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Nicholas-James Clavet, Mayssun El-Attar and Raquel Fonseca

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Replacement Rates of Public Pensions in Canada: Heterogeneity across Socio-Economic Status[1,2]

Nicholas-James Clavet, HEC Montréal and ESG UQAM

Mayssun El-Attar, McGill University and ESG UQAM

Raquel Fonseca, ESG UQAM and CIRANO

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Abstract

When individuals decide to retire from the labour force, different sources of income can help to maintain consumption and welfare. One of those is public pensions. Their importance as an income source varies greatly according to socio-economic status (SES). This paper analyzes how replacement rates (RR) of public pensions (OAS and GIS) and mandatory public pension benefits (C/QPP) vary across SES by using the Longitudinal and International Study of Adults dataset (LISA). Using the longitudinal nature of this survey, we compute and compare average RRs by SES. We specifically consider the role of education and health, and we study how living arrangements can explain RRs variations. To give an idea the average RR of public pensions for individuals in bad health is 32%, while it is 21% for those who report being in good health. Including public pensions and C/QPP benefits, these numbers become 54% for those in bad health and 41% for those in good health. When estimating a multivariate regression model and controlling for past income, we find for couples, that past income does not eliminate differences in replacement ratio by individuals' characteristics. We argue that assortative mating plays a role in explaining the variation of replacement rates across individuals' characteristics.

Keywords: Replacement rates, retirement, Canadian public pensions, LISA
JEL Codes: H55, J26

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1 Introduction

Most countries aim to protect individuals from old-age poverty, and this prevention of elderly poverty relies heavily on public pensions. One characteristic of old-age poverty is its high persistence – exit rates from poverty are lower for old age individuals and poverty spells last longer. The reason for this high persistence is that once people stop working due to job loss or health issues, they are rarely able to increase again their income by finding a new job or a more lucrative one. Marital separations at the end of the career can also create a wealth shock that cannot be compensated by delaying retirement. Therefore, to avoid poverty for some individuals, the receipt of public pensions – which in turn depends on lifetime earnings – becomes crucial (i.e., Smeeding and Sullivan, 1998; Milligan, 2008; Veall, 2008; Shirlie, 2013; El-Attar and Fonseca, forthcoming, among others.)

In this paper we empirically measure the replacement rates (RRs) of older people to accurately evaluate the adequacy and generosity of the Canadian retirement pension system. OECD ranks the different countries on the generosity of retirement pension according to replacement rates derived from pension rules. According to their calculations, Canada's public pensions provide a gross replacement rate (before taxes) of 54.1% for people with half average earnings, 41.0% for people with average earnings and 28.5% for people with one and half average earnings. Canada is then ranked 23rd (out of 35) in the OECD for the generosity of its mandatory public pensions. The average replacement rate

in OECD is 64.6% for people with half average earnings, 52.9% for people with half average earnings and 48.4% for people with one and half average earnings (OECD, 2017).[3]

The OECD analysis accounts only for mandatory public pensions and employer-based pensions, but in Canada, private savings are an important contribution to retirement income, particularly for higher-earning Canadians. Although Baker and Milligan, 2009 argue that an analysis of Canadian replacement rates must include all sources of income, not just the public sources, in our analysis we follow the approach of the OECD and we use two main measures of replacement rates: one that uses only public pension income (Old Age Security (OAS), Guaranteed Minimum Income (GIS) and the Allowance) and a second one that uses also mandatory employment-based contributions (Canada/Quebec Pension Plan (C/QPP))[4]. We argue that by focusing only on public pensions and mandatory employment-based contributions, we can better understand what the level of income security is and how much of the pre-retirement living standards is guaranteed by the public pension system.

The goal of this paper is to compute updated replacement rates in Canada, and to gain a better understanding on how these replacement rates vary across individuals' demographics and socio-economic characteristics, such as past average income, gender, marital status or living arrangements, education level and health status. We also relate the replacement rates to an indicator of individuals' subjective financial well-being at

[3] OECD (2017) includes OAS, GIS and C/QPP when measuring replacement rate of public pensions.

[4] See https://www.canada.ca/en/services/benefits/publicpensions for a description of the different components of the pension system in Canada.

retirement. Understanding better the generosity of public pensions across individuals' characteristics will help us to better evaluate the adequacy and progressivity of the system.

In Canada, most papers compute aggregate replacement rates or use administrative data to compute individual RRs. The administrative longitudinal data reported from tax filings have the advantage to contain information on the same individuals over a long period of time and have detailed and accurate measures of individuals' income sources. However, this type of data lacks information on individual characteristics, like health or education, or measures of financial well-being, which are important to consider. In Canada, several papers have used the Longitudinal Administrative Databank (LAD) to compute RRs. See for example Larochelle-Côté et al. (2008), Ostrovsky and Schellenberg (2010), Baker and Milligan (2009), and Milligan and Schirle (2014).

Replacement rates have also been calculated using longitudinal survey data. This type of data allows to study the heterogeneity of replacement rates across individual characteristics, like family structure, health, education or labour market status. However, these datasets typically contain a short time series dimension, which makes the study of the RRs based on individuals' past earnings less precise. Several papers have used longitudinal survey data to compute RRs for Canada (see Boskin and Shoven, 1987; Smith, 2003; Munnell and Soto, 2005; Larochelle-Côté et al., 2008; Ostrovsky and Schellenberg, 2009; and Denton et al., 2011) and for other countries (see Nivakoski and Barret (2019) for Ireland, Khan et al. (2018) for the US, and Borella and Fornero (2009) for Europe).

Simulated synthetic data has also been used to analyze replacement rates. This approach combines administrative and survey data to generate income distributions. Macdonald et al. (2016) follow this approach to compute RR, using the Statistics Canada's Life Paths dynamic micro-simulation model. Although this is a useful and interesting approach, the RRs calculated this way are highly relying on the specification used to match or simulate the data. Heterogeneity across individuals must then be interpreted with caution.

In contrast to these studies, we use the *Longitudinal and International Study of Adults* (LISA), which includes survey and longitudinal administrative data. The survey component of the data allows us to obtain information on individual demographic and socio-economic characteristics such as the respondent's level of education and their health status. We also know their reasons for retirement (we know, for instance, if they retire earlier because of a health shock) and we have information on the financial well-being of the respondents. From the longitudinal administrative component of the data, we also have access to retrospective earnings records that allow us to accurately measure the replacement rates.

There is a large international literature that analyses the adequacy of the retirement income by measuring the of replacement rates of the retirees (i.e., Smith, 2003; Borella and Fornero, 2009; and more recently Nivakoski and Barret, 2019; or Khan et al., 2018) and even if cross country comparisons are limited, due to the availability of comparable data sources, some have been carried out (see Hauser, 1997; Disney, Mira D'Ercole and Scherer, 1998; Förster and Pellizzari, 2000; and Disney & Johnson, 2001). From the review

of the literature, it appears that different definitions of replacement rates have been used. Our main definitions of replacement rates are based on the retirement income considered: one includes only public pension income (RR_1) and the other one also includes C/QPP (RR_2). But replacement rates can also vary in terms of the working-life income considered. A review of the literature reveals that researchers have used different ways of measuring working -life income (e.g: pre-tax or after-tax earnings). Since we aim for our measures to be as comparable as possible, we summarize the main measures of working-life income used in the literature and we show that our results are robust to these different specifications.

Our main results show that replacement rates differ with individuals' characteristics: replacement rates are higher for females, less educated individuals and for those reporting fair or poor health. When we estimate a multivariate regression model and we control for past income, we find that for individuals living in couples, past income does not eliminate differences in replacement rates by individuals' characteristics. We argue that assortative mating plays a role in explaining the variation of replacement rates across individuals' characteristics. We find that the fact that pensions depend on past household earnings, not just individual earnings, increases the progressivity of the system.

2 Data and Stylized Facts

We use four waves of the Longitudinal and International Study of Adults (LISA). This longitudinal dataset contains survey data collected every two years between 2011 and 2017, and contains information on individuals' income, health status and demographics (such as

education or marital status). The survey also contains information on reasons for retirement and subjective measures of well-being. Moreover, LISA has been linked to administrative data sources (T1 and T4 files) going back to 1982. This retrospective component of the data allows us to study the evolution of earnings and income for both respondents in the family, and therefore to compute each individual's replacement rate. Combining the survey component with the longitudinal retrospective data component, we can then investigate if differences in replacement rates can be attributed to individual characteristics, and how replacement rates correlate with an indicator of subjective financial wellbeing.

Table 1 shows the distribution of characteristics in our dataset. For each characteristic, we also show the mean, the median and the standard deviation of the past average earnings used to compute the replacement rates in the next section. We can see that the differences in past average incomes across individual's characteristics are important. Male earnings are on average 40% higher than female earnings (mean of $77,400 vs $55,300). When we compare individuals by their educational level, we see that those with a university degree have average past earnings 123% higher than those without a diploma (mean of $94,700 vs $42,400). We also see that past earnings standard deviation increases with education level ($25,600 for those without a diploma compared to $62,900 for those with a university diploma). Half of the individuals in our sample report having excellent or very good health. For those individuals, past average earnings are 43% higher than for those who report having fair or poor health (mean of $74,300 vs $51,800). Standard deviation is again higher for people with excellent or very good health than people with fair or poor health ($55,700

compared to $32,400). These patterns are in line with those typically found in the literature for working-age individuals.

Most of the individuals in our sample (74%) are retired and not currently working. In terms of past average earnings, we do not observe much of a difference between those who work and those who do not work. In our sample, 17% of respondents have been born outside Canada. The distribution of past earnings for this group is different than the distribution for those born in Canada. Both groups have similar median earnings, but the individuals born outside Canada have a lower mean, indicating a thinner right tail of their earnings distribution. This statement is reenforced when looking at the standard deviation of these two groups ($75,900 for those born in Canada compared to $55,400 for those born outside Canada). Only 2.2% of our sample were classified as poor[5] in 2009 (that is, eight years before we measure replacement rates). The median of past earnings is much lower for the poor ($19,800 compared to $50,300), but its standard deviation is much higher ($75,500 compared to $57,600).

[Insert Table 1]

3 Replacement rates

Several methods of calculating RRs have been used in the literature. Researchers have built RRs differently depending on their research questions or on their data constraints. If the objective is to shed some light on the adequacy of retirement incomes in the population,

[5] We use the relative measure of poverty that is called LIM (Low Income Measure). It is defined by a threshold set at 50% percent of the median income.

these differences in measurement have to be taken into account. RRs are usually computed with retirement income as numerator and "income" earned during a certain period of an individual's life as denominator. The measurement of past income (or earnings) used to compute the RR varies across studies. Some use working-life income, others compute permanent income, and others still prefer to look at earnings in different age ranges (more stable working ages or last years of working life). Income can also be measured before or/and after-tax. These different measures result in different RRs, and all provide important information. La Rochelle-Côté et al. (2008), for example, computes RRs using the after-tax family size average income (ages 54-56) in the denominator and pension as well as labour market income (ages 55-77) in the numerator. This measure is not exactly a RRs for retirees but gives an indication of adequacy income at older ages. Other example in the literature is in Borella and Fornero (2009) that compute the RRs using, in the denominator, the net income from work in the year prior to retirement, that gives information about the income shock that individuals have just retired.

Using the retrospective component of the administrative data, we compute the amount of public pension that each person receives, and we obtain information on the evolution of their past income and earnings to compute the replacement rates. Our main measures of replacement rates are defined as:

$$RR_1 = \frac{(OAS + GIS + Allowance)}{Past\ Average\ Earnings}$$

$$RR_2 = \frac{(OAS + GIS + Allowance + C/QPP)}{Past\ Average\ Earnings}$$

In the first definition (RR_1), public pensions are defined as the sum of the Old Age Security pension (OAS); the Guaranteed Income Supplement (GIS); and the Allowance. In the second definition (RR_2) we also include Canada/Quebec Pension Plan (C/QPP).[6] Receiving the retirement benefit is based on age and working experience. Individuals can start to collect their pensions at age 60 for C/QPP and 65 for OAS. Our statistical unit is the census family. The pre-retirement earnings used as baseline capture the past pre-tax average earnings when the individuals were in the more stable ages of their career, 35 to 54 years old.[7] When the respondent reports living with a partner, we consider the public pensions received as a family and the average earnings of both individuals while they were 35 to 54 years old. Pension benefits and earnings are in 2011 dollars. We have also done robustness checks, using different measures of past income to construct the replacement rates. As our baseline, we use income related to central years of working life (35 to 54 years old), but we also check other measures as permanent income and income year prior to retirement. More detail about these different measures can be found in the robustness section.

Our sample is composed of those individuals who are between 66 and 69 years old in 2018.[8] For each individual, we know their sex, their marital status, their working status, their place of birth (i.e. whether they were born in Canada or abroad), and their level of education.

[6] See Milligan (2008), Veall (2008), Schirle (2013), and El-Attar and Fonseca (forthcoming) among others and official information in https://www.canada.ca/en/services/benefits/publicpensions.html to have a full description of Canadian public pension.

[7] In the robustness section, we also compute the replacement rates using three different measures of past earnings (or income): i) using average pre-tax earnings from age 18 until retirement, and ii) using average after tax income.

[8] Results are qualitatively similar if we restrict the sample to individuals who were 66 in 2018, but the sample size is considerably smaller.

Working status is an indicator that takes the value 1 if the individual reports to be still working. We consider four levels of education: no diploma, less than high school, some college, and university or more. Marital status is divided in four categories: single, married, divorced or widowed. We also relate replacement rates to individual past income; we consider the quintile of career average earnings. We also use an indicator of poverty that takes the value one if the individual's income in 2009 was 50% below the adjusted median household income of that year. Health is an important variable in our analysis. To measure health, we use a self-reported indicator that takes three values: excellent health, good health, and fair or poor health. RRs will be also compared with an indicator of financial well-being where individuals are asked whether their retirement income is sufficient to comfortably cover living expenses.

Figure 1 shows the distribution of replacement rates in our sample, using a kernel density plot. The mean of RR_1 is 25%, with a standard deviation of 18.9%. The distribution is right skewed, with a median of 18.8%. Most of the mass of the distribution lies between zero and 40%, with a small fraction of individuals having higher replacement rates. For RR_2, which also includes the C/QPP, mean and median are higher, at 46% and 40.6%, respectively, and the distribution is more symmetric. There is substantial dispersion, with a standard deviation of 24%. These mean replacement rates are in line with those found in the literature (see OECD, 2017).

[Insert Figure 1]

In Table 2, we break down the replacement rates by individual characteristics. We report the mean, median and standard deviation of RR_1 and RR_2 for each demographic group. In

general, medians are lower than means indicating that the distribution of RRs is skewed at right across group of variables. Higher replacement rates groups tend to have higher standard deviation too, meaning that more vulnerable groups have also higher inequalities in them.

Furthermore, results show that replacement rates are lower for men. Females have 50% higher replacement rates when we use RR_1. This difference reflects the fact that women are more likely than men to receive the allowance, which typically benefits widows, and that they have lower past earnings on average. The RR_2 is about 20 percentage points larger for both groups, indicating receipt of similar C/QPP benefits relative to earnings.

The replacement rates also decrease with the level of education, reflecting higher earnings in higher education groups. When we compare RR_1 and RR_2, we see that including the C/QPP increases the replacement rates by 22 percentage points in all categories of education except for those with a university degree. For levels lower than university, this again reflects similar C/QPP replacement rates. The exception occurs for university graduates, for whom C/QPP benefits add less to the replacement rate than they do for other groups. This reflects the cap on benefits in the C/QPP system.

Table 2 also shows that the replacement rates are higher for individuals who report having fair or poor health when old. When using RR_1, we see that individuals with fair or poor health have replacement rates 50% higher than those with good health. The difference in replacement rates reflects earning differences across health groups. For those in good, fair or poor health, again RR_2 is 22 percentage points higher than RR_1. The difference is smaller for those in excellent or very good health, due to the cap on C/QPP benefits.

A potential concern is that health may affect the age at which individuals claim their pensions, which could reduce the replacement rates of those individuals. In Table 2, we show that even for those whose reason for retirement was health, the difference in the replacement rates is maintained. Therefore, we conclude that higher replacement rates for individuals with poor health is explained at least partly by the fact that individuals in bad health have lower past earnings, as seen in Table 1. Nevertheless, we can see that the median RR_1 for people who say that they retired due to personal health or disability issues is nearly the half of the mean (0,159 comparted to 0.285). This result suggests a bimodal distribution for people retired due to personal health or disability issues. One part with high replacement rates and another part with lower ones. This statement is less preeminent with RR_2 but it is still noticeable.

[Insert Table 2]

Individuals living alone have 30% higher RR_1 than individuals living in couples. When we include the C/QPP this difference is 26%. Replacement rates are 21% higher for widows or widowers compared to other individuals. It has already been noticed in the literature that marital status plays an important role in explaining differences in replacement rates (Larochelle-Coté, et all (2012)). Widows and widowers have access to survivor benefits from C/QPP, while divorced individuals or singles do not.

Replacement rates are also much higher for individuals who were classified as poor in 2009 (90% higher on average). The difference decreases when we include C/QPP. This reveals that the design of the OAS and GIS is particularly targeted to help those individuals with lower past earnings, while the C/QPP benefits are proportional to past earnings.

There is no statistical difference in replacement rates between those born in Canada and those not born in Canada, and between those currently working and those currently not working.

4 Regressions

Replacement rates vary systematically with demographics. However, demographics are correlated, and different demographic groups also differ systematically in past earnings. For example, most widows are female and have lower career earnings and less education. Lower career earnings are also associated with worse health outcomes. It is therefore important to quantify if these characteristics have systematic effects on the replacement rates on their own, or if their effects simply capture differences in past earnings across demographic groups. Therefore, we next use a multivariate regression model to estimate the correlation between the replacement rates and the different individual characteristics that we found relevant in the previous section.

4.1 Overall results

Table 3 shows the coefficients from these regressions. In these regressions, we include different socio-demographic factors, health outcomes, and measures of past income. We also include a dummy that indicates if the individual is currently working and a dummy that indicates if the individual was born in Canada or abroad. Overall, the multivariate regression results are mostly in line with those of the bivariate regressions. However, there are a few exceptions, as discussed below.

We control for the effect of past earnings in two ways. In column 1, we include a dummy for past poverty. In column 2, we include quintiles of past earnings. Clearly, past income contributes to differences in replacement rates. Past poverty increases the replacement rate by 10 percentage points, conditional on other demographics.[9] Past earnings are a highly statistically significant predictor of the replacement rate; however, the relationship is not linear: The replacement rate RR_1 does not decrease between earnings quintiles four and five. This reflects the fact that the OAS represents a small fraction of the retirement income for the individuals in these quantiles.

[Insert Table 3]

Women have higher replacement rates. This effect persists when we control for living arrangements, marital status, or other demographics. It also persists when controlling for past poverty. However, the coefficient on gender becomes small and insignificant once we control for past earnings quintiles. This does not reflect the effect of differences in the incidence of past poverty, as shown in the first column. Instead, it reflects that overall, the distribution of past earnings for women differs from that of men. These cumulative differences imply a higher replacement rate.

The effect of education on replacement rates is interesting. We clearly saw in the descriptive statistics that education was negatively related to the replacement rates. Education is positively correlated with past average income. So, one would have expected that after controlling by past average income the correlation of education with replacement

[9] Previous work (El-Attar and Fonseca forthcoming) shows that public pensions are likely related to decrease of poverty rates in Canada. For example, most of those who are poor in 2009 are not considered poor in 2017 with a positive association to the redistributive nature of the public pension system.

rates would be fully explained. This is not the case. The correlation continues being negative and statistically significant. One possible explanation for this is assortative mating. If more educated individuals have partners with higher past earnings, they have a lower replacement rate, even conditional on their own past earnings. Regressions shown below that separate singles and couples will shed further light on this issue.

Worse health is also associated to higher replacement rates. Again, this could partly reflect the effect of lower past earnings for those in fair or poor health. However, the regression results show that the health variables included in our models are always statistically significant, even when controlling for various measures of past earnings. A possible explanation of this finding is assortative mating. If those with poor health and low earnings have partners with also low past earnings, they will have higher replacement rates, even conditional on their own past earnings.

When the C/QPP is included in our measure of replacement rates, we obtain stronger correlations with health and education. The coefficients on income quintiles themselves are different for RR_2, and do not flatten out between quintiles 4 and 5. This reflects the fact that those in past earnings quintile 5 are affected by the cap on C/QPP benefits, which reduces their replacement rate relative to those in the quintile below. Finally, for RR_2, the coefficient on gender remains positive and significant when controlling for past earnings quintiles. However, it is small, implying that most of the raw difference in RR_2 between men and women is explained by differences in earnings and other characteristics, not gender.

4.2 Assortative mating

We have mentioned assortative mating as a possible explanation on why the replacement rates differ across health status and educational level. To understand better the role of assortative mating, we estimate our models for singles and couples separately. Table 4 and 5 show the regression parameters of replacement rates (RR_1 and RR_2) on individual characteristics by marital status.

Results by marital status differ substantially; the first two columns in Table 4, show that for singles, once the level of past income is considered, the RRs do not vary across gender, educational level or health status. For couples the variation across gender, education and health remains, even after controlling for past income. These patterns are similar when we use RR_2. These findings fit well with the explanation of the assortative mating. There is a broad consensus in the literature about the fact that there is assortative mating among couples at all levels of education (e.g: Eika, Mogstad and Zafar, 2019) and by innate health (see Guner, Kulikova and Llull, 2018).

[Insert Table 4]

In column 1 of Table 5, we see that RRs of singles are more correlated with health status than those of couples (column 3), but it is the reverse with education level. When income quintile is included in the regression (column 2), parameters for gender, health status and education level approach zero and are no longer significant with singles. A similar effect is observed for couples but parameters for health status and education level are less affected (column 3 and 4). These observations suggest that past income mainly explain variations in replacement rates for singles but that other factors linked with education explain

replacement rates for couples. This effect could come from the positive correlation between education level of spouses. Even after controlling for past earnings of a spouse, RRs stay correlated with education level since people in couple with higher education level tend to have more educated spouse that have higher past earnings. RRs for couple are calculated at the household level since GIS is function of family income.

In table 5, we see that RR_2 parameter dynamics seem to be the same as RR_1, except that single's parameters are greater and more significant for RR_2 when income quintiles are not included. This result comes from the fact that C/QPP benefits depends mainly on past earnings.

[Insert Table 5]

Concluding remarks of this section are that assortative mating implies that two individuals in the same quintile of past income but with different levels of education or health, could have different replacement rates because of their partner's income. Assortative mating matters. In general, assortative mating increases inequality, but in this case assortative mating makes the design of the public pensions much more progressive. Generating higher replacement rates to individuals who have characteristics associated to lower incomes, independently of their actual level of income.

5 Robustness

In Table 6 we show the results obtained using different measures of replacement rates. The difference between the three measures used is the definition of past average income. In columns 1 and 4 we report our base specification for RR_1 and RR_2 respectively; recall that

in the base specification we use the average of the pre-tax average earnings when the individual was between 35 and 54 years old (RR_1 and RR_2 respectively). In columns 2 and 5 we have used the average of the pre-tax average earnings for the individual whole career (18 years old to the last year before retirement).[10] In columns 3 and 6 we used after-tax average earnings when the individual is between 35 and 54 years old. The results are qualitatively similar. When considering RR_1, we see that the negative association of the replacement rates with education and the positive association with health strengthens when using the whole career (columns 2 and 5). This result shows that the end of the career (55 years old to age of retirement) has an impact on replacement rates but that it only strengthens trends observed during the core of the career. On the other hand, the use of after-tax earnings yields similar magnitude parameters than the baseline but with a greater variance. Testing for replacement rates with after-tax earnings is still useful since Baker and Milligan (2009) argue that taxes during the career are higher than during retirement. Not accounting for it could then leads to underestimate replacement rates.

[Insert Table 6]

The association with past income quintiles follows a similar pattern with the three different measures. The replacement rates decrease as the quintile of past income increases. Most action takes place at the lower 3 quintiles. Practically no difference is observed at the top two quintiles. The difference between the first quintile and the rest of quantiles is smaller when we include earnings starting at age 18 or when we use after tax earnings.

[10] We have also computed RRs with the pre-tax average earning prior to retirement. And the results are closer to this method, when we compute the whole career.

6 Conclusion and Discussion

In this paper we find evidence that replacement rates differ with individuals' characteristics: Replacement rates are higher for females, less educated individuals and for those reporting fair or poor health. When we estimate a multivariate regression model and we control for past income, we find that for singles, differences in past income fully account for differences in replacement rates. Hence, differences across characteristics only reflect difference in past income. For individuals in couples, in contrast, controlling for past income does not eliminate differences in replacement rates by individuals' characteristics. For instance, even after controlling for income, individuals with poor health have higher replacement rates than individuals with good health. The same is true for education, which is negatively related to replacement rates, even after controlling for past income. The fact that characteristics matter beyond past income, but only for couples, suggests a role for assortative mating in explaining the variation of replacement rates across individuals' characteristics. If more educated individuals have partners with higher past earnings, they have a lower replacement rate, even conditional on their own past earnings. The fact that pensions depend on past household earning, not just individual earnings, increases the progressivity of the system.

On the adequacy of replacement rate, we find that OAS and GIS alone (RR_1) give a relatively low replacement rate for people with no diploma (0.396) or with fair or poor health (0.326). The replacement rate for these groups becomes on average more interesting when C/QPP is added with a value of 0.623 for people with no diploma and 0.548 for people with fair or poor health. Nevertheless, we still find a lower proportion of people declaring

that their income during retirement is sufficient to comfortably cover their living expenses when education level is low (no diploma) or when heath is fair or poor. A relatively good replacement rate with public pensions and C/QPP doesn't seem to be enough for these groups. Hopefully, with the enhancement of C/QPP to a targeted replacement rate of 33%, and the 10% increase of OAS at age 75, we estimated that the replacement rate of these programs will reach 0.738 for people with no diploma and 0.654 for people with a fair or poor health. These improvements represent a replacement rate increase of 10 percentage points. Recent changes in the public retirement system will undoubtably improve the well-being of these groups, but more studies would be necessary to evaluate at what extent these improvements increase the satisfaction of income during retirement for most vulnerable groups of the society.

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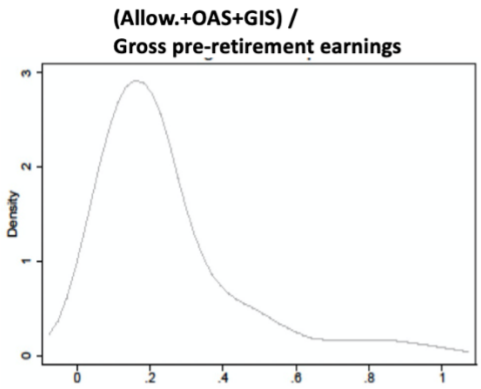
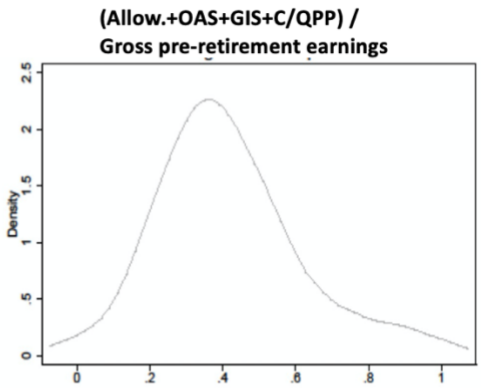
Figure 1



Mean	Median	Std. Dev.
0.250	0.188	0.189



Mean	Median	Std. Dev.
0.461	0.406	0.242

Tables

Table 1. Distribution of characteristics and mean, median and standard deviation of past average income

Variables	Proportion (%)	Past average earnings		
		Mean	Median	Std. Dev.
Total		65500	50,200	57,700
Gender				
Male	49.5	77,400	62,000	67,500
Female	50.6	55,300	45,000	45,500
Marital status				
Living alone	17.1	44,800	37,000	38,100
In couple	82.9	70,200	56,200	60,300
Education				
Without diploma	12.5	42,400	35,200	25,600
High school	39.5	59,100	56,100	32,300
College	24.8	57,900	62,000	29,000
University	23.0	94,700	83,200	62,900
Health				
Excellent or very good	50.1	74,300	62,400	55,700
Good	35.9	71,500	70,300	35,600
Fair or poor	14.0	51,800	49,400	32,400
Work Status				
Not working	74.1	65,600	50,300	57,800
Working	25.9	65,100	50,200	58,000
Birth Country				
Canada	82.9	78,400	52,200	75,900
Other	17.1	64,100	50,200	55,400
Poverty Status				
Not poor	97.8	65,800	50,300	57,600
Poor	2.2	48,800	19,800	75,500

Table 2. Mean, median and standard deviation of replacement rate (RR_1 and RR_2) according to characteristics

Variables	RR_1			RR_2		
	Mean	**Median**	**Std. Dev.**	**Mean**	**Median**	**Std. Dev.**
Total	0.250	0.188	0.189	0.461	0.406	0.242
Gender						
Male	0.209	0.162	0.164	0.402	0.365	0.198
Female	0.291	0.208	0.202	0.52	0.454	0.265
Marital status						
Living alone	0.310	0.207	0.233	0.555	0.485	0.302
In couple	0.236	0.182	0.173	0.438	0.396	0.218
Widowhood						
No	0.234	0.153	0.207	0.463	0.335	0.372
Yes	0.342	0.228	0.303	0.559	0.413	0.393
Education						
No diploma	0.396	0.301	0.246	0.623	0.569	0.265
High school	0.263	0.202	0.186	0.489	0.435	0.247
College	0.237	0.179	0.162	0.452	0.403	0.218
University	0.165	0.13	0.124	0.337	0.295	0.172
Health Status						
Excellent or very good	0.211	0.166	0.158	0.415	0.371	0.218
Good	0.276	0.202	0.209	0.493	0.421	0.265
Fair or poor	0.326	0.255	0.202	0.548	0.501	0.224
Retirement due to personal health or disability issues						
No	0.180	0.126	0.165	0.388	0.302	0.295
Yes	0.285	0.159	0.257	0.610	0.413	0.531
Birth country						
Canada	0.259	0.19	0.213	0.449	0.396	0.234
Other	0.244	0.184	0.179	0.455	0.404	0.235
Work Status						
Not working	0.265	0.193	0.202	0.474	0.414	0.252
Working	0.207	0.17	0.135	0.424	0.396	0.205
Poverty Status						
Not poor	0.237	0.182	0.173	0.449	0.399	0.235
Poor	0.471	0.391	0.281	0.641	0.562	0.275

Table 3. Regression of replacement rate (RR_1 and RR_2) on individual characteristics

Variables	**RR_1**		**RR_2**	
	(1)	**(2)**	**(3)**	**(4)**
Female	0.082***	0.012	0.127***	0.030**
	(0.014)	(0.010)	(0.019)	(0.013)
Good	0.026*	0.014	0.039*	0.022
	(0.015)	(0.009)	(0.021)	(0.014)
Fair or poor	0.093***	0.055***	0.147***	0.087***
	(0.027)	(0.017)	(0.035)	(0.021)
High school	-0.106***	-0.052**	-0.128***	-0.053**
	(0.034)	(0.022)	(0.042)	(0.026)
College	-0.127***	-0.058**	-0.145***	-0.048*
	(0.037)	(0.023)	(0.046)	(0.028)
University	-0.178***	-0.081***	-0.236***	-0.094***
	(0.035)	(0.022)	(0.044)	(0.026)
At work	0.002	-0.022**	0.024	-0.009
	(0.014)	(0.009)	(0.020)	(0.014)
Born in Canada	0.009	-0.002	0.033	0.021
	(0.019)	(0.012)	(0.023)	(0.015)
Poor	0.101**		0.107**	
	(0.041)		(0.053)	
Past earnings quintile 2		-0.314***		-0.380***
		(0.034)		(0.060)
Past earnings quintile 3		-0.468***		-0.590***
		(0.033)		(0.059)
Past earnings quintile 4		-0.523***		-0.672***
		(0.033)		(0.060)
Past earnings quintile 5		-0.551***		-0.743***
		(0.032)		(0.060)
N	803			

Table 4. Regression parameters of RR_1 according to marital status (singles and couples) and control variables

Variables	Singles		Couples	
	(1)	(2)	(3)	(4)
Female	0.086***	0.027	0.077***	0.014
	(0.031)	(0.019)	(0.016)	(0.010)
Good	0.057	0.009	0.020	0.013
	(0.040)	(0.023)	(0.017)	(0.010)
Fair or poor	0.145***	0.046	0.083***	0.040**
	(0.048)	(0.031)	(0.032)	(0.018)
High school	0.006	0.050	-0.132***	-0.072***
	(0.076)	(0.043)	(0.038)	(0.026)
College	-0.025	0.034	-0.148***	-0.083***
	(0.078)	(0.045)	(0.041)	(0.027)
University	-0.104	0.015	-0.194***	-0.101***
	(0.075)	(0.042)	(0.039)	(0.026)
At work	0.075**	-0.047**	-0.017	-0.015*
	(0.036)	(0.020)	(0.014)	(0.009)
Born in Canada	0.061	-0.012	-0.000	0.008
	(0.044)	(0.024)	(0.020)	(0.013)
Poor	0.102		0.105***	
	(0.090)		(0.040)	
Past earnings quintile 2		-0.293***		-0.305***
		(0.039)		(0.030)
Past earnings quintile 3		-0.571***		-0.404***
		(0.035)		(0.030)
Past earnings quintile 4		-0.701***		-0.447***
		(0.020)		(0.028)
Past earnings quintile 5		-0.762***		-0.476***
		(0.020)		(0.028)
N	144		659	

Table 5. Regression parameters of RR_2 according to marital status (singles and couples) and control variables

Variables	Single		Couples	
	(1)	(2)	(3)	(4)
Female	0.133***	0.033	0.116***	0.033**
	(0.045)	(0.024)	(0.021)	(0.013)
Good	0.075	-0.004	0.032	0.023
	(0.058)	(0.029)	(0.023)	(0.015)
Fair or poor	0.176***	0.009	0.141***	0.080***
	(0.063)	(0.039)	(0.041)	(0.023)
High school	-0.059	0.011	-0.149***	-0.069**
	(0.087)	(0.046)	(0.047)	(0.032)
College	-0.063	0.030	-0.165***	-0.079**
	(0.095)	(0.050)	(0.052)	(0.034)
University	-0.230**	-0.045	-0.240***	-0.107***
	(0.089)	(0.048)	(0.050)	(0.032)
At work	0.120**	-0.061**	-0.004	-0.003
	(0.053)	(0.025)	(0.020)	(0.016)
Born in Canada	0.091	-0.016	0.022	0.035**
	(0.069)	(0.037)	(0.024)	(0.015)
Poor	0.086		0.123**	
	(0.102)		(0.060)	
Past earnings quintile 2		-0.125**		-0.362***
		(0.050)		(0.046)
Past earnings quintile 3		-0.560***		-0.507***
		(0.041)		(0.046)
Past earnings quintile 4		-0.728***		-0.565***
		(0.024)		(0.046)
Past earnings quintile 5		-0.863***		-0.633***
		(0.027)		(0.045)
N	144		659	

Table 6. Regression parameters of replacement rate (RR_1 and RR_2) according to different measures of replacement rates (gross earning 35-54, gross earnings 18-retirement and after-tax income 35-54)

Variables	RR_1			RR_2		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Female	0.012	0.017	0.007	0.030**	0.082	0.109
	(0.010)	(0.021)	(0.010)	(0.013)	(0.074)	(0.134)
Good	0.014	0.033	0.031***	0.022	0.023	0.252
	(0.009)	(0.022)	(0.010)	(0.014)	(0.071)	(0.182)
Fair or poor	0.055***	0.080**	0.049***	0.087***	0.177	0.407
	(0.017)	(0.031)	(0.014)	(0.021)	(0.362)	(0.314)
High school	-0.052**	-0.121***	-0.044**	-0.053**	-0.308	0.148
	(0.022)	(0.040)	(0.021)	(0.026)	(0.368)	(0.394)
College	-0.058**	-0.174***	-0.055**	-0.048*	-0.390	-0.096
	(0.023)	(0.040)	(0.021)	(0.028)	(0.399)	(0.239)
University	-0.081***	-0.152***	-0.082***	-0.094***	-0.437	-0.063
	(0.022)	(0.044)	(0.022)	(0.026)	(0.377)	(0.295)
At work	-0.022**	0.025	-0.029***	-0.009	0.007	-0.119
	(0.009)	(0.027)	(0.010)	(0.014)	(0.043)	(0.090)
Born in Canada	-0.002	0.032	-0.018	0.021	-0.401	0.164
	(0.012)	(0.023)	(0.013)	(0.015)	(0.268)	(0.117)
Past earnings quintile 2	-0.314***	-0.193***	-0.293***	-0.380***	-1.118	-1.682**
	(0.034)	(0.053)	(0.028)	(0.060)	(0.825)	(0.720)
Past earnings quintile 3	-0.468***	-0.258***	-0.395***	-0.590***	-1.289	-1.864***
	(0.033)	(0.051)	(0.027)	(0.059)	(0.789)	(0.695)
Past earnings quintile 4	-0.523***	-0.325***	-0.432***	-0.672***	-1.337*	-1.937***
	(0.033)	(0.049)	(0.027)	(0.060)	(0.748)	(0.691)
Past earnings quintile 5	-0.551***	-0.335***	-0.460***	-0.743***	-1.376*	-1.971***
	(0.032)	(0.053)	(0.027)	(0.060)	(0.709)	(0.695)
N	803	597	843	803	597	843

Note: In columns 1 and 4, we used pre-tax earnings from age 35 to 54 as denominator to compute replacement rates. In columns 2 and 4, we used instead pre-tax earnings from age 18 to retirement, and in columns 3 and 6, we used after-tax income from age 35 to 54.