Health, Human Capital and its Contribution to Economic Growth

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Delivering insight through data for a better Canada

Human capital (education, training and health) and economic growth

- Human capital is the most important component of total wealth globally (World Bank) and is an important determinant of economic growth and individual income (Shultz 1961, Becker 1961, Jorgenson and Fraumeni 1989)
- It can be acquired through education, training, or improvement in health or any investment activities that contribute to gains in income and earnings in the future.
- A significant progress has been made on the measurement of human capital arising from education and training (UNECE, 2016, 2020; Fraumeni, 2021), there has also been important, though more limited process on the measurement of health human capital (O'Mahony and Samek, 2016)
- This paper makes a process on measurement of heath as human capital.

Contributions of this paper

- The paper argues that Jorgenson-Fraumeni human capital measurement framework can be extended to examine the contribution of health to human capital.
  - Health has two dimensions, one is related to mortality and the other related to morbidity. Those two dimensions are both captured in the extended Jorgenson-Fraumeni framework.
- It implements this approach for Canada and estimates investment in human capital from the decline in mortality rates in Canada.
  - To our knowledge, this is the first such estimate of investment in health human capital using the income-based approach.

Outline

- Previous studies
- Extended Jorgenson-Fraumeni human capital measurement
- Data sources
- Main findings

Previous studies on health and human capital

- Cost-based estimate of human capital from health related activities as part of a broader effort to estimate human capital from child rearing, education, training, health and migration (Kendrick (1964, 1975)
- Income-based approach to estimate human capital from health improvement.
  - Large literature on income-based approach for estimating human capital after the pioneering work of Jorgenson and Fraumeni.
  - The focus is often on overall level of investment activities from all sources. Investment activities that contribute to health as human capital is limited.
  - O'Mahony and Samek (2016, 2021) represented the first major attempt using the income approach.

Income-based approach for estimating investment in health human capital

- The income approach for measuring investment in health will capture monetary returns over future periods from health.
- Health has two dimensions: mortality (life expectancy), and morbidity (disability and debility).
  - The additions to labor compensation and national income from decreasing mortality as it prolongs working life have been shown to be very great (Murphy and Topel, 2003).
  - The reductions in morbidity yield an increase in income: increase in employment rates, hours worked and hourly compensation. (Becker 2007, Currie and Madrian, 1999)
  - Much of the economic effect of health is from the increase in life expectancy. The effect of morbidity is less but is most difficult to measure.

Extended Jorgenson-Fraumeni Income-based approach

- Human capital stock of an individual is estimated as the present discounted value of the future earnings of the individual in the remainder of the working life.
- The extended approach accounts for the effect of health improvement in gains in future income: mortality (survival rates in the estimation) and morbidity (health status of individuals in the estimation).
- Backward induction
  - Individuals are cross-classified by gender, age, education and health status.
  - 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 younger individuals, they may be enrolled in in school that will increase future income.

Human capital stock

- The stock of human capital in current price is the sum of lifetime labour incomes for all individuals in the working-age population.
  - This nominal value of human capital stock can be aggregated into nominal capital stock by gender (e,g. Gu, 2022, Liu, Fraumeni and Managi, 2022, and Fraumeni and Christian, 2019).
  - It can also be aggregated into human capital stock by health status (O'Mahoney and Samek, 2016, 2021).

Human capital investment from all sources

- The changes in human capital stock are decomposed into three components:
- 1. gross investment in human capital: it is measured by increases in human capital stock from the activities that contribute to an increase in lifetime income: education, training, health and net migration.
- 2. depreciation on human capital: it is the change in human capital stock due to aging, death and emigration.
- 3. revaluation of human capital: it represents the change in human capital over time for individuals with a given set of demographic statistics – sex, age, education and health.

Investment in human capital from health improvement

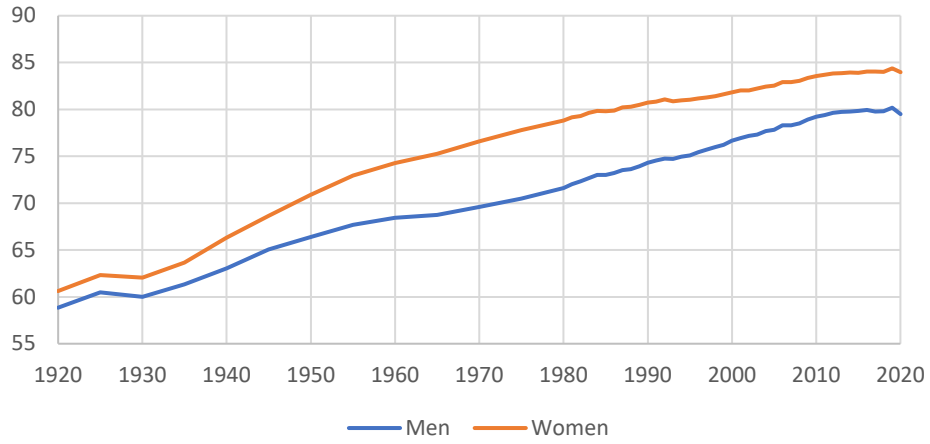
- Investment in health in this extended framework is measured by the impact of health improvement on human capital stock from two sources: mortality rates and change in health status of individuals.
  - The first component can be estimated using a counterfactual.
  - The second component of health capital investment is from changes in the composition of individuals with different health status.

Data sources and construction of data

- Individuals are classified by 2 genders, 60 ages (15 to 74), 5 education levels (below high school, high school graduate, some post-secondary below bachelor's degree, bachelor's degree, and master's degree or above), and immigrants and native-born for a total of 1200 groups of individuals.
- Tables on population counts, paid employment, self-employment, school enrolment, annual labour compensation and annual hours worked for 1200 different types of individuals.
- Census of Populations 1971 1981, 1986, 1991,… 2016
- Monthly LFS, 2006 to 2020. Immigrant status of individuals are collected in the LFS starting in 2006
- National account data on hours worked and labour compensation
- Survival rates (or life tables) of HAD.

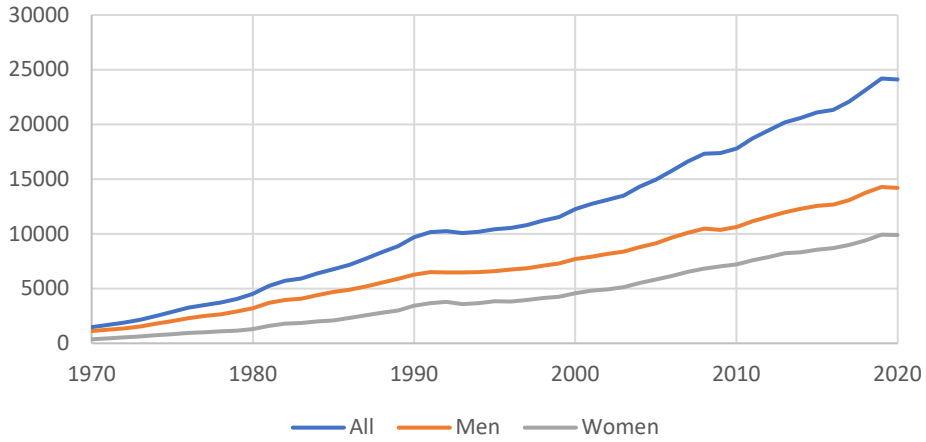
Life expectancy in Canada

Figure 1. Life expectency at birth, by gender, Canada
1970-2020



Human capital stock in Canada

Figure 2. Human capital stock in billion Canadian dollars, 2012 price, by gender, Canada



Investment in human capital from all sources

Figure 3. Investment in human capital stock, billon dollars, 2012 price, Canada, 1971 to 2020

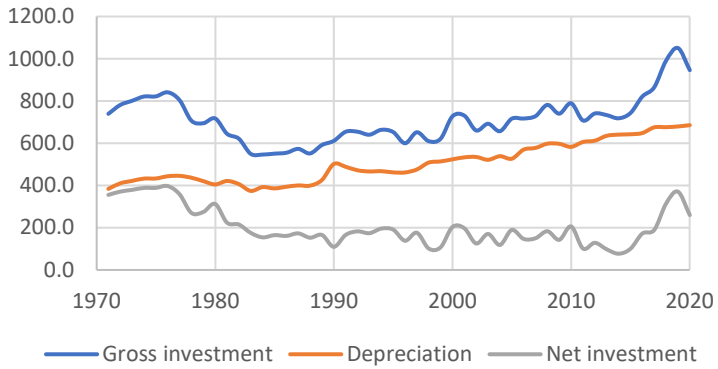
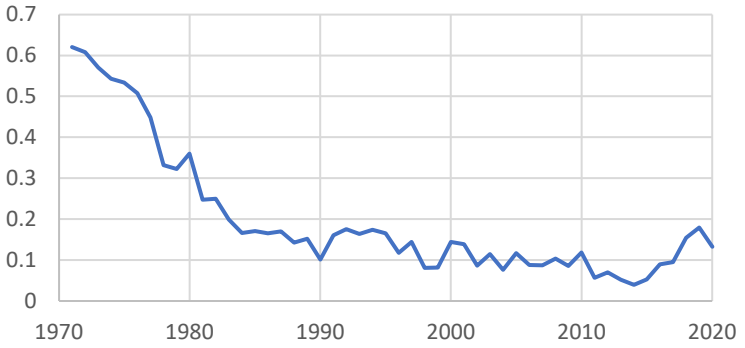


Figure 4. The ratio of net investment in human capital to GDP, Canada, 1971 to 2020



Investment in human capital from activities that reduce mortality rates (billion Can dollars)

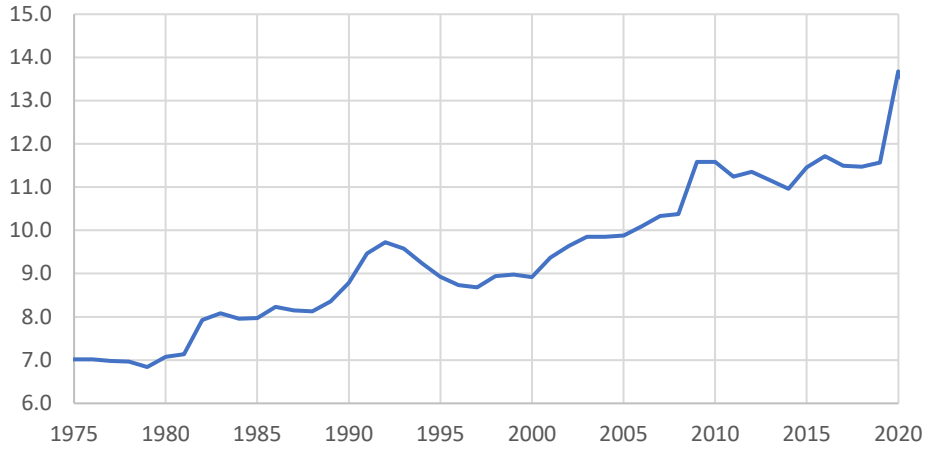
	Gross investment	Depreciation	Net investment	Net investment from decline in mortality	Share of decline in mortality in net investment (%)
1971 to 1980	858.6	470.0	388.6	3.6	0.9
1981 to 1990	643.8	455.3	188.5	7.0	3.7
1991 to 2000	719.5	537.6	181.9	8.1	4.5
2001 to 2010	801.3	620.1	181.2	8.4	4.6
2011 to 2019	921.1	727.2	193.9	2.8	1.4
2020	945.8	685.9	259.9	-75.8	-29.2

Investment in health human capital from decline in mortality rates

- Net investment in human capital from health was about 4% to 5% of total net investment in human capital from 1980 to 2010.
  - Net investment in health human capital was higher for men than for women for the period after 1970. This reflected a large improvement in life expectancy for men in that period.
- That share was lower in the 1970s and 2010s.
- The year 2020 saw a large decline in net investment in human capital from health.
  - The 2020 decline in net investment in health human capital was larger for men then for women as mortality rates increased more for men than for women from the Covid-19 pandemic

Heath expenditures in Canada

Figure 6 Total health expenditure as a percentage of GDP, Canada, 1975 to 2020



Health expenditures: investment vs consumption

- Health expenditures were much higher than the estimate of investment in health human capital from the income-based approach.
- Health human capital investment as a share of GDP was less than one percent while health expenditures as a share of GDP ranged from 7% to 12%.
- This suggests that much of health expenditures should be classified as consumption rather than investment.

Conclusions

- It presents an extended Jorgenson-Fraumeni income-based approach for estimating human capital to account for the effect of health on human capital:
- Net investment in human capital from health increased in the 1970s and 1980s, changed little in 1990s and 2000s and declined in the 2010s.
- Net investment in human capital from health was about 4% to 5% of total net investment in human capital from 1980 to 2010. That share was lower in the 1970s and 2010s. Education, training and birth of children accounts for most of overall investment in human capital.
- The year 2020 saw a large decline in net investment in human capital from health due to increase in mortality rates during the Covid-19 pandemic.
- Investment in health capital is larger for men than for women after 1970 as the decline in mortality rates was larger for men over the period in that period.
- The estimate of investment in health human capital from the income approach is found to be lower than health expenditures in Canada.

Future work - ongoing

- The proposed measurement framework will be used to examine the effect of decline in morbidity on lifetime income of individuals and investment in human capital.
- To integrate this health investment component in the national accounts and examine the effect of this integration on macro aggregates such as gross domestic product, investment, income and wealth.