger, 15 to 34 years	1,193	1,445	954	0.66
Prime working age, 35 to 54 years	797	976	636	0.65
Older, 55 years or above	156	207	107	0.52
Canadian-born population				
All	808	940	674	0.72
Less than high school graduation	661	757	539	0.71
High school graduate	666	836	477	0.57
Some postsecondary education below bachelor's degree	804	958	646	0.67
Bachelor's degree	1,014	1,160	900	0.78
Graduate degree	1,059	1,127	1,001	0.89
Younger, 15 to 34 years	1,353	1,512	1,181	0.78
Prime working age, 35 to 54 years	837	981	690	0.70
Older, 55 years or above	142	185	101	0.55
		ratio		
Ratio of immigrants to Canadian-born population				
All	0.86	0.91	0.82	0.90
Less than high school graduation	0.69	0.81	0.59	0.73
High school graduate	0.76	0.80	0.74	0.92
Some postsecondary education below bachelor's degree	0.83	0.85	0.83	0.99
Bachelor's degree	0.83	0.88	0.77	0.88
Graduate degree	0.86	0.92	0.77	0.83
Younger, 15 to 34 years	0.88	0.96	0.81	0.85
Prime working age, 35 to 54 years	0.95	1.00	0.92	0.93
Older, 55 years or above	1.10	1.12	1.06	0.94

Source: Statistics Canada, author's estimation.

As a result of these differences, the gender gap in human capital was higher among the immigrant population than among the Canadian-born population. Human capital among immigrant women was 35% lower than that among immigrant men in 2019. In contrast, the human capital of Canadian-born women was about 28% lower than that of Canadian-born men. The larger gender gap in human capital for immigrants at each education level and in each age group is consistent with the fact that a higher proportion of women immigrants are classified as spouses or dependants or in the family class, while a lower proportion are classified as economic class principal applicants, within the framework of the immigration point system (Lu & Ng, 2019).

A relatively large gender gap in human capital within the immigrant population compared with that within the Canadian-born population existed for almost all age groups and for all education levels. The gender gap within the immigrant population was especially large for those with less than a high school diploma. For immigrant women with less than a high school diploma, the average human capital was about 52% of the average human capital of immigrant men with the same level of education in 2019 ($316,000 versus $610,000). In contrast, the average human capital for Canadian-born women with less than a high school diploma was about 71% of the average human capital of Canadian-born men with the same level of education in 2019 ($539,000 versus $757,000).

Another notable difference in gender gap between immigrants and the Canadian-born population relates to individuals with a high school diploma. There was a large gender gap for immigrants with a high school diploma, as the average human capital of women in that category was about 53% that of immigrant men with the same education level. This large gender gap also existed among the Canadian-born population with a high school diploma (at 57%).

While the gender gap was smaller for the younger population (aged 15 to 34) than for the older population, the gender gap for immigrant youth was larger than that of Canadian-born youth. On average, younger immigrant women had human capital of about 66% of that of younger immigrant men. The average human capital of younger Canadian-born women was about 78% of that of younger Canadian-born men.

4.4 Changes in the gender gap in average human capital by education level and age group

From 1970 to 2019, human capital per capita among the working age population increased 0.71% per year (Table 3). However, the increase in human capital per capita was much faster for women than for men, resulting in the decline in the gender gap in human capital shown in Chart 1.

Table 3
Average annual growth in human capital per capita, 1970 to 2019

	All	Male	Female	Difference between female and male
		percent		percentage points
All	0.71	0.10	1.74	1.64
Less than high school graduation	0.78	0.03	2.02	1.99
High school graduate	0.37	-0.15	1.42	1.57
Some postsecondary education below bachelor's degree	0.05	-0.37	0.68	1.05
Bachelor's degree	-0.02	-0.20	0.79	0.98
Graduate degree	-0.42	-0.44	0.62	1.05
Younger, 15 to 34 years	1.07	0.44	2.07	1.63
Prime working age, 35 to 54 years	1.52	0.79	2.96	2.17
Older, 55 years or above	1.30	0.74	2.45	1.71
Immigrants	0.77	0.22	1.95	1.73
Canadian-born population	0.73	0.09	1.76	1.66

Source: Statistics Canada, author's estimation.

From 1970 to 2019, the average human capital rose 1.74% per year for women, while it increased 0.10% per year for men. The faster growth of human capital per capita for women occurred for all age groups, for all education levels, and for both immigrants and Canadian-born individuals. The difference in the growth in human capital between prime working age women and prime working age men was the highest.

As a result of faster growth in human capital for women for all age groups, education levels, and both immigrants and Canadian-born individuals, the gender gap in human capital declined for those groups, especially for prime working age women.

From 1970 to 2019, the human capital of immigrant women and Canadian-born women rose at a similar rate (1.95% for immigrant women versus 1.76% for Canadian-born women), and human capital increased more for women than for men for both the immigrant and Canadian-born populations (Table 4). The difference in human capital growth between women and men was similar for the immigrant and Canadian-born populations. As a result, the rate of decline in the gender gap was similar for both population groups.

Table 4
Average annual growth in human capital per capita for immigrants and Canadian-born population, 1970 to 2019

	All	Male	Female	Difference between female and male
		percent		percentage points
Immigrants				
All	0.77	0.22	1.95	1.73
Less than high school graduation	0.70	0.17	1.62	1.45
High school graduate	0.53	-0.01	1.48	1.49
Some postsecondary education below bachelor's degree	-0.12	-0.40	0.82	1.22
Bachelor's degree	-0.31	-0.39	0.59	0.98
Graduate degree	-0.53	-0.50	0.45	0.95
Younger, 15 to 34 years	0.72	0.22	1.78	1.56
Prime working age, 35 to 54 years	1.19	0.58	2.59	2.01
Older, 55 years or above	1.94	1.50	2.90	1.39
Canadian-born population				
All	0.73	0.09	1.76	1.66
Less than high school graduation	0.83	0.03	2.16	2.13
High school graduate	0.17	-0.30	1.24	1.54
Some postsecondary education below bachelor's degree	0.10	-0.36	0.69	1.06
Bachelor's degree	0.11	-0.10	0.92	1.01
Graduate degree	-0.34	-0.38	0.71	1.09
Younger, 15 to 34 years	1.14	0.47	2.14	1.67
Prime working age, 35 to 54 years	1.62	0.85	3.07	2.23
Older, 55 years or above	1.09	0.49	2.31	1.82
Difference between immigrants and Canadian-born population				
All	0.04	0.13	0.20	0.07
Less than high school graduation	-0.14	0.14	-0.54	-0.68
High school graduate	0.36	0.29	0.24	-0.05
Some postsecondary education below bachelor's degree	-0.22	-0.04	0.13	0.16
Bachelor's degree	-0.42	-0.30	-0.33	-0.03
Graduate degree	-0.19	-0.12	-0.26	-0.14
Younger, 15 to 34 years	-0.42	-0.26	-0.36	-0.11
Prime working age, 35 to 54 years	-0.43	-0.26	-0.48	-0.22
Older, 55 years or above	0.84	1.01	0.59	-0.43

Source: Statistics Canada, author's estimation.

While the gender gap declined at a similar rate for both the immigrant and Canadian-born populations from 1970 to 2019, the decrease was slower among the immigrant population for almost all age groups and education levels, except for those with some postsecondary education below a bachelor's degree, as shown in Table 3. For these individuals, the gender gap in human capital declined faster among immigrants.

Table 5 presents the growth of human capital per capita in two periods: 1970 to 1995 and 1995 to 2019. The relative growth in the human capital of women compared with that of men was faster before 1995 for all demographic groups. After 1995, the growth in human capital for women was still higher than that of men, but the difference in the growth rates was smaller. The relatively large

decline in the gender gap before the mid-1990s compared with that after the mid-1990s occurred among all age groups, all education levels, and both the immigrant and Canadian-born populations.

Table 5
Average annual growth in human capital per capita, 1970 to 1995 and 1995 to 2019

	All	Male	Female	Difference between female and male
		percent		percentage points
1970 to 1995				
All	0.52	-0.48	2.28	2.76
Less than high school graduation	-0.47	-1.37	1.14	2.51
High school graduate	-0.15	-0.73	1.63	2.36
Some postsecondary education below bachelor's degree	0.00	-0.83	1.26	2.09
Bachelor's degree	-0.35	-0.81	1.20	2.01
Graduate degree	-1.06	-1.16	0.86	2.03
Younger, 15 to 34 years	0.75	-0.31	2.51	2.82
Prime working age, 35 to 54 years	1.41	0.32	3.65	3.32
Older, 55 years or above	-1.01	-1.56	0.24	1.81
Immigrants	0.31	-0.62	2.37	2.99
Canadian-born population	0.58	-0.44	2.31	2.75
1995 to 2019				
All	0.63	0.49	0.83	0.33
Less than high school graduation	1.47	1.05	2.08	1.02
High school graduate	0.64	0.32	0.84	0.53
Some postsecondary education below bachelor's degree	0.08	0.07	0.05	-0.02
Bachelor's degree	0.23	0.31	0.25	-0.06
Graduate degree	0.17	0.22	0.25	0.03
Younger, 15 to 34 years	0.99	0.86	1.13	0.27
Prime working age, 35 to 54 years	1.16	0.90	1.58	0.68
Older, 55 years or above	2.62	2.22	3.36	1.14
Immigrants	0.88	0.77	1.07	0.30
Canadian-born population	0.62	0.46	0.83	0.37

Source: Statistics Canada, author's estimation.

While the decline in the gender gap was slower among the immigrant population than among the Canadian-born population for almost all age groups and education levels from 1970 to 2019, when the period is divided in two—1970 to 1995 and 1995 to 2019—this difference in the decline occurred only after 1995. Before 1995, the gender gap actually declined faster among immigrants for all almost age groups and education levels.[5] For individuals with less than a high school education and in the prime working age group, the decline in the gender gap was slower among immigrants than among the Canadian-born population.

4.5 Contribution to the growth in aggregate human capital stock by gender and population type

This section examines the contributions of different groups of the Canadian population to overall growth in human capital stock in constant dollars. The contribution of a group of the population is estimated as the growth in human capital stock in that group times the average share of the group in nominal human capital stock.

Table 6 presents the contribution from 1970 to 2019. Over this period, total human capital stock increased 1.81% per year. The male and female populations each accounted for about half of the growth (0.90 percentage points for men and 0.91 percentage points for women). The female

5. The estimates are prepared from the data but are not shown in the paper.

population's contribution to the growth in human capital was much higher than its share of human capital (33%) because the human capital of women increased much faster than that of men.

Table 6
Average share of human capital and contribution to human capital growth by demographic group, 1970 to 2019

	All	Male	Female
	decimal value		
Share			
All	1.00	0.66	0.34
Less than high school graduation	0.29	0.22	0.08
High school graduate	0.09	0.06	0.03
Some postsecondary education below bachelor's degree	0.41	0.26	0.15
Bachelor's degree	0.14	0.08	0.06
Graduate degree	0.07	0.04	0.03
Younger, 15 to 34 years	0.67	0.44	0.23
Prime working age, 35 to 54 years	0.29	0.19	0.10
Older, 55 years or above	0.04	0.03	0.01
Immigrants	0.18	0.12	0.06
Canadian-born population	0.82	0.54	0.28
	percentage points per year		
Contribution			
All	1.81	0.90	0.91
Less than high school graduation	-0.39	-0.37	-0.04
High school graduate	0.58	0.37	0.22
Some postsecondary education below bachelor's degree	0.68	0.37	0.31
Bachelor's degree	0.67	0.32	0.38
Graduate degree	0.36	0.17	0.23
Younger, 15 to 34 years	0.82	0.35	0.46
Prime working age, 35 to 54 years	0.84	0.45	0.42
Older, 55 years or above	0.15	0.09	0.06
Immigrants	0.51	0.27	0.25
Canadian-born population	1.30	0.62	0.67

Source: Statistics Canada, author's estimation.

Immigrants contributed about 0.51 percentage points, or 28%, of the 1.81% growth in human capital from 1970 to 2019. Immigrant women and men made similar contributions to the aggregate growth in human capital over that period. Immigrant women accounted for 0.25 percentage points, or 49%, of the immigrant contribution to aggregate human capital growth, while immigrant men accounted for 51%. Immigrants' contribution to the growth in human capital was disproportionate and was higher than their share of human capital, which was about 22% over that period, as the immigrant population became relatively younger and more educated over time.

Tables 7 and 8 present the contribution of demographic groups to aggregate human capital growth for two periods—1970 to 1995 and 1995 to 2019. Women accounted for more than half (about 58%) of the growth in human capital before 1995 because of their dramatic increase in labour force participation. This proportion is larger than their share of human capital in that period (33%). From 1995 to 2020, women accounted for less than half (45%) of the growth in human capital, which is also larger than their share of human capital in that period (40%).

Table 7
Average share of human capital and contribution to human capital growth by demographic group, 1970 to 1995

	All	Male	Female
	decimal value		
Share			
All	1.00	0.67	0.33
Less than high school graduation	0.33	0.25	0.09
High school graduate	0.05	0.03	0.02
Some postsecondary education below bachelor's degree	0.49	0.30	0.18
Bachelor's degree	0.09	0.06	0.03
Graduate degree	0.04	0.03	0.01
Younger, 15 to 34 years	0.71	0.47	0.24
Prime working age, 35 to 54 years	0.27	0.19	0.08
Older, 55 years or above	0.02	0.02	0.01
Immigrants	0.14	0.10	0.04
Canadian-born population	0.86	0.57	0.28
	percentage points per year		
Contribution			
All	1.93	0.80	1.13
Less than high school graduation	-0.64	-0.59	-0.06
High school graduate	0.46	0.27	0.19
Some postsecondary education below bachelor's degree	1.43	0.71	0.73
Bachelor's degree	0.48	0.23	0.26
Graduate degree	0.21	0.12	0.11
Younger, 15 to 34 years	0.93	0.23	0.69
Prime working age, 35 to 54 years	0.99	0.55	0.45
Older, 55 years or above	0.02	0.01	0.01
Immigrants	0.34	0.15	0.19
Canadian-born population	1.59	0.65	0.94

Source: Statistics Canada, author's estimation.

Table 8
Average share of human capital and contribution to human capital growth by demographic group, 1995 to 2019

	All	Male	Female
	decimal value		
Share			
All	1.00	0.60	0.40
Less than high school graduation	0.14	0.10	0.05
High school graduate	0.12	0.08	0.04
Some postsecondary education below bachelor's degree	0.47	0.28	0.19
Bachelor's degree	0.18	0.10	0.08
Graduate degree	0.08	0.05	0.04
Younger, 15 to 34 years	0.62	0.36	0.26
Prime working age, 35 to 54 years	0.34	0.21	0.13
Older, 55 years or above	0.04	0.03	0.01
Immigrants	0.19	0.11	0.08
Canadian-born population	0.81	0.48	0.33
	percentage points per year		
Contribution			
All	1.68	0.92	0.77
Less than high school graduation	-0.10	-0.09	-0.01
High school graduate	0.52	0.35	0.17
Some postsecondary education below bachelor's degree	0.14	0.12	0.03
Bachelor's degree	0.74	0.36	0.38
Graduate degree	0.40	0.19	0.22
Younger, 15 to 34 years	0.70	0.40	0.31
Prime working age, 35 to 54 years	0.75	0.37	0.37
Older, 55 years or above	0.25	0.15	0.10
Immigrants	0.63	0.35	0.28
Canadian-born population	1.06	0.57	0.49

Source: Statistics Canada, author's estimation.

Both immigrant women and immigrant men increased their contribution to human capital growth after 1995; immigrants accounted for about 40% of growth in human capital, which was much greater than their share of human capital (less than 20%). Before 1995, immigrants accounted for about 18% of the growth in human capital and 14% of human capital. Before 1995, women accounted for a larger share of immigrants' contribution to aggregate human capital growth: 44% was from immigrant men, and the remaining 56% was from immigrant women. After 1995, 56% of the contribution of immigrants to human capital growth was from immigrant men, and the remaining 44% was from immigrant women.

4.6 The impact of the COVID-19 pandemic on the gender gap in average human capital

Table 9 presents the percentage change in average human capital by type of population in 2020 to examine the impact of the pandemic on annual earnings and human capital. These estimates should be considered preliminary as the data on hours worked and labour compensation are subject to revision.

Table 9
Changes in average human capital per capita from 2019 to 2020

	All	Male	Female
	percent		
All	-1.30	-1.26	-1.33
Less than high school graduation	-1.54	-1.84	-1.16
High school graduate	-2.74	-2.87	-2.92
Some postsecondary education below bachelor's degree	-3.09	-2.92	-3.41
Bachelor's degree	-1.25	-0.91	-1.47
Graduate degree	2.83	4.28	1.20
Younger, 15 to 34 years	-0.56	-0.69	-0.40
Prime working age, 35 to 54 years	-0.25	-0.53	0.12
Older, 55 years or above	-5.08	-3.21	-8.14
Immigrants	-1.96	-2.64	-1.46
Canadian-born population	-1.04	-0.77	-1.27

Source: Statistics Canada, author's estimation.

Data from Statistics Canada's National Accounts indicated a large decline in hours worked in 2020, of 12.5%. Labour compensation declined slightly, by 1.4%, because of wage subsidies and other support programs for workers by the government. As human capital is based on labour compensation, the value of human capital for the entire working age population is expected to be marginally affected by the pandemic (as shown in Table 9).

While the overall decline in human capital was small in 2020, the decrease was slightly larger for women and the immigrant population. It was especially large for older women and for both men and women with a high school diploma and with some postsecondary education below a bachelor's degree.

The extent to which these changes are transitional or permanent depends on industry adjustment after the pandemic and the transition of the workers associated with those structural changes. If the individuals impacted can successfully transition into a post-pandemic economy, the current decline in earnings and human capital will be temporary.

5 Conclusion

Human capital contributes to current well-being through its effect on economic growth and to future well-being through its effect on comprehensive wealth. This paper provides a gender analysis of human capital and examines the contribution of women and immigrants to the level and growth of human capital in Canada.

The average human capital per capita of women was lower than that of men. However, the gender gap in human capital declined over time as a result of the relatively faster growth of human capital among women, which arose from increases in the labour force participation, education level and earnings of women compared with those of men. In 1970, there was a large gap in human capital between women and men, and the average human capital of women was 35% of that of men. This large gap reflects lower labour force participation, fewer hours worked and lower hourly earnings for women. By 2020, the average human capital of women reached 70% of that of men because of increases in the labour force participation, hourly earnings and hours worked of women.

Gender gaps in the average human capital between men and women existed among all age groups and education levels. Since 1970, all the gaps have narrowed significantly—especially for prime working age women.

The gender gap in human capital was larger for immigrant women than for Canadian-born women. In 1970, the average human capital for immigrant women was about 31% of that of immigrant men, while the average human capital of Canadian-born women was about 36% of that of Canadian-born men. Over time, the gender gap narrowed at a similar pace for both immigrant and Canadian-born women. By 2020, the average human capital of immigrant women was about 66% of that of immigrant men, while the average human capital of Canadian-born women was about 71% of that of Canadian-born men.

Relatively large gender gaps among immigrants existed for almost all age groups and education levels, especially for immigrant women with a high school education or below. After the mid-1990s, the decline in the gender gap in human capital was slower among the immigrant population compared with the Canadian-born population, while it was faster for the immigrant population before the mid-1990s.

As result of rapid growth in human capital among women, the share of total human capital accounted for by women rose from 30% in 1970 to 41% in 2020. The increase in that share was much faster before the mid-1990s. From 1970 to 1995, the share of human capital of women rose from 30% to 39%. From 1995 to 2020, the share increased from 39% to 41%.

While women's share of human capital was lower than that of men, women accounted for about half of the growth in human capital from 1970 to 2020. Women's contribution to aggregate growth in human capital declined slightly after the mid-1990s because of a decline in the relative growth in human capital for women during the same period. Before 1995, women accounted for about 58% of the growth in human capital, which was larger than their share of human capital (33%) during that period. From 1995 to 2020, women accounted for 45% of the growth in human capital, which was larger than their share of human capital (40%).

Both immigrant women and immigrant men have increased their contribution to human capital growth over time. After 1995, immigrants accounted for about 40% of the growth in human capital—56% of which may be attributed to immigrant men and 44% to immigrant women—which is much larger than their share of human capital (less than 20%). Before 1995, immigrants accounted for about 18% of the growth in human capital—44% from immigrant men and 56% from immigrant women—and 14% of human capital.

To align with the national accounts framework that focuses on market transactions, the estimate of human capital in this paper includes the market component of human capital and excludes the non-market component. In addition, there are substantial data and methodology challenges to be overcome to have appropriate estimates of the non-market component of human capital. As women are more likely to engage in non-market activities, such as caring for children and elders, the approach in this paper underestimated human capital more for women than for men. This suggests that the relative human capital of women compared with that of men is higher than the estimate in this paper.

The gender gap presents potential for future income. If the gender gap in human capital were removed, there would be significant gains in both human capital and total wealth, or in the capacity for generating future income. Policies that increase the labour force participation, earnings and hours worked of women will also increase the human capital and future income of women. A comprehensive assessment of policies for overall income well-being and its sustainability requires an estimate of human capital that includes both the market component and the non-market and unpaid household component of human capital. The estimation of the non-market component of human capital for women remains an area of important future analysis.

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