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E-BRIEF

August 23, 2018

RETIREMENT SAVING AND INCOME

Rich Man, Poor Man: The Policy Implications of Canadians Living Longer

by
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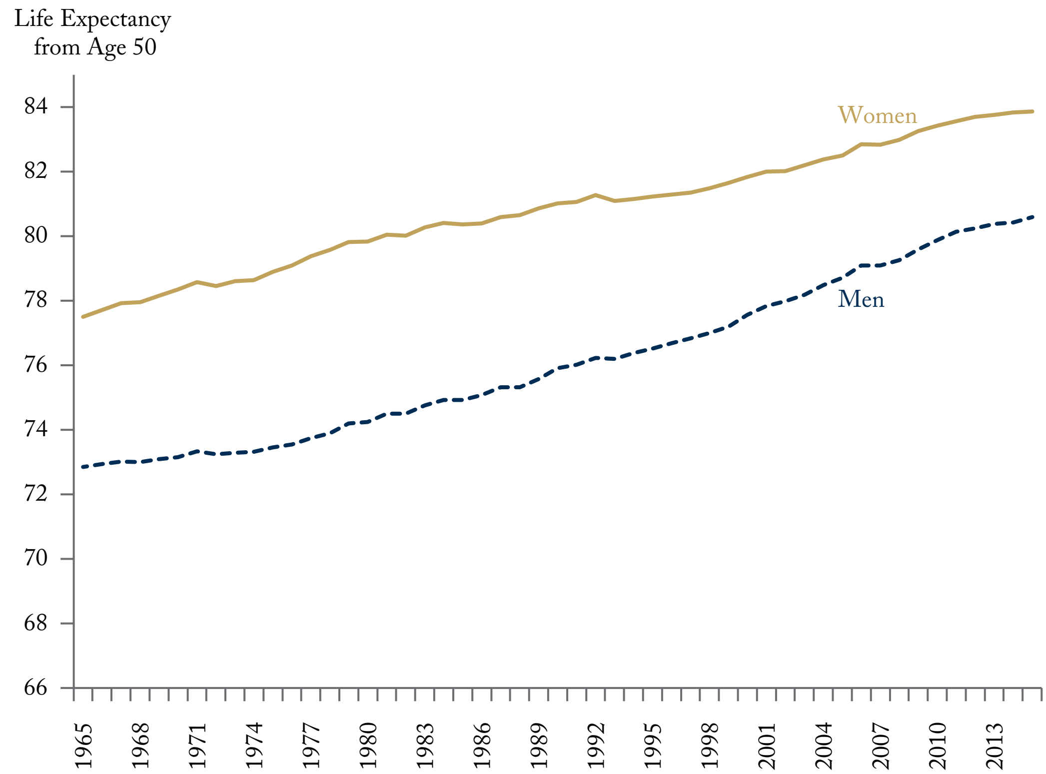
- Increases in longevity have been brisk for Canadians, with both men and women experiencing longer lifespans past age 50 than the generations before them. Until now, however, there has been no study of long-term changes in longevity across earnings groups in Canada. This matters because with those extra years of life come some costs such as pensions, healthcare, and other age-dependent expenditures.
- In this paper, we examine the relationship between earnings and longevity in Canada using an administrative dataset of Canada Pension Plan (CPP) contributors. We measure how longevity differs across earnings levels. By repeating these calculations for individuals in different birth cohorts, we can observe if this earnings-longevity gradient (or upward slope) is steepening – like in the United States – or if longevity is improving equally for everyone.
- Our results show clear evidence of an earnings-longevity gradient for Canadians born between 1923 and 1955, with the highest male earners outliving the lowest earners by 8 years. For women, the earnings gradient is flatter than for men. Importantly, we find that the gap in life expectancy between high and low earners has not grown over time – improvements in longevity are evident across all earnings levels. This result is in sharp contrast with evidence from the United States.
- Longevity is a highly valued aspect of well-being, so its distribution across different types of Canadians matters. Our findings also matter for pension policy. Private annuity markets are shaped by the longevity expectations of different potential purchasers of annuity products. In addition, the valuation of public retirement income programs should reflect the differing longevity of different groups of Canadians.

Canadians are living longer than ever before, allowing more time to enjoy life's pleasures with family and loved ones. Longevity increases have been brisk. In the aggregate data (Figure 1), we see men have added 7.7 years of life after age 50 since 1965 – and 1.9 years over the last decade alone. The increase for women has been slightly slower, at 6.4 years gained, narrowing the gap between men and women.

The authors thank Alexandre Laurin, Keith Ambachtsheer, Bob Baldwin, Robert L. Brown, Stephen Bonnar, David Dodge, Guy Legault, James Pesando, James Pierlot, Paulo Salomao, George Turpie, and members of the Pension Policy Council for comments on an earlier draft. The authors retain responsibility for any errors and the views expressed.

Figure 1: Life Expectancy from Age 50



Source: Canadian Human Mortality Database and Statistics Canada tables 13-10-0709-01 and 17-10-0005-01.

Of course, these extra years of life come with some costs as pensions, healthcare, and other age-dependent expenditures shift to the new demographic circumstances. In the United States, Congress commissioned the National Academy of Sciences to study the macroeconomic and policy implications of longer lifespans. The central finding of the American study was that the economic changes stemming from longer lifespans were driven by the patterns of who was living longer. In the US, there is a growing gap in longevity between lower and higher earners, with almost no change in longevity in the bottom half of the population and substantial gains in the upper half.[1] Canadian actuaries in both the public and private sectors have taken care to calculate the sensitivity of pension plans to changing longevity and have examined longevity differences between lower and higher earners.[2] However, until now there has been no study of long-term changes in longevity across earnings groups in Canada.

1 See the National Academy of Sciences, Engineering and Medicine (2015) for a detailed discussion of the growing gap in American life expectancy by income.

2 For example, the Office of the Chief Actuary (OCA) has included estimates of cohort life expectancies by level of pension (OCA 2016, Table 70) and Ahmadi and Brown (2018) investigate correlates of pensioner's mortality to inform the assessment of pension plans.

In this paper, we examine the relationship between earnings and longevity in Canada using an administrative dataset of Canada Pension Plan (CPP) recipients. We measure how longevity differs across earnings levels. By repeating these calculations for individuals in different birth cohorts, we can observe if this earnings-longevity gradient is steepening – as in the United States – or if longevity is improving equally for everyone.

Our results show clear evidence of an earnings-longevity gradient, or upward slope, for Canadians born between 1923 and 1955, with the highest male earners outliving the lowest earners by eight years. For women, the earnings gradient is flatter than for men. Importantly, we find that the gap in life expectancy between high and low earners has not grown over time – improvements in longevity are evident across all earnings levels. This result is in sharp contrast with evidence from the United States.

The goal of the analysis is not to uncover causal relationships or the driving forces underlying these changes in longevity. Instead, we think that documenting the facts is an important step, both because how long one lives is an important aspect of well-being, and because these facts have important policy implications. As one example, the policy impact on pensions is direct. If those who are living longest are the ones with the highest annual pension benefits then the total costs of the pension payouts may be higher than expected. Moreover, differential longevity alters the net balance of pension contributions and pension benefits across high and low earners.

We begin this paper by discussing our approach and methods. We then present our main results showing the longevity gradient and how it has shifted. Finally, we explore the policy implications by showing how longevity affects the value of an annuity, which exemplifies the importance of our findings for various types of public and private pensions.

Measuring the Earnings-longevity Gradient

Our Approach

The mortality and life expectancy statistics most commonly used in Canada and around the world are derived from annual vital statistics. The number of deaths is compared to the population count to arrive at age-specific mortality rates. For a given year, these age-specific mortality rates are then combined to produce estimates of life expectancy, under the assumption that the prevailing age-specific mortality rates hold into the future.

There are two shortcomings to this usual approach. First, in Canada the vital statistics do not contain information on income, education, or other factors important for understanding how mortality varies across demographic and economic groupings. Second, the use of annual data to approximate life expectancy gives a distorted picture of the actual experience of different birth cohorts. We may want to know how the actual life expectancy of those born in one decade differs from those born in another decade in order to understand whether longevity is truly shifting, and the usual approach does not deliver this information.

To overcome these shortcomings, we obtained access to the records of the Canada Pension Plan (see Box 1 for details). These data allow us to follow all Canadians born from 1923 to 1955 who have contributed to the Canada Pension Plan. We use 50 years of data, from 1966 to 2015, to line up Canadians' career earnings to their eventual patterns of longevity.

The CPP data we accessed provide a unique opportunity to study longevity in ways previous Canadian studies could not. For example, Wolfson et al. (1993) used the CPP administrative data to study the earnings-longevity gradient but was limited to ages 65 to 74 given the short period of time that records had been kept at the time of their study. Mustard et al. (2013) used 1986 Canadian census files merged to vital statistics and Boisclair et

Box 1: Canada Pension Plan Administrative Data

In cooperation with Employment and Social Development Canada, and the Statistics Canada's Research Data Centre program, we gained secure access to a subset of the files used by the Office of the Chief Actuary for its actuarial assessment of CPP. With records stripped of all identifying information, the database we use includes the records of anyone born 1923 to 1955 who has contributed at least once to CPP. We are able to observe their reported earnings every year since 1966, their date of birth, and date of death (if they have died), and their gender. We draw a sample of individuals alive at age 50 that is representative of the working population of Canada outside Quebec. More details about the database and our sampling can be found in Milligan and Schirle (2018).

al. (2015) used longitudinal survey data to study longevity, but the available data limited their ability to explore relationships over time. Baker et al. (2017) studied mortality at all ages by comparing across measures of socio-economic status aggregated to the Census Division.

Our data are representative of the working population of Canada, outside of Quebec. We consider men and women separately, recognizing that comparisons across cohorts of women are complicated because of the emergence of females in the workplace over the last 50 years, which changes the mix of women we can observe in our dataset through time.

Measurement of Earnings

Central to our approach is the proxy for lifetime earnings we use to sort people into earnings groups. The earnings measure we employ is average individual inflation-adjusted earnings from ages 45 to 49.[3] To calculate this, we first required that individuals had at least some earned income in at least four of the five years covering ages 45 to 49 to be in our sample. We experimented with various options, finding little sensitivity in our results to the size of the earnings window (see Milligan and Schirle 2018).

Using this measure of earnings, we categorize people into earnings 'bins' from highest to lowest earners by gender and year of birth. In this paper, we use both percentile bins (ranking individuals from 100 for the highest earners down to one for the lowest earners) and quintile bins (ranking individuals from five for the highest down to one for the lowest).

3 Ages 45-49 were chosen as a proxy for lifetime earnings. We can only include earnings before age 50, since we measure survival from age 50. We experimented with other age ranges and found the results not very sensitive to other age ranges. This is because of limited mobility within a cohort's earnings distribution. See Milligan and Schirle (2018) for details. We use individual earnings because we cannot link spouses, so family income or earnings are not available. However, Chetty et al. (2016) show in Supplementary Figure E9 that using individual vs family income makes little difference to income-longevity gradients.

Measurement of Life Expectancy

We aim to estimate a life expectancy for individuals who have survived to age 50 for each birth cohort and earnings group in our data. To do so, we require an estimate of survival from age 51 up to age 100, which we use as our upper age limit. In our data, which stop at 2015, we can see survival up to age 92 for the 1923 birth cohort, but only up to age 60 for the 1955 birth cohort. So, while we can directly observe survival rates for much of our sample, we are missing information for some cohorts at older ages that need to be filled in. We follow an established methodology to fill in the missing data.[4] The result is a complete block of survival rates between ages 51 and 100 for each gender, birth cohort, and earnings group considered. We take these estimated survival rates and sum them to obtain an estimate of life expectancy.

The Longevity of Canadian Workers

Our analysis begins by looking at the longevity of Canadians characterized by their earnings in 100 groups (percentiles). For this, we pool together the data across all our birth cohorts, born 1923 to 1955.

Figure 2 shows the ages that women and men can expect to live to, given they survived to age 50, across earnings percentiles. The top line shows a slight gradient for women's life expectancy, ranging from 83 years for the lowest earners to nearly 86 years for the highest earners. Because many women born between 1923 and 1955 did not have a strong attachment to careers outside the home, many of those in the lower earnings groups would have resided in households with substantial lifetime family earnings.

The second dashed line in Figure 2 represents the life expectancy of men. It ranges from 75 for the lowest earners up to 83 for the higher earners, a difference of eight years. Put differently, men in the highest earning group live 10.7 percent longer than those in the lowest earnings group. As a point of comparison, a similar analysis of American men by family income percentile finds a range of 14 years from bottom to top percentile (Chetty et al. 2016), so the gradient in Canada is smaller than it is in the United States.[5]

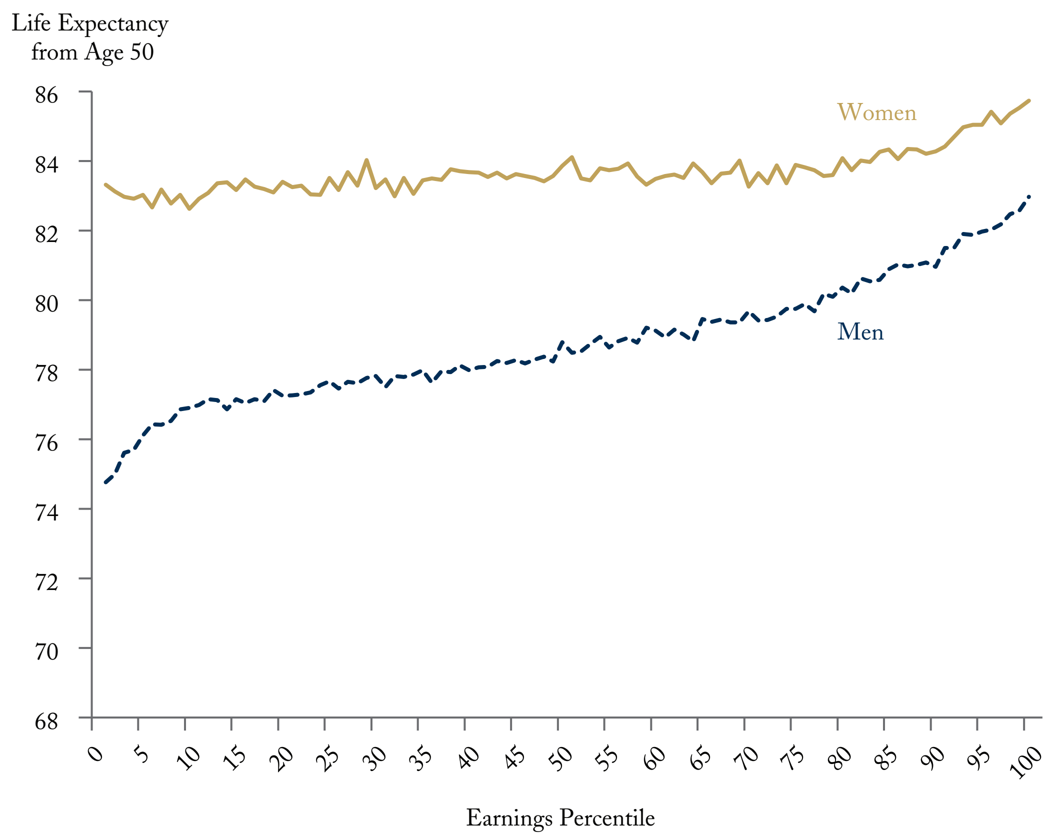
We next turn to examining how this earnings-longevity gradient has changed through time, to see if the Canadian gradient is steepening similar to the growing gap observed in the United States. We repeat our life expectancy calculations separately for those in our sample born in the 1920s and those born in the 1950s, this time categorizing individuals into five earnings quintile groups. We then take the difference in life expectancy by earnings quintile to arrive at the gain in life expectancy across cohorts.

Figure 3 displays the gain in life expectancy between the 1920s and 1950s birth cohorts for women and men by earnings quintile. For women, the pattern is mixed, with the gain in life expectancy peaking at 4.9 years in the middle quintile. Of course, because more women born in the 1950s were working than those born in the 1920s, this result embeds a different mix of women in the population of workers.

4 Like Chetty et al. (2016), we use Gompertz projections (linear regression on log mortality) to fill mortality rates from ages 76 to 89 and cross-section mortality rates for ages 90-100. See Milligan and Schirle (2018) for details, checks on the methodological assumptions, and breakdowns of the results by decade.

5 Because of greater income inequality, the income percentile cutoffs for the US are different than Canada. In Milligan and Schirle (2018, figure 6) we re-evaluate our Canadian data using income cutoffs derived from the US income distribution. Using the US income cutoffs, the gradient changes only slightly.

Figure 2: Life Expectancy from Age 50 by Earnings Percentile



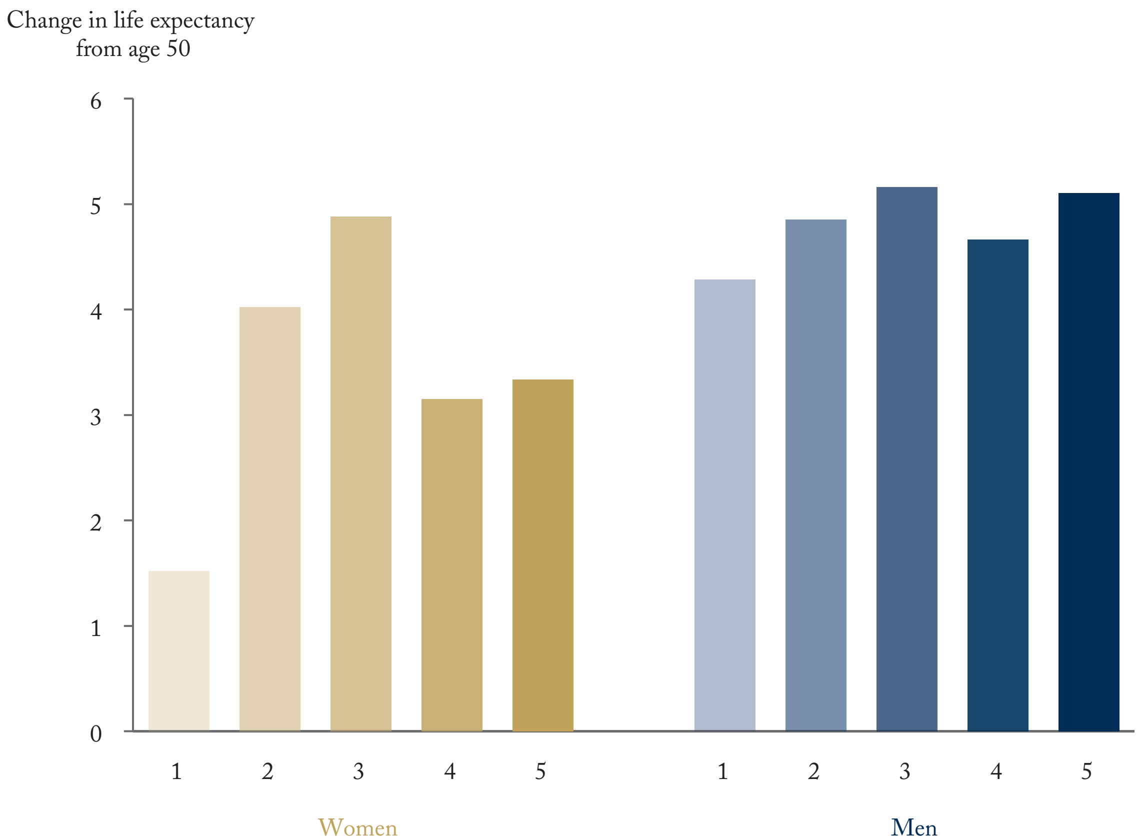
Source: Authors' calculations using the CPP administrative data files.

For men, the gains in life expectancy across quintiles are within a fairly narrow band of 4.3 to 5.1 years. In other words, the gains in longevity are very similar for high earners and low earners. The difference from the US experience is stark. In the landmark study of the National Academy of Science Engineering and Medicine (2015), changes in US life expectancy between the 1930 and 1960 birth cohorts are negligible in the bottom two quintiles but is nearly seven years for the top quintile. So, while the growth of longevity in the United States is sharply tilted toward high earners, longevity growth in Canada is almost uniform across earnings groups.

Discussion

Our data do not allow us to draw conclusions about the causes of the earnings gradient and its uniform shift in Canada and why it is different from the United States. Because our results reveal differences across earnings groups does not mean we can link earnings and longevity causally, and we don't offer any evidence in favour of a causal interpretation here. There are many factors that differ across birth cohorts and earnings groups that could contribute to the phenomenon we have uncovered. In this section, we discuss several of these factors.

Figure 3: Growth in Life Expectancy between the 1920s and 1950s by Earnings Quintile



Source: Authors' calculations using the CPP administrative data files.

The first factor to consider is healthcare. While access to healthcare is an important difference between the two countries, it is important to recognize that the birth cohorts we compare here (1920s to 1950s) were born before public health insurance became widespread in Canada in the 1960s. Moreover, the Medicare program in the United States provides universal health coverage to American seniors from the age of 65. So, while health insurance may contribute to the US-Canada difference in earnings-longevity gradients, the impact would have to be through middle-age health insurance coverage. Still, this may be an important factor.

The second factor to consider is government transfer income. While for the lowest earners the current Canadian tax and transfer system is more distributive than the US, it is harder to maintain this explanation higher up the earnings distribution scale.[6] In the United States, the gains in life expectancy in the second lowest quintile of earnings are much lower than in Canada, and the impact of government transfers on those in the second lowest quintile in Canada is relatively small.

6 See Hoynes and Stabile (2017) for a comparison of US and Canadian social safety nets.

The third factor to consider comes through health behaviours, such as smoking, diet, and exercise. Evidence clearly suggests health behaviours are important to longevity.[7] However, for this explanation to hold, lower earners in the United States would have to show a differential decline in health behaviours compared to lower earners in Canada.

The underlying cause of Canada's difference from the United States may be a combination of these factors or some other determinant; our data do not allow us to distinguish the causal channel. We leave the investigation into the causes of Canada's distinctive pattern of longevity growth to future work.

Policy Implications

The implications of the earnings-longevity gradient and how it shifts over time are potentially large. People clearly value extra years of life very highly, and we should take notice of who lives longer simply as an important indicator of inequality of well-being. In addition to these broader ramifications, longevity differentials have important policy implications.

The importance of differential longevity can be illustrated with the following simple calculation. Consider an annuity that pays $1 each year from age 65 until one dies. From the point of view of someone age 50, what is this annuity worth? The calculation involves figuring out the expected present value of this flow, which depends on the discount rate and the probability one is alive to receive the payment at each age.

We calculate the expected present value using the following equation:

$$EPV_{50} = \sum_{i=65}^{100} \frac{\$1 \times Surv_{50}^{i}}{(1+r)^{i-50}}$$

where $Surv_{50}^{i}$ is the survival rate for someone at age i who is alive at age 50 and r is the discount rate. For this illustrative exercise, $r = 3\%$.

In Table 1, we show the result of this expected present value calculation across earnings quintiles and birth decades, for women and men. The differences in the annuity values reflect differences in the survival rates $Surv_{50}^{i}$ which vary by birth decades, sex, and earnings quintile. We show the expected present value of the annuity for each group, with differences in dollar terms and/or percentage terms.

For women born in the 1920s and in the lowest earnings quintile, the annuity from age 65 onward has an expected present value when the individual turns age 50 of $8.86. For those in the fifth quintile, the annuity is worth $9.32, or 5.3 percent more. This relatively small difference corresponds to the relative flatness of the earnings-longevity gradient for women.

7 Li et al. (2018) find that life expectancy gains from healthier lifestyles can add 14 years of life for men and 12 for women. Olshansky et al. (2012) attribute some of the widening longevity gap across education and race to harmful health behaviours. Cutler, Deaton, and Lleras-Muney (2006) also argue that education differences in the US are leading to widening differences in health behaviours, and review the causal evidence.

For men, the differences are much larger. An annuity for the 1920s cohort is worth $6.11 to the bottom quintile, but $7.99 to the 5th – a difference of 30.8 percent. In the 1950s, the difference across earnings groups is similar, at 27.9 percent. Looking down each column, men in the 1950s birth cohort with earnings in the first quintile would receive 26.6 percent more from an annuity than first quintile men born in the 1920s. For the 5th quintile men, the 1920s – 1950s spread in the value of the annuity was similar, at 23.8 percent. These are substantial differences in annuity values. The important point is that for each dollar of annual pension income promised, the present value of the annuity provided by that pension is much larger for those with higher earnings than those with lower earnings.

Table 1: Value of an Annuity

	Women		
	1st Quintile	5th Quintile	Difference (*percent*)
1920s	8.86	9.32	5.3
1950s	9.41	10.55	12.1
Difference ($)	0.55	1.22	
Difference (*percent*)	6.2	13.1	
	Men		
	1st Quintile	**5th Quintile**	**Difference (*percent*)**
1920s	6.11	7.99	30.8
1950s	7.74	9.89	27.9
Difference ($)	1.63	1.90	
Difference (*percent*)	26.6	23.8	

Notes: Each cell shows the expected present value of an annuity of $1 paid from age 65 to death, from the point of view of a 50 year old. The results are shown for the 1920s and 1950s birth cohorts, the 1st and 5th quintiles of earnings, and men and women.

Source: Authors' calculations.

These simple calculations illustrate why annuity markets are often presented as examples of a challenging insurance product. For any given price at which an annuity is offered to the public, those with strong longevity expectations will receive much more benefit than those with lower longevity expectations, causing asymmetries in the risk pool to arise.[8] As the pool tilts more toward the longer lived, the annuity will become an ever-worse deal for those with shorter life expectancy, leading to even fewer of them purchasing the annuity. In the extreme, these pressures can lead insurance markets to unravel.

Moreover, in employer-sponsored defined-benefit pension plans, there will be some degree of cross-subsidy between those who live longer and those who don't since the length of the pension payment period varies. This can result in substantial differences between 'winners' and 'losers', as demonstrated for the case of public-sector employment-based pensions by Young (2012).

Beyond private annuity markets, the differences in annuity value across earnings groups put our public retirement income system in a different light. When evaluating the way taxation and public programs affect the distribution of well-being across society, we may want to take note of the differential value of lifetime pension income across income groups. The targeting of some benefits like the Guaranteed Income Supplement and Old Age Security to lower and middle income seniors may be seen as partial compensation for shorter payout periods for Canada Pension Plan benefits.

8 Evidence of the impact of longevity on annuity markets can be found in Finkelstein and Poterba (2002), which studied UK annuities. They found that purchasers of annuities outlived those who did not buy annuities and that the price structure of annuities reflected these longevity biases.

Conclusions

In this paper, we provide new evidence on the incomes and longevity of Canadians. We show that there is a strong longevity gradient across earnings groups in Canada, with highest-earning women living three more years than the lowest-earning women. For men, the longevity gap between the highest and lowest earners is eight years – more than 10 percent of a lifespan. However, we find that this longevity gradient is fairly stable, with approximately equal gains over time for both high and low earnings groups. This finding is in stark contrast to the United States, where longevity growth has been concentrated in the top half of income groups.

We do not have evidence that the earnings-longevity relationship is causal – those with higher earnings may have higher education, different health habits, and other characteristics that drive their longevity more than the income itself. However, longevity is a highly valued aspect of well-being, so its distribution across different types of Canadians matters. Our findings also matter for pension policy. Private annuity markets are shaped by the longevity expectations of different potential purchasers of annuity products. In addition, the valuation of public retirement income programs should reflect the differing longevity of different groups of Canadians.

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This E-Brief is a publication of the C.D. Howe Institute.

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