Research paper

Retirement Consumption, Risk Perception and Planning Objectives

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1 Executive Summary

1.1 Overview

The Ontario Retirement Survey (ORS), conducted by Saisai Zhang, Mary Hardy and David Saunders at the Department of Statistics and Actuarial Science, University of Waterloo, explores retirement consumption, risk perception and alternative objective functions and decision-making models in the retirement planning phase of Canadians' lives. The study carried out an online survey of 1,000 randomly selected Ontario pre-retirees and retirees aged 50 to 80, with the purpose of determining key elements of the retirement planning and experience of Canadians, including retirement age, subjective survival beliefs, private pension wealth and income, preferences among different consumption patterns, key risks concerning retirees and pre-retirees, and subjective time discounting factors.

This study is motivated by concerns regarding the adequacy of traditional applications of mathematical optimization to retirement planning problems. These applications typically focus on either the mean-variance tradeoff, or the maximization of expected discounted life-time utility derived from consumption and wealth. While the resulting optimization models have nice mathematical properties, it is not clear that the optimal portfolio strategies genuinely reflect the retirement planning concerns of individual Canadians. The ORS aims to explore the adequacy of the utility maximizing framework under risk-averse agents, by gaining a more complete picture of retirement planning concerns and behaviours of Canadians, and by comparing and contrasting observed preferences with preferences implied under such a theoretical framework.

The study explores three key areas. The first is the difference between expectations and experience among Canadian retirees, in particular, as it relates to longevity (life expectancy and survival rates), consumption (annuity prices and expected savings required to maintain a given level of income), and risk and variability of income (expectations of future income requirements and their variability). The second area relates to the current level of wealth in retirement, or savings pre-retirement (in particular in contrast to expectations). The third area addresses preferences and objectives. In this area, following in the vein of some of the literature on the elicitation of utility functions, survey participants are presented with a sequence of choices aimed at determining their risk and time preferences, and in particular in assessing whether the emergent preferences are well-represented by commonly employed utility functions and objectives

The survey was launched on September 20, 2016 and closed on October 13, 2016. The survey had a response rate of 7.7% and an average survey length of 27 minutes. The sample is reasonably well-representative of the population in terms of key demographic factors such as age, gender, marital status, household income, and retirement assets.

1.2 Main Findings

The main findings of this study are highlighted below.

- **Expected retirement age:** on average, pre-retirees expect to retire at a later age than retirees have experienced: the median and mean retirement age for retirees is 60 and 58.6, respectively; pre-retirees' expectation for the age of retirement has a median of 65 and a mean of 67.1.

- **The prevalence of low retirement wealth:** the study finds that a majority (61%) of the respondents have/expect relatively "low[1]" liquid retirement assets, with the phenomenon more pronounced for female respondents. Alarmingly, 10% have/expect less than $25,000 of liquid retirement assets and do not own their home or other properties, implying low living standards in retirement. Overall, 21% expect/have liquid retirement assets under $25,000, 40% under $100,000.

- **Severe underestimation of survival probability to an extreme old age:** while respondents have reasonable beliefs for their own life expectancies, there is strong evidence that they highly underestimate the probability of survival to at least age 95 or more. 92% of respondents report a subjective survival rate below the objective rate implied by the most recent life table, 27% believe that they have zero chance of surviving to age 95.

- **Retirement income expectations:** overall, when compared to retirees' experience, pre-retirees have reasonable expectations regarding income in retirement from a variety of sources. Fewer pre-retirees (than retirees) have defined benefit (DB) workplace pensions, mirroring a shift away from DB arrangements. Pre-retirees expectations for social insurance pensions are quite strongly related to the highest level of education attained (which is positively correlated with financial literacy). Certain pre-retirees may underestimate public pension benefits due to a lack of knowledge of the Canadian retirement income system.

- **Retirement planning and spending concerns:** the four most importance concerns when making planning and spending decisions are: liquidity, consumption/income smoothing, inflation and longevity. Bequest and investment risk-taking are considered the least important. Concerns vary according to retirement wealth levels: high wealth respondents are more concerned with meeting home care or nursing home expenses than longevity risk; extremely low wealth respondents are more concerned with consumption/income smoothing. Female respondents, in general, are found to be more concerned than male.

- **Bequest motives:** bequest is generally viewed as fairly unimportant. Nonetheless, respondents with more dependents tend to have higher bequest motives. The strength of bequest motives is also found to be affected by when death occurs: respondents have mildly higher bequest motives if death were to occur earlier in life.

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[1]Below $200,000 for single respondents; below $300,000 for married/common-law respondents.

- **Seeking professional financial advice in retirement planning:** the overall attitude towards seeking professional financial advice is positive. Behaviour, however, is found to be strongly related to liquid retirement assets: respondents with low liquid assets show little interest in seeking advice, mainly due to affordability. In general, respondents show high concerns over potential issues such as accessing quality service, conflicts of interest, and frauds.

- **Attitudes towards life annuities:** the study found that respondents profoundly undervalue life annuities. 84% of respondents reported a subjective price that is below half of the average market price in 2015. Respondents additionally showed extremely low interest in purchasing annuities at any price, with top concerns being credit risk (i.e. the fear of provider default), a loss of flexibility and control, and a loss of financial security.

- **Risk preferences elicitation:** qualitatively, the average level of risk aversion among respondents is "moderate". The average elicited constant relative risk aversion (CRRA) parameter is between 1.74 and 2.48 for pre-retirees, and between 2.48 and 3.74 for retirees, implying that retirees are more risk averse. The elicited CRRA parameter is found to also depend on age, gender, education and wealth level, such that the female/less educated/poorer tend to be more risk averse.

- **Time preferences elicitation:** the median subjective time discount factor elicited is 0.997, and the mean is 0.965. 85% of the elicited factors are greater than 0.96, 71% are greater than 0.98. The two discount factors, 0.96 and 0.98, are commonly used in the retirement planning literature, and imply much stronger myopia in long-term problems than empirically observed in this study.

- **Decision-making under risky scenarios:** this quantitative section studies the descriptive validity of the traditional life-cycle investment approach to retirement planning, which is to maximize welfare measured by the expected discounted lifetime utility derived from real consumption. The study finds dramatic differences between the actual and implied choices under the welfare maximization framework.

  ▸ *Inflation-indexed pension versus steady pension:* the study of decision-making under risky inflation scenarios found that respondents, in general, lack the understanding of the long-term cumulative impact of inflation on the cost of living. This is manifested in the dramatic change in preferences when cumulative inflation impact is depicted. Respondents more concerned over the impact of inflation on the costs of living, and those with more optimistic longevity beliefs, are willing to "pay" more in exchange for inflation protection.

  ▸ *Equity-linked pension versus steady pension:* the study of decision-making under risky equity returns scenarios reveals that when choosing between an equity-linked pension and a steady pension, the potential for upside gain (in the equity scenarios) drives decision-making. It is also found that having a higher minimum income protection, which in most cases, provided by a social insurance pension income, induces more risk-taking behaviour.

2 Introduction

Traditional applications of mathematical optimization to portfolio selection problems for pension fund management and retirement planning typically focus on either the mean-variance tradeoff, or the maximization of expected discounted lifetime utility derived from consumption and wealth. While the resulting optimization models have nice mathematical properties, it is not clear that the optimal portfolio strategies genuinely reflect the retirement planning concerns of individual Canadians.

To address the concern regarding the adequacy of the utility maximizing framework under risk-averse agents, this study explores retirement consumption, risk perception and alternative objective functions and decision-making models in the retirement planning phase of Canadians. We carry out a survey of 1,000 randomly selected Ontario pre-retirees and retirees. The objective of the survey is to obtain a more complete picture of the retirement objectives of Canadians, and to compare and contrast them with the objectives that are commonly assumed in models of lifetime portfolio selection. We are interested in three key areas. The first is the difference between expectations and experience among Canadian retirees. In particular, as it relates to longevity (life expectancy and survival rates), consumption (annuity prices and expected savings required to maintain a given level of income), and risk and variability of income (expectations of future income requirements and their variability). The second area relates to the current level of wealth in retirement, or savings pre-retirement (in particular in contrast to expectations). The third area addresses preferences and objectives. In this area, following in the vein of some of the literature on the elicitation of utility functions, survey participants will be presented with a sequence of choices aimed at determining their risk and time preferences, and in particular in assessing whether the emergent preferences are well-represented by commonly employed utility functions and objectives.

The purpose of this study is to determine key elements of the retirement planning and experience of Canadians, including preferences among different consumption patterns, key risks concerning retirees and pre-retirees, and the subjective discount factors and mortality expectations. We further elicit quantitative risk preferences that will enable us to develop more realistic models for retirees' preferences and needs.

The report is organized as follows. Section 3 describes survey methodology. Section 4 discusses the design of the survey, which includes descriptions of each major section of the survey, and the assumptions and calculations made for the quantitative survey questions. Section 5 describes the data and assumptions used in the analysis. Section 6 assesses the representativeness of the sample, in terms of key demographic information, by comparing with the most recent census and national survey data. Section 7 provides an analysis of the survey data and detailed discussions of their implications. Sections 8 and 9 conclude and discuss future work, including possible improvements and extensions to the survey design. The survey questions are included in Appendix A. Appendix B reports the economic and pension scenarios used in the survey.

The survey is conducted in conjunction with the University of Waterloo's Survey Re-

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search Centre. The survey has received ethics clearing from the Office of Research ethics at the University of Waterloo. We acknowledge the support of the Canadian Institute of Actuaries, the University of Waterloo, and the Natural Sciences and Engineering Research Council of Canada (NSERC).

3 Methodology

The Ontario Retirement survey (the survey, or ORS) was administered by the online panel firm Leger, officially launched on September 20, 2016 and closed on October 13, 2016. A total of 1,001 completed and 10 partially-completed survey responses were collected. The average survey length of a completed survey was 27 minutes.

The target group of participants was 1,000 Ontario residents aged 50 to 80, with 500 self-identified as retired and 500 as pre-retired. Other demographic data such as gender, marital status, age group and urban or rural residence were monitored. An email was first sent by the panel firm to collect information regarding age, region of residence, and retirement status. A second email was sent, inviting the member to participate, if they satisfied the condition for completing the survey (i.e. belonged to the target group). During the launching period, invited members would receive up to two email reminders if they had not yet completed the survey. In total, 13,275 unique invitations and 6,100 reminders were sent. Detailed invitation timeline is included in Table 1.

Date	Number of invites	New/Reminder
9/20/2016	200	New (Soft Launch)
9/22/2016	2000	New
9/23/2016	2250	New
9/26/2016	3000	New
9/27/2016	500	New
9/28/2016	400	New
9/28/2016	900	Reminders
10/3/2016	100	New
10/3/2016	1400	Reminders
10/4/2016	1000	Reminders
10/6/2016	1500	New
10/7/2016	1250	New
10/11/2016	1075	New
10/11/2016	2800	Reminders
10/12/2016	1000	New

Table 1 Survey contact timeline (source: Survey Research Centre, University of Waterloo)

Respondents[2] who accepted the invitation to participate (i.e. who clicked on the link to the web survey) were categorized as two group, Completed or Drop-outs. Completed respondents were those who reached the very end of the survey and exited from the "Thank

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[2]Used interchangeably with participants and subjects.

you for participating..." page (henceforth the "Thank you" page). Note that a Completed respondent needed not complete the survey by answering every question, since questions were allowed to be skipped. Drop-out respondents were those who last exited the survey before reaching the "Thank you" page. Note that respondents were permitted to exit and return to the survey by re-clicking on the invitation link. A Completed respondent was marked as a Speeder, if their total survey time was less than 1/3 of the medium survey time of the up to date sample. Speeders' responses were considered unreliable and were removed from the sample of Completed respondents. A Drop-out respondent was marked as Partially-completed, if a significant proportion of the survey was completed. Partially-completed respondents' responses were considered to contain sufficient information and were collected in addition to the Completed responses.

The survey had a total number of 306 Drop-outs, 16 Speeders, and 10 Partial-completes. Out of the 306 Drop-outs, 125 occurred on the instruction page which is a typical observation for web surveys. The survey has a response rate of 7.7%, which is lower than the typical response rates seen for web studies (10% to 15%). This is likely due to the length of the survey and the complexity of the questions being asked. A summary of survey completion breakdown is given in Table 2.

Category	Number
Completed	1,001
Partially-Completed	10
Drop-outs	306
Speeders (removed)	16

Table 2 Survey completion breakdown (source: Survey Research Centre, University of Waterloo)

4 Survey Design

The objective of the study is to develop a better understanding of the concerns and risk preferences of individuals who are either close to retirement, or who are already retired. It is designed to include four major sections[3]: Preliminary, Expectations and Experience, Preferences, and Retirement Planning Objectives. A short list of demographic information is collected at the end of the survey. The survey is designed such that the questions presented to participants are adaptive of answers provided in the earlier section of the survey, in particular, on gender (female, male), martial status (married, single), retirement status (pre-retired, retired) and wealth status (low, medium, high). As a result, respondents are gradually divided into 24 categories. This process allows the survey to target the questions to the respondents. For example, when asked about annuity purchases, a female-identifying respondent would be presented with an annuity price that is computed based

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[3]Section information is not shown to the respondents.

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on female mortality assumptions.

4.1 Preliminary & Expectations and Experience

The section 'Preliminary' is designed to identify relevant information such that the remaining part of the survey can be properly presented. The section 'Expectations and Experience' collects information on expected and actual retirement age; subjective life expectancy; expected and actual asset level at retirement (liquid and real estate); expected and actual retirement consumptions with income sources including private and public pension, annuities, investment and employment; subjective annuity prices; and attitude towards seeking professional financial advice.

4.2 Preferences

The section 'Preferences' elicits preferences towards risk and time. Risk preferences are elicited both qualitatively and quantitatively. Qualitative elicitation questions, for example, include describing risk taking behaviour in managing investable assets before and after retirement. Quantitative elicitation questions are more involved and require participants to make hypothetical "lottery" choices based on smaller and larger stakes. There exists a variety of experimental methods on eliciting risk preferences. For a review of commonly used methods, see Charness et al. (2013). In this study, we use the Eckel and Grossman method developed by Eckel and Grossman (2002). Specifically, participants are presented with two lists of payoff options. Each list consists of 10 options that have a 50-50 chance of giving a higher or a lower payoff. Participants are asked to choose ONE option they prefer the most. The list of payoffs based on smaller stakes is presented in Table 3[4], along with the expected returns, standard deviations and the corresponding implied range of CRRA parameters. This implied CRRA range assumes zero background consumption, and that the payoffs are immediately consumed upon being received.

In particular, let p_{il} and p_{ih} denote the low and high payoff of option i. Then, a participant with CRRA preference prefers option i to j if

$$\frac{u(\omega + p_{il}) + u(\omega + p_{ih})}{2} > \frac{u(\omega + p_{jl}) + u(\omega + p_{jh})}{2} \tag{1}$$

where $u(\omega + c) = \dfrac{(\omega + c)^{1-\rho}}{1 - \rho}$, ω represents background consumption and $\rho \neq 1$ is the parameter that governs the degree of risk aversion. The implied CRRA range can be obtained by solving for ρ such that chosen option yields the highest expected utility among all ten options.

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[4]The last three columns of Table 3 are not shown to the respondents.

Option	Low Payoff	High Payoff	Expected Return	Standard Deviation	Implied CRRA range
1	$10.00	$10.00	$10.00	$0.00	$9.73 < \rho < \infty$
2	$9.50	$11.00	$10.25	$0.75	$5.87 < \rho < 9.73$
3	$9.20	$12.00	$10.60	$1.40	$3.74 < \rho < 5.87$
4	$8.90	$13.00	$10.95	$2.05	$2.48 < \rho < 3.74$
5	$8.30	$15.00	$11.65	$3.35	$1.74 < \rho < 2.48$
6	$7.70	$17.00	$12.35	$4.65	$1.36 < \rho < 1.74$
7	$7.10	$19.00	$13.05	$5.95	$0.88 < \rho < 1.36$
8	$6.00	$22.00	$14.00	$8.00	$0.26 < \rho < 0.88$
9	$4.00	$25.00	$14.50	$10.50	$0 < \rho < 0.26$
10	$2.00	$27.00	$14.50	$12.50	$-\infty < \rho < 0$

Table 3 An example of a quantitative risk preference elicitation question with low stake options.

Time preferences are elicited quantitatively using the multiple-horizon treatment based on the experimental method introduced by Coller and Williams (1999) and extended by Harrison et al. (2002). Specifically, participants are asked to consider seven hypothetical *binary* payoffs that are made with certainty (i.e. no risk associated with the payoffs). The options are presented such that a lower payoff is made 1 month from today, and a higher payoff is made 13 months from today. Both options are designed to be future payoff options to avoid the potential problem of subjects facing extra risk or transaction costs with the future income option, as compared to the "instant" income option (for a more detailed discussion of the experimental design, see Andersen et al. (2008)). A total of 7 choices are made. The question is presented in Table 4.

Scenario	Payoff Option A (pays 1 month from today)	Payoff Option B (pays 13 months from today)	I prefer: **Option A**	I prefer: **Option B**
1	$1,000	$1,020	☐	☐
2	$1,000	$1,040	☐	☐
3	$1,000	$1,080	☐	☐
4	$1,000	$1,140	☐	☐
5	$1,000	$1,240	☐	☐
6	$1,000	$1,340	☐	☐
7	$1,000	$1,440	☐	☐

Table 4 Time preference elicitation.

A rational respondent should fall into one of the three cases: 1) always prefers option A, 2) always prefers option B, or 3) starts with option A then switches to option B (i.e. a unique switching point). The first case implies high impatience; the second low impatience; the third in-between. Responses that involve multiple switching points, or from B to A are difficult to interpret from a rational standpoint, and hence should be ignored in the analysis. Let p_{kA} and p_{kB} denote the payoff from Option A and B of scenario k. Assuming

the switching point is scenario i, the range of discount rates is obtained by solving the following two inequalities,

$$u(\omega + p_{(i-1)A}) + \beta u(\omega) > u(\omega) + \beta u(\omega + p_{(i-1)B}) \tag{2}$$
$$u(\omega + p_{iA}) + \beta u(\omega) < u(\omega) + \beta u(\omega + p_{iB}) \tag{3}$$

which yields,

$$\frac{(\omega + p_{iA})^{1-\rho} - \omega^{1-\rho}}{(\omega + p_{iB})^{1-\rho} - \omega^{1-\rho}} < \beta < \frac{\left(\omega + p_{(i-1)A}\right)^{1-\rho} - \omega^{1-\rho}}{\left(\omega + p_{(i-1)B}\right)^{1-\rho} - \omega^{1-\rho}} \tag{4}$$

When there is no switching (i.e. consistent choice of either Option A or B), then,

$$0 < \beta < \frac{(\omega + p_{7A})^{1-\rho} - \omega^{1-\rho}}{(\omega + p_{7B})^{1-\rho} - \omega^{1-\rho}}, \qquad \text{if Option A} \tag{5}$$

$$\frac{(\omega + p_{1A})^{1-\rho} - \omega^{1-\rho}}{(\omega + p_{1B})^{1-\rho} - \omega^{1-\rho}} < \beta < 1, \qquad \text{if Option B} \tag{6}$$

4.3 Retirement Planning Objectives

The section Retirement Planning Objectives presents participants with hypothetical retirement scenarios on annuitization and retirement income decisions under inflation and investment risk exposures. This section is an extension of the study conducted by Beshears et al. (2014), where participants are asked to make hypothetical annuitization choices. One main focus of Beshears et al. (2014) is the effect of framing in annuitization decision-making (for more details, see the cited paper). Our study focuses on annuitization and retirement income decision-making under risky scenarios (with minimal framing to avoid framing biases). The remaining section describes the survey questions and the way they are presented to the respondents.

4.3.1 Match-Inflation Pension

This section examines decision-making under risky inflation and comprises of two parts. In the first part, participants are given no extra information on future inflation outlook (see Q22). In the second part, participants are provided with 10 possible scenarios of future costs of living (see Q23). The purpose is to study the impact of subjective inflation beliefs.

i. Subjective Inflation Beliefs – Q22

Participants are first asked to consider the following hypothetical scenario:

> Suppose that you are 65 years old and you are JUST about to retire. Your employer will pay you monthly pension income payments for the rest of your life. The pension will stop when you die. Your employer presents you with the following pension options:

1. **Match-Inflation Pension Option**: This option pays a monthly pension that increases at a rate that exactly matches inflation (i.e. the increase in the cost of living).

2. **Steady Pension Option**: This option pays a constant monthly pension that does not change.

Participants are then presented with six scenarios, with varying first monthly income payment under the Match-Inflation pension, as shown in Table 5. The dollar values are determined by the individual wealth level and gender, collected in the Preliminary section. Participants are prompted to choose either the Match-Inflation or Steady pension, under each of the six scenarios, meaning that six choices are made. At this stage, the choices are entirely based on each participant's subjective belief on future macroeconomic conditions.

First Monthly Income Payment		I would choose...	
Match-Inflation Option This option provides income payments that increase at the rate of inflation	Steady Option This option provides income payments that do not change	**Match-Inflation Option**	**Steady Option**
$1,551	$2,358	☐	☐
$1,650	$2,358	☐	☐
$1,752	$2,358	☐	☐
$1,857	$2,358	☐	☐
$1,965	$2,358	☐	☐
$2,358	$2,358	☐	☐

Table 5 An example of Match-Inflation pension option versus steady pension option under subjective inflation beliefs (high wealth & female).

ii. Objective Inflation Information – Q23

The next question repeats the previous hypothetical scenario but provides participants with *additional* information on inflation outlook. Participants are informed that inflation is targeted, but the actual rates can deviate from the target from year to year.

Consider the same hypothetical situation where you are 65 years old and JUST about to retire. This time, you will be provided with more information on what inflation will look like in the future.

Suppose the Canadian government targets inflation to be 2% per year, but the actual inflation in each year can be anywhere between 1% to 3%. You can expect inflation to be 2% per year on average for the rest of your life, but you do not know for certain what the actual future inflation rates will be.

To help you make a decision, the chart below presents 10 possible paths of how much things that cost $1 today could cost you in the next 35 years. Keep in mind there is an equal chance for any one of these paths to happen.

Future Cost of Something Worth $1 Today

Now, consider again the two pension options your employer presents you...

Respondents are asked to make the same choices as described in Table 5, with each choice supported with a chart of possible future pension payments. When prompted to make a choice, the respondent is reminded that future inflation is random, and that the Match-inflation pension has an equal chance of following any one of the ten coloured paths shown in the chart. An example of case 1 is given below:

Consider Case 1.

- If you choose the **Match-Inflation Pension** Option,
  - ▸ Your first monthly income payment will be *$1,551*.
  - ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension** Option,
  - ▸ Your first monthly income payment will be *$2,358*.
  - ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

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Monthly Pension Income

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Match-Inflation Pension Option

☐ Steady Pension Option

Respondents are shown the next case if they choose the steady option, with each succeeding case offering a higher starting value for the Match-inflation pension (as described in Table 5). The last case (i.e. case 6) is shown in Figure 1, under which the Match-Inflation pension gives strictly higher payments than the steady option. To minimize survey fatigue, at any point the respondent switches to the Match-Inflation option, the question terminates, skipping the remaining cases. The underlying assumption[5] is that the respondent would prefer the Match-Inflation option for the remaining cases since they give strictly higher payments.

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[5]We acknowledge that, in reality, certain respondents may make inconsistent choices.

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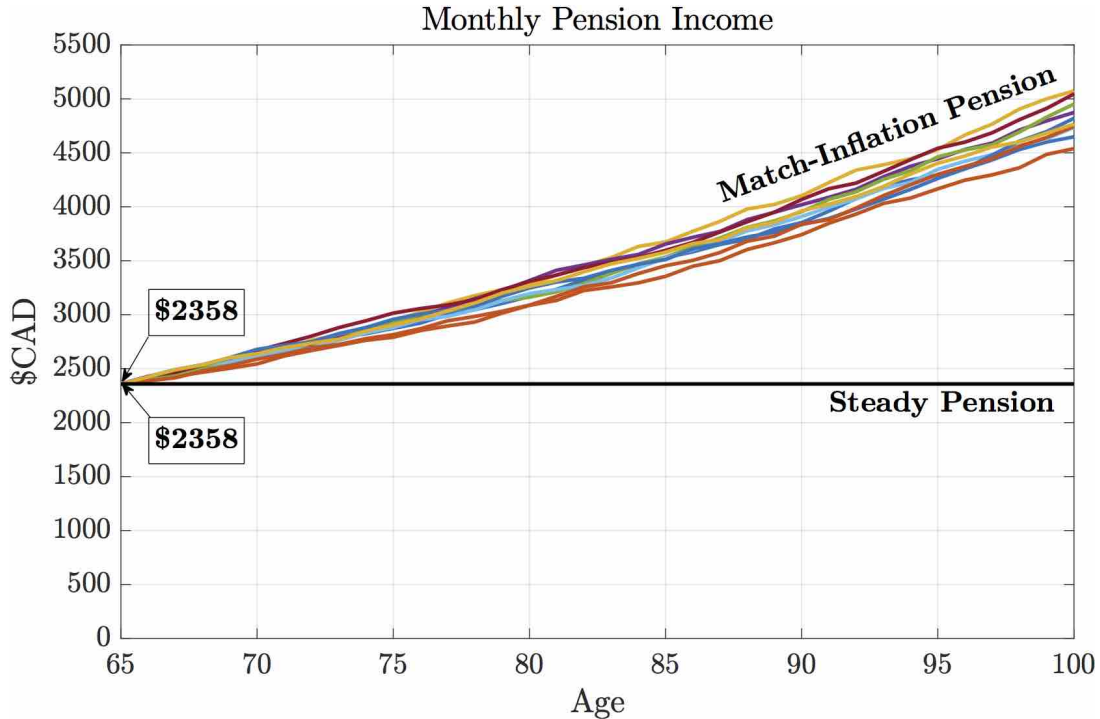
Figure 1 An example of the chart shown to respondents: Match-Inflation pension option versus steady pension option with objective inflation information given (high wealth & female, case 6).

We are interested in the point at which the respondent switches to the Match-Inflation option. Certainly, this is related to the subject's beliefs about longevity, inflation (single period and long term), and to a large degree, financial literacy. A follow-up question asks participants to rate the importance of four concerns/statements in making the choices regarding match-inflation pensions (see Q23A). Following this, an additional question is asked to assess participants' understanding (see Q23B). The first pension payments are summarized in Table 40 in the Appendix.

4.3.2 Equity-Linked Pension

The third section alters the pension scenario and introduces an Equity-Linked pension option. Participants are asked to consider the following hypothetical pension scenario:

> Suppose that you are 65 years old and you are JUST about to retire. Your employer will pay you monthly pension income payments for the rest of your life. The pension will stop when you die. Your employer presents you with the following pension options:

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1. **Equity-Linked Pension Option**

   This option pays a monthly pension with payments linked to stock market performance. Every year your pension will be re-evaluated based on the performance of the stock market. *This means that your pension income payments are uncertain and will experience some ups and downs.*

2. **Steady Pension Option**

   This option pays a constant monthly pension that *does not change.*

   To help you make a decision, for each case, we will present you *10 possible future paths of what your future monthly pension will look like under the Equity-Linked Pension Option.*

   Keep in mind there is an *equal chance* for any one of the paths to happen.

Participants are then presented with six cases (i.e. 1A, 1B, 1C, 2A, 2B, 2C). The cases differ in the annuity interest rate assumptions (AIRs) and risk exposures (i.e. equity allocation). For details, see Section 4.4. In essence, the equity-linked pension becomes increasingly risky from cases A to C (i.e. 1A to 1C, 2A to 2C). Compared to the steady pension, the upside gains and downside losses of the equity-linked option becomes more pronounced. The difference between the two sets of scenarios is in the average trend of the pension income. For 1A to 1C, the trend is *flat*, and for 2A to 2C, the trend tends *downwards*. We are interested in the degree to which the trend impacts decision-making.

An example of case 1C is described below:

Consider Case 1C.

- If you choose the **Equity-Linked Pension Option**,

  ▸ Your first monthly income payment will be *$2,808*.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be *$2,358*.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

Note the difference in the first monthly income payments.

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Monthly Pension Income

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Equity-Linked Pension Option

☐ Steady Pension Option

After making the six choices, a follow-up question asks participants to rate the importance of seven concerns/statements in making the choices regarding equity-linked pensions (see Q24A). Following which, an additional question is prompted to assess participants' understanding (see Q24B). The first pension payments are summarized in Table 41 in the Appendix.

4.4 Scenario Calculations, Economic and Mortality Assumptions

4.4.1 Pension Scenario Calculations

In this section, we describe the calculations of the hypothetical pension scenarios in the second last section of the survey. We start by assigning a hypothetical wealth level W, which can be thought of as the accumulated individual pension account balance at retirement. W is dependent on the participant's wealth status (i.e. low, medium and high) and is assumed to take the following values:

	Low wealth	Medium wealth	High wealth
W	150,000	300,000	500,000

Table 6 Hypothetical pension account balance at retirement (not disclosed to participants).

Let $t = 0, 1, 2, 3...$ denote time in years. Let $\boldsymbol{P_t} = \left(P_t^S, P_t^M, P_t^E\right)^T$ be the yearly pension income for the Steady, Match-inflation and Equity-linked pension options, respectively. Then the monthly pension income, $\boldsymbol{p_t} = \left(p_t^S, p_t^M, p_t^E\right)^T$, is computed as,

$$p_t^S = \frac{P_t^S}{12}, \tag{7}$$

$$p_t^M = \frac{P_t^M}{12}, \tag{8}$$

$$p_t^E = \frac{P_t^E}{12}. \tag{9}$$

Let $\boldsymbol{i} = \left(i^S, i^M, i^E\right)^T$ denote the AIRs. The pension income in the first year is,

$$P_0^S = \frac{W}{\ddot{a}_{65:i^S}^{(12)}}, \tag{10}$$

$$P_0^M = \frac{W}{\ddot{a}_{65:i^M}^{(12)}}, \tag{11}$$

$$P_0^E = \frac{W}{\ddot{a}_{65:i^E}^{(12)}}. \tag{12}$$

The annuity factor is computed using the approximation $\ddot{a}_x^{(12)} = \ddot{a}_x - \frac{11}{24}$, and is calculated based on gender-specific mortality assumptions described in Section 4.4.3.

Recall that each risky pension choice involves 10 economic scenarios (i.e. ten paths). The remaining section describes the calculation for *each economic scenario.*

i. Steady Pension

The Steady pension option pays a constant income stream, therefore for all $t > 0$,

$$P_t^S = P_0^S. \tag{13}$$

ii. Match-Inflation Pension

Let δ_t denote the annual inflation in year t, then,

$$P_t^M = P_{t-1}^M \left(1 + \delta_t\right), \qquad \forall t > 0. \tag{14}$$

iii. Equity-Linked Pension

Let r_t denote the annual total return on equity in year t, r_f denote the risk-free interest rate, and α be the percentage of equity allocation in the underlying fund invested, then,

$$P_t^E = P_{t-1}^E \frac{1 + r_f + \alpha(r_t - r_f)}{1 + i^E}, \qquad \forall t > 0. \tag{15}$$

4.4.2 Economic Assumptions

The used inflation scenarios are shown in Table 39 in the appendix. The scenarios are randomly generated from $U(0.01, 0.03)$, which reflects the most recent inflation-control target adopted by the Bank and the Government of Canada in 2016 that aims to keep inflation at 2% (and within a target range of 1% to 3%). The total log returns scenarios (i.e. $\log(1+r_t)$) used are described in Table 38 in the appendix. The scenarios are randomly generated from $N(0.04078, 0.18703^2)$, which is a common assumption used in the life-cycle retirement planning literature (see, e.g., Maurer et al., 2013; Blake et al., 2008; Horneff et al., 2010). The risk-free interest rate r_f is assumed to be 2%, which is set based on the Canadian long-term government bond yields in 2017.

The equity scenarios are handpicked to represent a reasonably wide-spread range of scenarios. One may argue that the scenarios are " too good to be true", or "not reasonably representative of reality", since the changes for the upside largely outweigh the downside. This is by design, as we are interested in whether the unlikely worst case scenario would have a significant impact on decision-making. We acknowledge that in reality, the downside frequency may be low but the severity may be highly significant, especially in the event of unfavourable systematic mortality shifts and stock market crashes.

The annuity interest rates (AIRs) used to compute the incomes in Q14, Q22, Q23 and Q24 are based on the average of the three most competitive hypothetical quotes at December 31, 2015, obtained in Committee on Pension Plan Financial Reporting (2016). The AIRs used for Q14 and the Steady pension option in Q22, Q23 and Q24 are 2.85%, based on the non-indexed annuity proxy. The AIRs used in Q22 and Q23 for the Match-Inflation pension options are:

Scenario	1	2*	3	4	5	6
AIR (i^M)	-0.51%	-0.06%	0.39%	0.84%	1.74%	2.85%

Table 7 Annuity Interest Rates used in the Match-Inflation Pension Options.

Among these, the asterisked scenario AIR $= -0.06\%$ is based on the CPI-Indexed annuity proxy, representing a realistic market quote in early 2016 (when the survey was designed). For Q24, the AIRs used in computing the Equity-Linked pension incomes are:

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Case	1A	1B	1C	2A	2B	2C
AIR (i^E)	3.45%	4.04%	4.53%	4.83%	5.66%	6.34%
Equity allocation (α)	40%	60%	80%	40%	60%	80%

Table 8 Annuity Interest Rates and equity allocation assumptions used in the Equity-Linked Pension Options.

4.4.3 Mortality Assumptions

The mortality assumptions used are Canadian Pensioners' Mortality Table 2014 (CPM2014) combined with mortality improvement scale CPM Improvement Scale B (CPM-B) with no adjustments for sub- or super-standard mortality (CPM2014proj), for both female and male[6]. Details on CPM2014 can be found in Pension Experience Subcommittee (2014).

Four questions in this survey require mortality assumptions: Q14, Q22, Q23 and Q24. In Q14, mortality rates are used to compute the default (i.e. when participants skip the previous question) maximum price for the monthly income of $100. In Q22, Q23 and Q24, mortality rates are used to compute the monthly pension incomes for the Match-Inflation, Steady and Equity-Linked pension options.

5 Data and Assumptions

Historical inflation rates are computed based on monthly Consumer Price Index (all items) in Ontario from January 1979 to October 2016, obtained from Statistics Canada (table 326-0020). At times, future inflation assumptions need to be made to convert expected future monetary values to the present. In these cases, inflation is assumed to be 2% per annum.

Some responses regarding wealth and income are collected over dollar intervals. In our analysis, responses are assumed to be the midpoints of the intervals. For example, if one selects $10,000 to $20,000, we assume a response of $15,000. This may bias the results, especially in cases where responses are concentrated in the lower end. This can be improved by always giving options for choosing $0. Nonetheless, obtaining an accurate estimate of actual values is difficult without compromising the participation/completion rate, since respondents are far more likely to choose an interval than to provide a point estimate.

6 Assessing Sample Representativeness

To ensure that the collected data is representative of residents in Ontario, a comparison to the most recent census and national survey data is conducted. Key aspects of interest

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[6]Recall that a participant's gender is identified in this study. In the event that the question on gender identification is skipped, male mortality assumptions are used.

are age, marital status, household income, retirement liquid assets and real estate/home ownership. The following data provided by Statistics Canada are used,

- 2011 National household survey (sample size 4.5 million),
- 2012 Survey of Financial Security (sample size 20,000),
- CANSIM Database (updated daily).

6.1 Age

Age Group	ORS 2016 Percentage	NHS 2011 Percentage
$50 - 54$	17%	25%
$55 - 59$	20%	21%
$60 - 64$	22%	19%
$65 - 69$	21%	14%
$70 - 74$	14%	11%
$75 - 79$	6%	9%
Sum	100%	100%

Table 9 Age Distribution of ORS 2016 and NHS 2011.

Comparison to the National Household Survey 2011 shows that the sample has a higher concentration in age group $60 - 69$ and a lower concentration in age group $50 - 54$. Considering that the Canadian population is on average aging, we conclude that the sample represents the population reasonably well.

6.2 Marital Status

Age Group	ORS 2016 Married	ORS 2016 Single	CANSIM 2016 Married	CANSIM 2016 Single
$50 - 80$	71.2%	28.8%	70.3%	29.7%

Table 10 Marital Status of ORS 2016 and CANSIM 2016.

Comparison to CANSIM data in 2016 shows that the sample well-represents the population in terms of martial status. Here, the married status described in CANSIM 2016 includes those in common-law relationships and excludes separated, widowed or divorced married couples not living common law.

6.3 Household Income

	ORS 2016			NHS 2011	
	Frequency	Percentage	Cumulative	Percentage	Cumulative
Below $25,000	101	10%	10%	16%	16%
$25,000 to $49,999	185	19%	29%	22%	37%
$50,000 to $74,999	186	19%	48%	19%	56%
$75,000 to $99,999	164	17%	65%	15%	71%
$100,000 to $124,999	110	11%	76%	10%	81%
$125,000 to $149,999	82	8%	84%	7%	87%
$150,000 to $174,999	50	5%	89%	—	—
$175,000 to $199,999	37	4%	93%	—	—
$200,000 to $224,999	39	4%	97%	13%	100%
$225,000 to $250,000	7	1%	98%	—	—
Above $250,000	21	2%	100.0%	—	—
Skipped	19				
Sum	1001	100%		100%	
Median		$75,000 to $99,999		$66,358	
Average		$75,000 to $99,999		$85,772	

Table 11 Income Distribution of ORS 2016 (adjusted to 2011 dollars) and NHS 2011 (Total Household Income, Ontario).

To ensure that our results are comparable to NHS 2011, inflation adjustments to monetary values need to be made. The survey collects information on total household income for the year 2015 (for pre-retirees) and the year prior to retirement (for retirees). As information on retirement age is also collected (in Q5), combining with information on birth year, we can deduce the year of retirement and convert the income to 2011 dollars using historical inflation rates. For pre-retirees, no extra information is required since incomes are all expressed in the monetary value in 2015. Inflation adjustment is done by adjusting the midpoint of selection by historical inflation and then reassigning the selection.

The total household income reported in NHS 2011 refers to income from all sources, including employment income, income from government programs, pension income, investment income and any other money income. This is a reasonable benchmark because retirement status is self-identified, hence there is no restriction on the income source pre or post retirement (e.g. a self-identified pre-retiree may be receiving government pension income in 2015).

6.4 Retirement Liquid Assets

	ORS 2016		SFS 2012					
	Retirement Liquid Assets		Private Pension Assets		TFSA		Deposits	
Age Group	Below $25,000	Median (Excl. Below $25,000)	None	Median (Excl. None)	None	Median (Excl. None)	None	Median (Excl. None)
$55 - 64$	21.4%	$200,000 to $299,999	23.70%	$285,000	60.5%	$11,000	6.7%	5,000
$65 +$	18.7%	$200,000 to $299,999	25.80%	$266,000	55.1%	$18,000	2.6%	10,000

Table 12 Liquid Asset Distribution of ORS 2016 and SFS 2012 by age group.

The amount of liquid assets (actual and expected) at the time of retirement is compared with the 2012 Survey of Financial Security. In particular, comparisons are made to the level of private pension assets, tax-free savings account (TFSA) and any deposits held in financial institutions, for all family units in Ontario. The age group reflects the age of the major income earner of the family unit. SFS 2012 reports other liquid assets sources, such as bonds and stocks, but the percentage owned and median values are very small hence excluded. The ORS finds that roughly 20% had/expected liquid assets to be below $25,000 (including none). This mirrors the findings of SFS that nearly a quarter of the population had no private pension assets. It appears that our sample may be slightly wealthier than the population on average. This is reasonable since we asked the respondents to either indicate their expected assets or actual assets at retirement, at which asset level is typically high (i.e. the end of the retirement asset accumulation stage), whereas the SFS looks at actual asset level at the time. Other factors including pre-retirees' salary inflation, interest rate expectations, as well as past inflation also may impact the value of the assets. Overall, we conclude that our sample represents the population to a reasonable degree.

6.5 Real Estate/Home Ownership

	ORS 2016		SFS 2012					
	Real Estate (net Mortgage)		Principal Residence		Other Real Estate		Mortgages	
Age Group	Do not own	Median (Excl. Do not own)	None	Median (Excl. None)	None	Median (Excl. None)	None	Median (Excl. None)
$55 - 64$	20.3%	$200,000 to $399,999	27.9%	$300,000	79.9%	$230,000	65.7%	$135,000
$65 +$	16.7%	$200,000 to $399,999	25.3%	$300,000	20.5%	$200,000	86.9%	$60,000

Table 13 Real estate distribution of ORS 2016 and SFS 2012 by age group.

Comparison to SFS 2012 suggests that the sample contains a slightly higher proportion of households that own real estate (including principal residence and other properties).

Among those households that own real estate, the median of value net mortgage is reasonably close to the value reported in SFS. In terms of home ownership (principal residence), the sample has 20.5% (age 55 − 64) and 19.1% (65 − 80) who do not own a home.

6.6 Overall

Overall, the sample is reasonably representative of the population in terms of age, marital status, household income, retirement liquid assets and real estate. There is some evidence that the sample is slightly biased towards wealthier households. This is a reasonable observation given that selection bias is present in web based surveys. For example, those who have less access to the internet may be under-represented (see, e.g., Fowler Jr, 2013; Couper, 2000).

7 Data Analysis

7.1 Introduction

This section provides an analysis of the survey data and and detailed discussions of their implications. Specifically, the relationships between any two variables are shown graphically using 'frequency plots', and are quantified by Kendall's rank correlations (i.e. Kendall's tau).

A frequency plot resembles a heat-map, which shows the proportions of respondents that fall under each pair of choices. It can also be viewed as a graphically represented 2-dimensional matrix, with the colour of each square representing the relative size of each element. The first frequency plot can be found in Section 7.2 and is described with more details.

Kendall's rank correlation, or Kendall's tau, measures the concordance, or pairwise dependence, for two random variables (X, Y), and is formally defined as

$$\tau_k(X, Y) = E\left(\text{sign}((X - \tilde{X})(Y - \tilde{Y}))\right) \tag{16}$$

where $(\tilde{X}, \tilde{Y})$ is an independent copy of (X, Y). Kendall's tau takes values in $[-1, 1]$, where 1 implies comonotonicity, and -1 implies countermonotonicity. The intuition is that if larger values of X (relative to its sample space) are associated with larger relative values of Y, and smaller values of X with smaller values of Y, then X and Y are concordant. On the other hand, if larger relative values of X are associated with smaller relative values of Y (and vice versa), then X and Y are discordant. The estimator is computed by,

$$\widehat{\tau}_k = \frac{2}{n(n-1)} \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \text{sign}((X_i - X_j)(Y_i - Y_j)) \tag{17}$$

where n is the total number of pairs observed. We further conduct the Tau test to establish whether the pair of variables can be considered as statistically dependent. Under the null hypothesis of independence, the test statistic $\widehat{\tau}_k$ is approximately Normally distributed with mean 0 and variance $\frac{2(2n+5)}{9n(n-1)}$. We use * to denote a p-value ≤ 0.05, and ** for a p-value ≤ 0.01.

7.2 Retirement wealth

We find that the majority of the respondents fall under "low" under expected and actual liquid assets at retirement, with the phenomenon more pronounced for female respondents. The breakdown for all respondents is shown in Figure 2.

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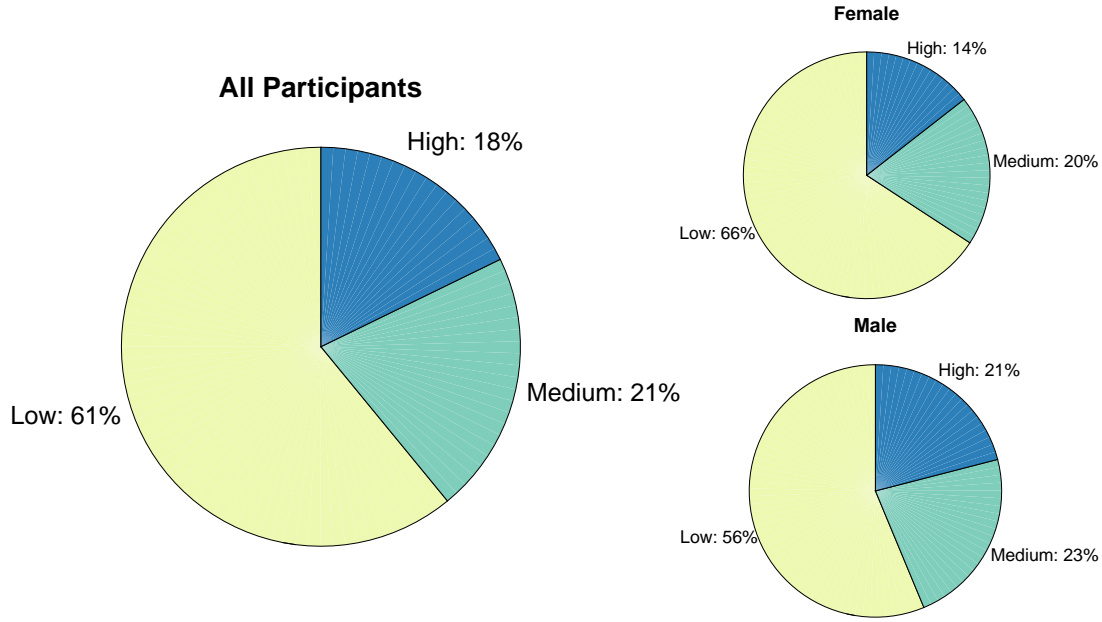
Figure 2 All participants: liquid assets at retirement.

|	Single	Married
Low	Below $200,000	Below $300,000
Medium	$200,000 to $399,999	$300,000 to $699,999
High	Above $400,000	Above $700,000

Table 14 Definition of liquid wealth levels.

It is important to note that the wealth categories are defined differently for single and married participants, as shown in Table 14. We highlight that the result does not necessarily suggest that those having "low" retirement liquid assets have inadequate retirement savings, since the amount of liquid assets required to provide for an adequate retirement living is highly subjective. Contributing factors may include lifestyle, life expectancy, household size, health, pension income (e.g. workplace pension or public pension), other income (e.g. employment and investment) and fixed assets.

Comparing liquid and fixed assets reveals respondents' overall asset level at retirement. Fixed assets include home (i.e. principal residence) and other property investment, and are highly relevant to the cost of retirement and income in retirement. Specifically, home ownership directly impacts the cost of living in retirement (i.e. renting costs); it is also a source of liquidity through downsizing or a reverse mortgage. Investment properties bring in rental income, which is a regular income that hedges price inflation, and capital gains if sold.

Figure 3 is a frequency plot, which we use extensively to illustrate the relationship between two variables. In this case, the figure shows the proportion of respondents who fall under each pair of liquid and fixed asset levels. For example, the dark square in the bottom left indicates that 10% of respondents do not own real estates *and* expect/have had less than $25,000 of liquid assets at retirement. This proportion is alarming, along with the evident positive relationship between liquid and fixed assets (Kendall's tau: 0.4323**; correlation: 0.4791**), suggesting that those with low retirement savings tend to have low fixed assets, which implies higher costs of living, lower liquidity, and lower income from property investment.

Overall, 21% expect/have had liquid assets under $25,000, 40% under $100,000; 19% do not own property. This issue is discussed in more detail in Section 7.4.2.
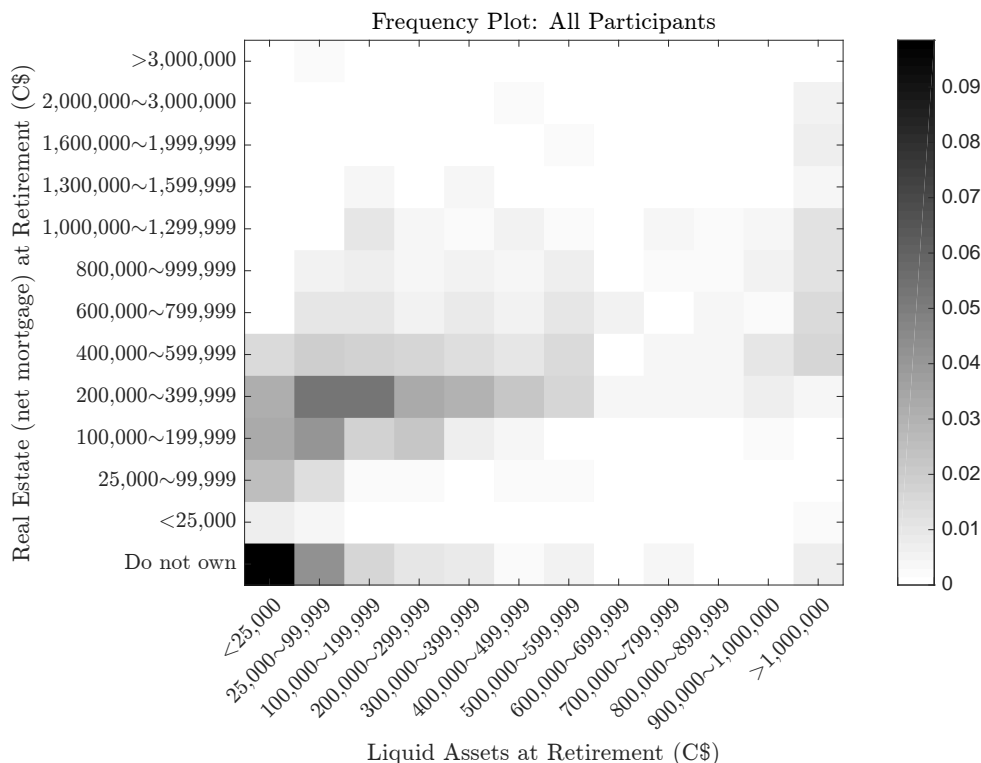
Figure 3 All participants: liquid assets and real estate at retirement.

7.2.1 Respondents with extremely low assets

One may be interested in investigating those with extremely low private pension assets, in particular relating to income at retirement. For this part, we examine the 101 respondents who do not own property and expect/have had less than $25,000 at retirement (i.e. the bottom left square). We find the following:

- 71 do not have defined benefit pensions, those who do receive, on average, $14,667

- 85 do not have life annuities, those who do receive, on average, $12,333

- 97 expect/have made very little withdrawal from liquid assets

- respondents expect/have public pension income of $10,860 on average

- respondents on average expect/have income from other sources that averages around $9,167

Overall, the 101 respondents expect/had an income of $34,083 in the first year of retirement, of which 32% comes from public pension benefits, and 27% from other income sources. When asked to specify these income sources, 44 respondents provided written responses, among which 15 indicated there are simply no other income sources, 14 indicated some form of work or employment, 7 mentioned income associated with disabilities, others mentioned spouse's salary, inheritance etc. These findings highlight that retirees with extremely low assets are highly dependent on public pensions, and potentially expect to re-enter to workforce to supplement their retirement income.

7.3 Longevity and survival beliefs

The survey collects three responses that measure respondents' subjective beliefs on survival rates and life expectancy (see Q6, Q7 and Q8). We are interested in respondents' beliefs about their 1) life expectancies, 2) survival probabilities for at least 10 more years, and 3) survival probabilities to an extreme old age of 95. We explore the degree to which these subjective beliefs differ from actual mortality experience, and their corresponding influence on retirement decision-making.

The mortality data[7] for Ontario male and female residents are obtained from Statistics Canada. As of August 2017 (the time of writing), the most up-to-date mortality information from Statistics Canada is for 2011-2013. The mortality experience from 2014 to 2016 is not reflected, thus comparisons should be interpreted with caution. Results are illustrated in Figure 4, 5 and 6. We highlight the following findings:

i. **Severe underestimation of survival probabilities to an extreme old age:** we find strong evidence that respondents highly underestimate their probability of survival to at least age 95 or more. As shown in Figures 5 and 6, 92% report a survival rate below the objective rate, 27% believe that they have zero chance of surviving to age 95. This evidence points to a severe underestimation of longevity risk. This raises questions as to whether such underestimation plays a key role in retirement decision-making.

ii. **Mild underestimation of life expectancy:** the objective expected age at death for Ontario individuals aged 50 to 80 is 85.6 to 90.6 for females and 82.1 to 88.9 for

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[7]Data source: Statistics Canada. 2017. Life tables, Canada, provinces and territories, catalogue no. 84-537-X.

males. The left plot of Figure 4 shows the distribution of responses, which ranges from 60 to 200, centred around 85. On the right hand side, we take each of the subjective responses and divide them with the expected age at death computed based on population mortality experience (i.e. objective mortality rates) and plot the distribution of this ratio. We find that 54% report an expected age at death lower than the objective estimate, and that the median ratio is 0.98. This suggests that on average, respondents mildly underestimate their life expectancies. While 54% and 0.98 are not strong evidence, the degree of underestimation may be more pronounced if mortality improvement[8] from year 2014 to 2016 is taken into account.

iii. **Close estimation of survival probabilities for 10 or more years:** on average, the subjective estimates for survival probabilities for 10 or more years are relatively close to the objective estimates. 47% reported a probability estimate below the objective rate. The median ratio (i.e. subjective divided by objective rates) is 1.02. We conclude that these are close estimates, taking into account mortality improvement in the past 3 years.
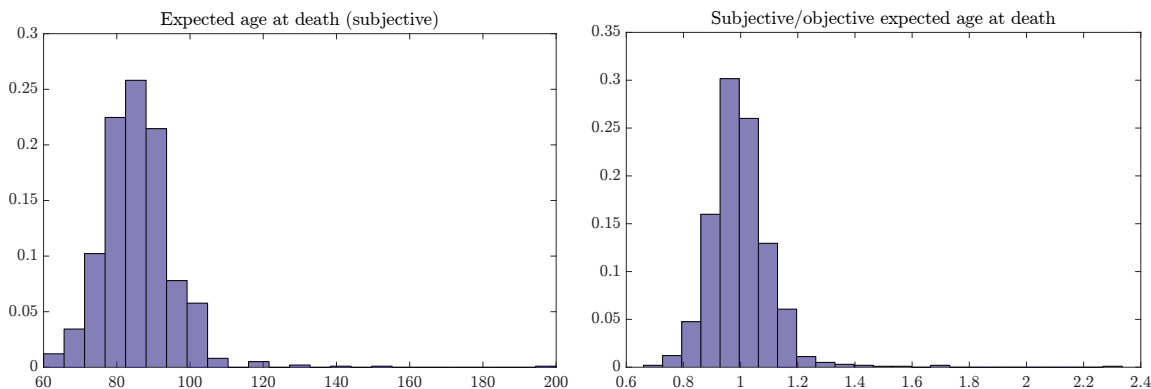
Figure 4 Expected age at death: subjective estimates (reported) and subjective/objective estimates.

7.4 Retirement expectation and experience

In this section, we separate responses from pre-retirees and retirees regarding retirement expectation and experience. For responses involving dollar values, such as assets and income, we report findings without adjusting for inflation. This is because adjusting for inflation requires ad hoc assumptions to be made about future inflation rates. Inflation adjustment also does not make a large impact when responses are given within a range.

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[8]The expected age at death for Ontario females aged 50 to 80 is 85.4 to 90.5 in 2010-2012, and 85.2 to 90.4 in 2009-2011.
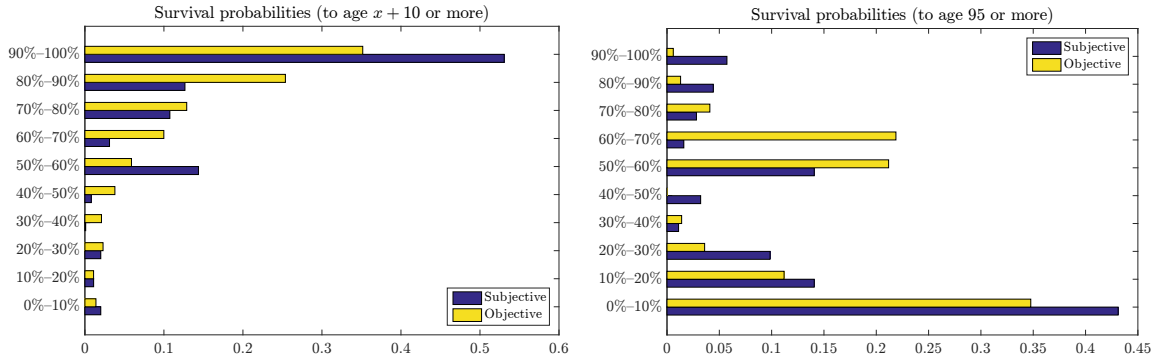
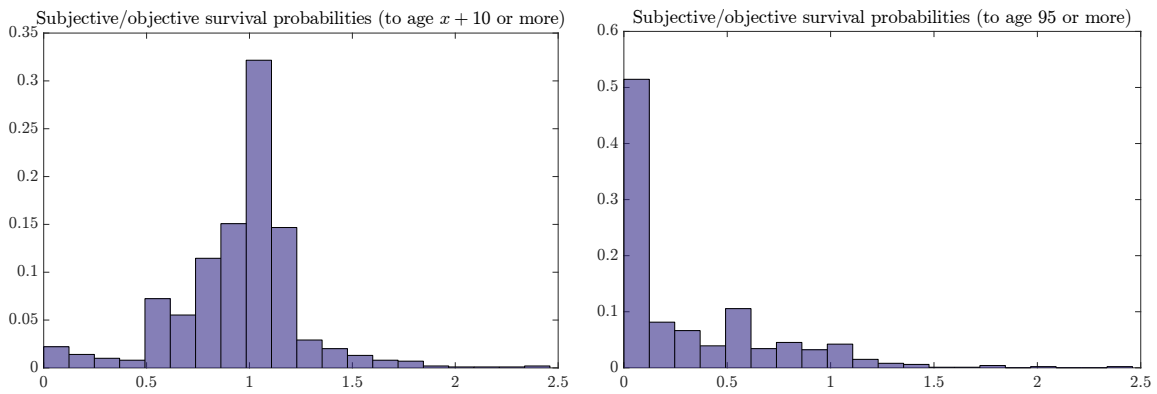**Figure 5** Survival probabilities: subjective and objective estimates.

Figure 6 Survival probabilities: subjective/objective estimates.

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For example, a response within the range of $10,000 to $20,000 will most likely be within the same range after adjusting for inflation for 5 to 10 years.

We highlight that this is *not* an expected versus observed comparison, as many objective factors may contribute to the differences. In other words, if pre-retirees' expectation is significantly different from retirees' experience, it is not necessarily the *wrong* expectation. Nonetheless, the direction and magnitude of such differences, combined with other evidence collected in the survey, may reveal important insights on the retirement planning behaviours of Canadian individuals.

We find that on average, pre-retirees' expectation of asset values at retirement quite reasonably matches retirees' experience, taking a number of factors into account. The following section discusses retirement age, assets, income and planning concerns in detail.

7.4.1 Retirement age

Compared to retirees' experience, pre-retirees on average expect a higher retirement age. Figure 7 plots the distribution of expected and experienced retirement age. Table 15 summarizes the average retirement age. A myriad of factors may contribute to the difference in expectation and experience, including life expectancy, age eligibility of public pension schemes, involuntary retirement, retirement readiness (e.g. asset and retirement income) and survey bias. We provide an explanation for each.

i.   **Life expectancy:** on average, pre-retirees estimate a lower expected age at death than retirees (84.99 and 86.05). It therefore cannot be concluded that pre-retirees expect to retire later because they expect to live longer.

ii. **Age eligibility:** the normal retirement age for receiving CPP and OAS benefits has stayed at 65 since 1970 (CPP benefits can be taken at a reduced rate as early as age 60 since 1987). This means that pre-retirees are not compelled to retire later to be eligible to receive public benefits. Nonetheless, it is still possible for pre-retirees to anticipate a future increase in the eligibility age, since such increases are taking place in other aging countries such as Australia, Sweden, and the United Kingdom.

iii. **Involuntary retirement:** pre-retirees may overestimate their remaining working life, by underestimating the probability of declining health, direct or indirect involuntary termination, or other relevant personal circumstances. The survey does not collect information on the reasons behind retirement for retirees; doing so may reveal more insight.

iv. **Retirement readiness:** it is plausible that pre-retirees expect to retire later due to lower retirement readiness. Particularly for those in the private sector, the shift from having generous defined benefit pension arrangements to defined contribution or no arrangements means that pre-retirees need to accumulate more assets to meet retirement needs, which translates to a longer working life and shorter retirement length (see section 7.4.3 on defined benefit pension income).

v. **Survey bias:** the survey targets an audience between ages 50 to 80, which means pre-retirees cannot report a retirement age less than 50, whereas retirees can. This may create a biased sample and contribute to a larger average expected retirement age, which we observe.

	Mean	Median
Expectation of pre-retirees	67.11	65.00
Experience of retirees	58.59	60.00

Table 15 Average age at retirement.
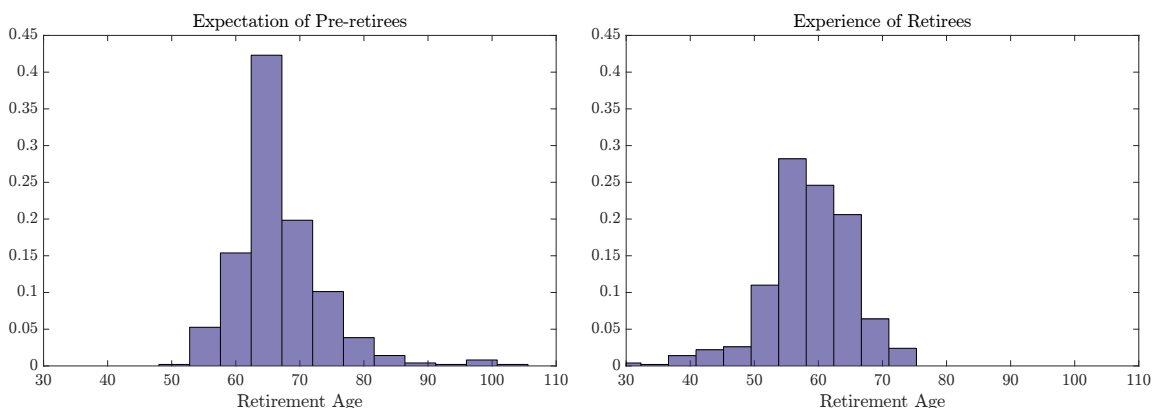
Figure 7 Distribution of retirement age.

7.4.2 Assets at retirement

We compare pre-retirees' expectation of asset values at retirement with retirees' experience, and find that, on average the expectations are very close to retirees' experience. Table 16 summarizes the mean and median of reported asset values at the year of retirement. Figure 8 shows the proportion of each response for pre-retirees and retirees.

We see that for pre-retirees, the means are higher for both liquid and fixed assets while the medians are the same. This shows that the larger means are driven by higher expectations in the right tails (see Figure 8), meaning that a small proportion of pre-retirees expect much higher assets at retirement, while the majority expect similar asset levels with retirees' experience. For liquid assets, the largest difference in expectation and experience comes from the response "$> 1,000,000$". This may be a manifestation of a tendency to overweigh small probability events, as behavioural economic theory suggests (see Kahneman and Tversky, 1979), or overconfidence in one's investment skills. For fixed assets, pre-retirees with medium to high property holdings consistently expect higher property

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values at retirement. This is reasonable, since historical property inflation has been high in the recent years. Pre-retirees may also have high confidence in the Ontario housing market based on these favourable observations. Additionally, historical inflation and pre-retirees' beliefs of future price inflation contribute to the difference.

Further, pre-retirees on average expect to retire later than retirees have, which provides additional explanation for much higher fixed asset values at retirement (the accumulation of property inflation over a longer period). For liquid assets, the difference is small, which provides further evidence that lower retirement readiness, in terms of liquid retirement assets and income on average contributes to the large difference in expected retirement age for pre-retirees. A shorter retirement life, combined with a similar level of assets, sheds light on pre-retirees' lower retirement income expectations. We investigate retirement income in the next section.

	Liquid asset		Fixed asset	
	Mean	Median	Mean	Median
Expectation of pre-retirees	$320,230	$150,000	$462,960	300,000
Experience of retirees	$306.210	$150,000	$357,640	300,000

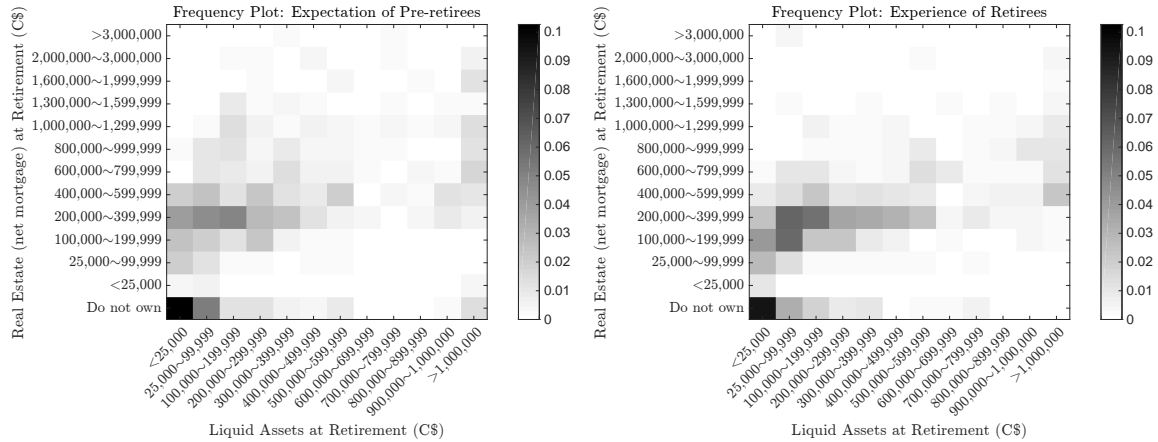**Table 16** Liquid and fixed assets at retirement.
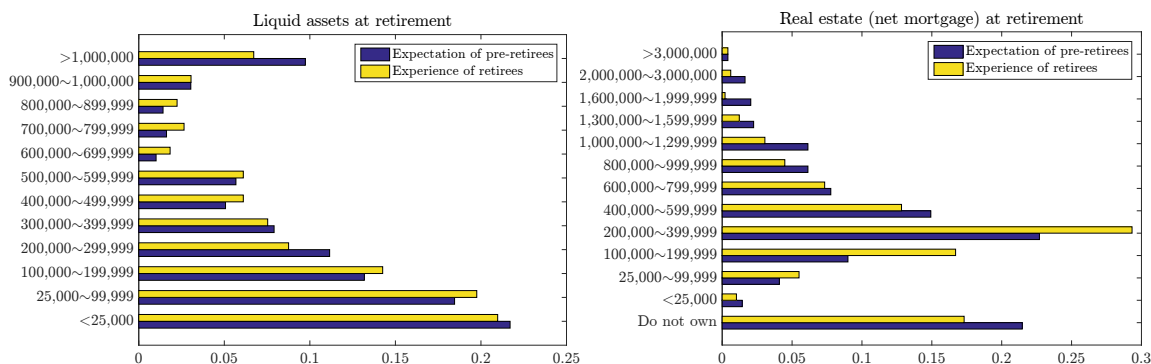
Figure 8 Liquid and fixed assets at retirement.

7.4.3 Retirement income

We compare pre-retirees expectations of retirement income from five sources with retirees' experience. Table 17 summarizes the average income expected and experienced in the first year of retirement. Figures 10 to 14 show the distribution of expected and experienced income from various sources in the first year of retirement, separated by marital status[9]. We highlight the following main findings:

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[9]Survey options presented differ for married and single respondents.

Figure 9 Liquid and fixed assets at retirement.

i. **Reasonable expectations by pre-retirees:** taking inflation into account, the mean of the expected total income is close to the experience (i.e. 2,101 higher), but the median is considerably *lower* (i.e. 8,000 lower).

ii. **Defined benefit pension:** the most notable difference lies in income from defined benefit pension plans, where pre-retirees' expectation is significantly *lower* (i.e. 4,707 lower in the mean, 10,000 lower in the median). Overall, 48% of pre-retirees and 36% of retirees do not have defined benefit pension. The shift away from defined benefit arrangement is evident.

iii. **Social insurance pension:** the pension income from social insurance programs[10] (i.e. public pension), which pre-retirees expect significantly *higher* amounts (i.e. 3,887 higher in the mean, 6,000 higher in the median). We more closely examine public pension in the following paragraph.

iv. **Withdrawals:** comparing the two means, pre-retirees expect to make moderately higher withdrawals from liquid assets (i.e. 3,295 higher), which is consistent with their moderately higher expectation of liquid assets at retirement.

v. **Life annuities:** very few respondents have or expect to purchase private life annuities (i.e. 21% of pre-retirees and 12% of retirees).

vi. **Other income sources:** expectation of income from other sources, such as investment income or employment, is moderately lower than retirees' experience. This may reflect a lower expectation for the need for employment in retirement.

As mentioned above, the seemingly high expectation of public pension benefits among pre-retirees compared to retirees' experience needs to be more closely examined. At first

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[10]Public pension programs in Canada include the Canada Pension Plan, Old-age Security and Guaranteed Income Supplement.

	Expectation of pre-retirees		Experience of retirees	
	Mean	Median	Mean	Median
Defined benefit	$23,478	$5,000	$28,185	$15,000
Life annuities	$6,298	$0	$2,833	$0
Withdrawals	$21,793	$10,000	$18,498	$10,000
Public pension	$15,505	$15,000	$11,618	$9,000
Other income	$17,782	$10,000	$21,759	$10,000
Total income	$85,194	$61,000	$83,093	$ 69,000

Table 17 Average income in the first year of retirement.
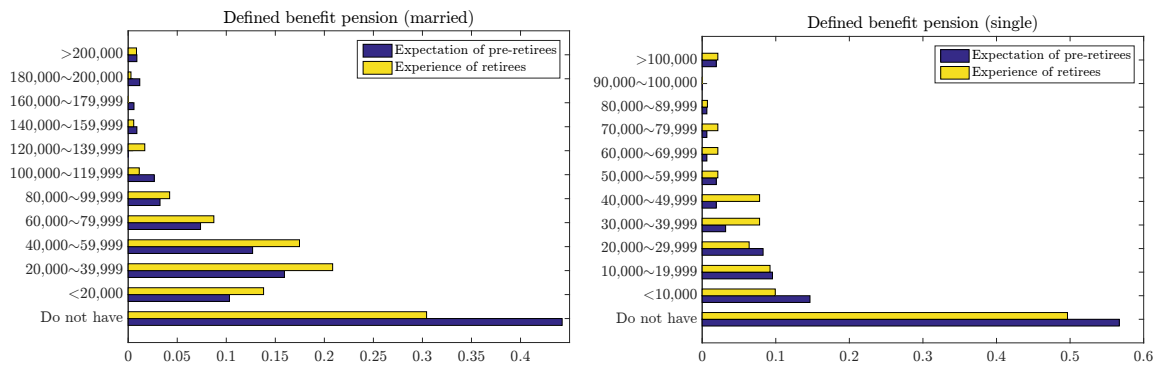
Figure 10 Defined benefit pension in the first year of retirement.
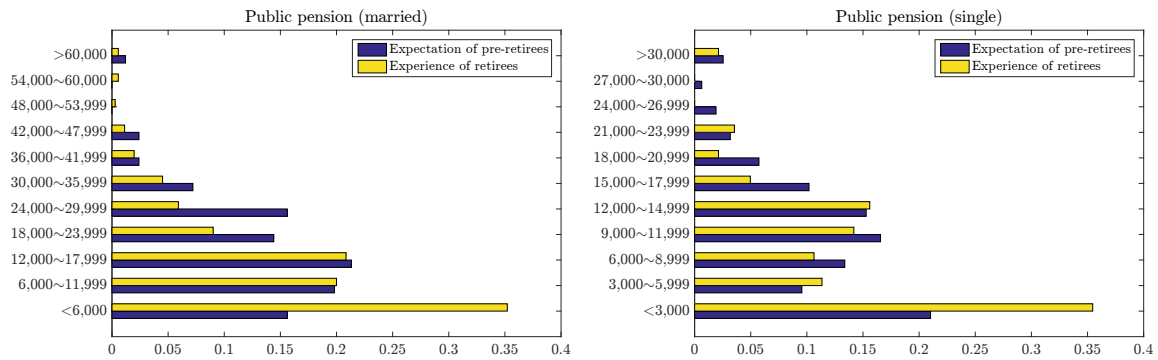
Figure 11 Public pension in the first year of retirement.
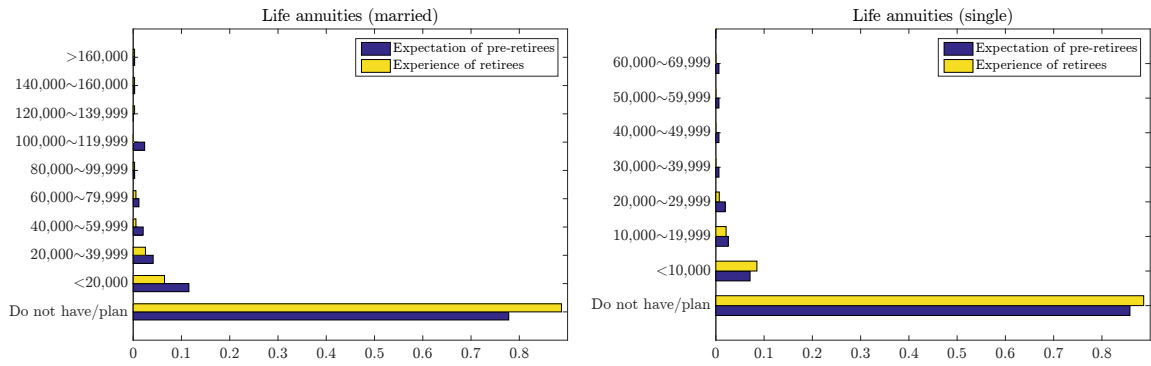
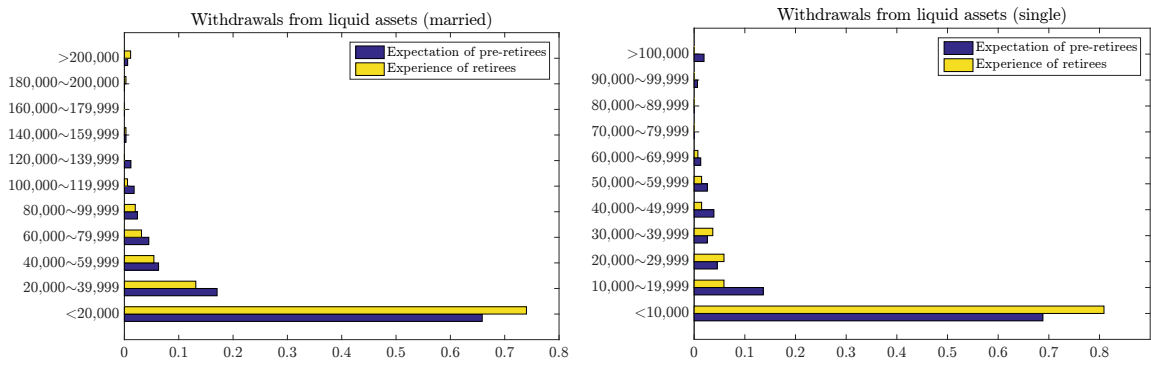**Figure 12** Life annuities in the first year of retirement.

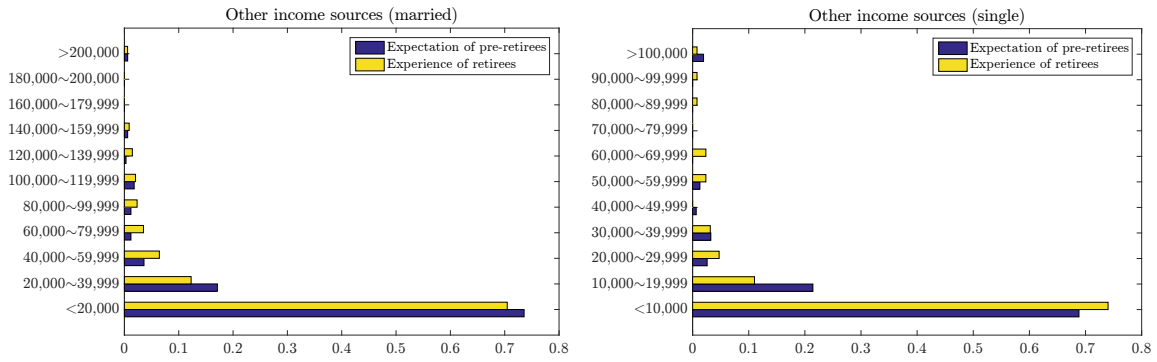**Figure 13** Withdrawals from liquid assets in the first year of retirement.

Figure 14 Income from other sources in the first year of retirement.

glance, this may seem to indicate overconfidence in the Canadian public pensions program among pre-retirees. However, this does not account for the age eligibility requirement for receiving these pension benefits. The normal retirement age for the OAS, GIS and CPP is 65 (though CPP benefits can be taken at a reduced rate starting from age 60), meaning that those who retire prior to age 65 (or 60, in the case of CPP only) are not eligible, in the first year of retirement, for receiving public pension benefits.

	60 and above			65 and above		
	All	Married	Single	All	Married	Single
All	72%	70%	75%	49%	45%	59%
Pre-retirees	93%	92%	96%	76%	72%	84%
Retirees	50%	50%	52%	22%	18%	31%

Table 18 Percentages of respondents with retirement age at least 60 or 65.

Table 18 summarizes the percentages of respondents with expected or actual retirement age at least 60 and 65. It can be observed that half of the retirees were not eligible for OAS and GIS benefits in the first year of retirement, which explains the high proportions of "Below \$6,000" and "Below \$3,000" responses from retirees. It would be sensible to repeat the analysis excluding those who expect to, or have retired before the age 60 or 65, which is summarized by Table 19, Figure 15 and 16.
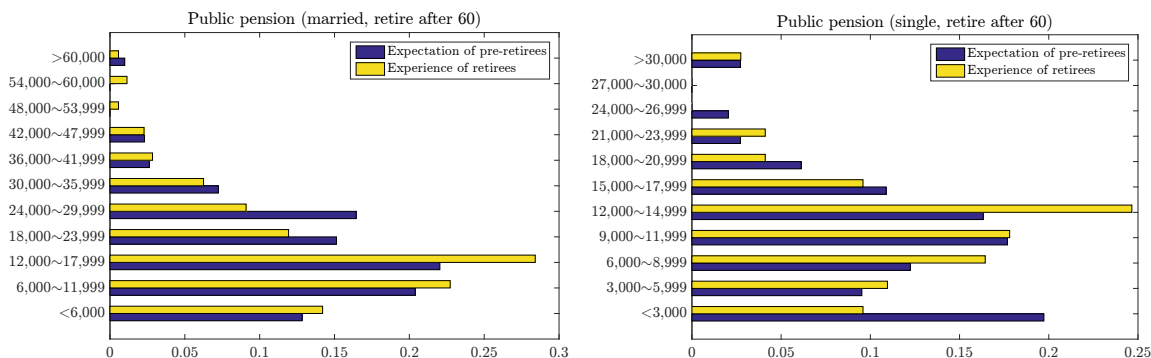
Figure 15 Public pension in the first year of retirement (retirement age 60 and over).

We observe that when ineligible respondents are excluded, the difference between expectation and experience diminishes. We attribute this to the rise in the average of retirees' public pension income, since ineligible respondents are excluded. For the 65 and above group, pre-retirees' lower[11] expectation is largely driven by the high percentage choices at the lower end, which we discuss below. It should be noted that inflation and inflation

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[11]The Mann-Whitney U-test is performed with $p = 0.0817$. The null hypothesis of equal distributions is not rejected at the 5% level.
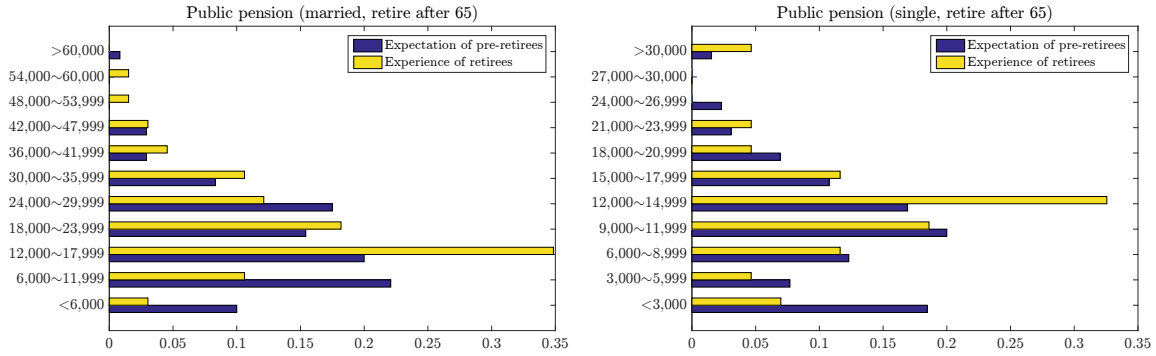
Figure 16 Public pension in the first year of retirement (retirement age 65 and over).

	Expectation of pre-retirees		Experience of retirees	
	Mean	Median	Mean	Median
60 and above	$15,762	$15,000	$15,440	$15,000
65 and above	$16,111	$15,000	$18,179	$15,000

Table 19 Average public pension income in the first year of retirement (excluding ineligible respondents).

expectations play a role, as benefits are indexed[12] to price inflation.

i. **Complexity/Lack of knowledge:** The Canadian pubic pension system is complex, and includes the two pillars. The first pillar includes OAS and GIS which are means-tested. The second pillar, the CPP,[13] has earnings-related contributions and benefits. As such, estimating future public pension benefits is difficult, especially for those with low financial literacy who have not sought retirement planning advice. This is particularly the case for the CPP, where the calculation of the benefit is tied to past contributions. The CPP benefits, as well as income from other sources, also interact with the first pillar through "clawbacks", that is, higher CPP benefits and other income may reduce benefits from the OAS and GIS.

ii. **Age of application:** We solicit responses based on the first year of retirement, which means even if the retirement age is above 60 or 65, respondents may choose to postpone taking benefits to a later age, either irrationally (e.g. lack of knowledge, inaction, etc), or rationally (e.g. CPP benefits can be taken as early as 60, at a reduced rate, or postponed to as late as age 70, with an incentive of increased benefits).

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[12]The OAS and GIS benefits are indexed to quarterly changes in the Consumer Price Index, whereas the CPP benefits are adjusted annually.

[13]Or the Quebec pension plan (QPP) for residents in Quebec, which we do not consider since respondents are residents of Ontario. Some (very few) respondents report income from QPP in the "other income sources" category.

iii. **Changed incentives on age of application:** from 2012, the CPP introduced changes to further incentivize late retirement and disincentivize early retirement. Gradually by 2016, the benefit reduction rate for each year of early retirement increased from 6% to 7.2%; the adjustment rate for each year of late retirement increased from 6% to 8.4%. Consequently, pre-retirees in this study have a *higher* incentive to postpone CPP benefits than retirees, meaning that they may report *lower* expected public pension income in the first year of retirement.

iv. **Increase in future benefits:** Pre-retirees may expect public pension benefits to change due to future changes in the public retirement income system. This is a reasonable expectation since historically the Canadian public pension system has evolved greatly. Specifically, GIS benefits for single retirees increased in 2016; the CPP was also set to increase its benefits starting in 2019. Pre-retirees may or may not be aware of these introduced changes, and may or may not accurately translate legislative changes to monetary changes in their retirement income expectations. The effect on expectations due to future changes in public pension is inconclusive since the survey does not specifically solicit directly relevant responses.

v. **Increase in future eligibility age:** In 2012, the Canada government announced plans to increase the age of eligibility for OAS and GIS from 65 to 67, taking effect between 2023 and 2029. The proposed change was reversed in March 2016, prior to the time this survey takes place. Assuming that the survey respondents are informed of both events, it is reasonable that certain pre-retirees may hold the belief that the age of eligibility may increase in the future (since it has been proposed in the past). If these respondents expect to retire before the age of eligibility (say 67), then their expected social insurance pension should be low in the first year of retirement.

vi. **Immigration:** one factor that may contribute to the high concentration of low expected public pension income among pre-retirees is immigration. Since the early 1990s, the inflow of immigrants to Canada has been on average roughly 235,000 per year, which is nearly 50% higher than the average number from the 60s to 80s (source: Statistics Canada Catalogue no. 11-630-X). Pre-retirees who migrated to Canada at older ages would receive lower CPP benefits, since benefits are linked to historical contributions throughout one's working life. We do not collect immigration information in the survey, however, a 21% of Canadian total population are foreign-born (source: NHS 2011) it is likely that we have a similar composition among the survey respondents. Nonetheless, it remains inconclusive as to what extent immigration contributes to the difference in expectation and experience.

Looking at those who retire at age 65 and above, the difference between expectation and experience is most significant for the first choice "below 6,000" and "below 3,000". It may be interesting to single out these respondents, and compare certain demographic information. For this we make the following comments.

We find that these pre-retirees are on average less educated, hence less likely to be

financially literate (see, for example, Lusardi and Mitchell (2007a)): 62% report the highest level of education completed being "trades or college certificate or diploma" or below, whereas only 40% of the retirees in the same choice category report similar education levels. This is reasonable, since income is typically positively correlated with education received[14], and higher income earners receive less from means-tested public pension schemes. Further, 59% of the pre-retirees have not sought professional financial planning advice in the past, which, combined with likely lower financial literacy, raises questions as to whether they can accurately estimate future benefits. This percentage is higher than the 51% among the remaining pre-retirees. The above evidence suggests that it is quite likely that these pre-retirees underestimate public pension benefits due to lack of knowledge, which results in the mean being lower than retirees' experience even when future benefits are to increase due to recent legislative changes.

	Expectation of pre-retirees		Experience of retirees	
	Mean	Median	Mean	Median
Defined benefit	$18,562	$0	$16,822	$0
Life annuities	$5,538	$0	$3,148	$0
Withdrawals	$20,082	$10,000	$23,619	$10,000
Public pension	$16,111	$15,000	$18,179	$15,000
Other income	$18,003	$10,000	$19,688	$10,000
Total income	$78,296	$35,000	$81,456	$ 35,000

Table 20 Average income in the first year of retirement (retirement age 65 and above).

For pre-retirees who expect to retire at 65 or above (i.e. eligible for public pension benefits), we observe a positive relationship between public pension income and liquid assets expectations (the estimated Kendall's tau is 0.08*). In Table 20, we observe that public pension income is a primary source of income for an average (median) individual. This implies that those who expect more public pensions also tend to have higher liquid assets at retirement. This appears counterintuitive since one would imagine that with such low expectations, these individuals would save more. This may be counteracted by the fact that the major source of public pension, the CPP, is an earnings-related, rather than means-tested, program.

7.5 Retirement planning and spending

7.5.1 Concerns

The results, summarized in Figure 17, show that for **all respondents**, the top four important concerns when making retirement planning and spending decisions are:

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[14]Our results show a positive estimated Kendall's tau of 0.2503** and a correlation coefficient of 0.3280** for income and the highest education received among all respondents. This is consistent with other research findings such as Lusardi and Mitchell (2007b).

- **Liquidity** (setting money aside to access quickly when unforeseen expenses arise)
- **Consumption/Income smoothing** (avoiding ups and downs in my income / having a smooth income stream during retirement)
- **Inflation** (the impact of inflation on my standard of living)
- **Longevity** (the possibility of living longer than expected)
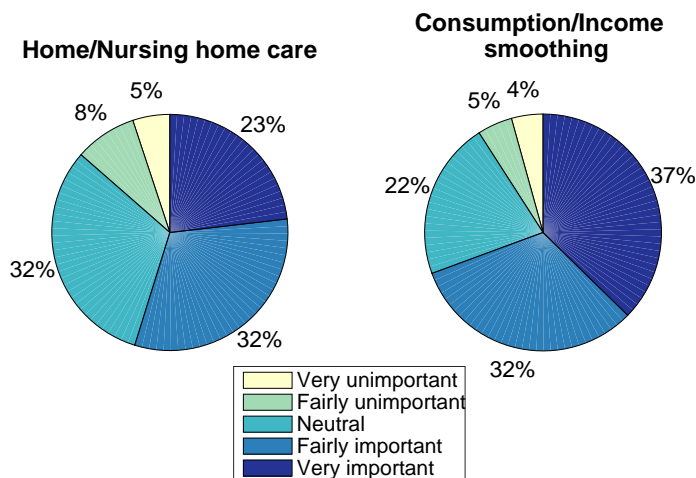
The least important concerns are:
- **Bequest** (leaving a bequest)
- **Investment risk** (taking some investment risk with my savings during retirement)
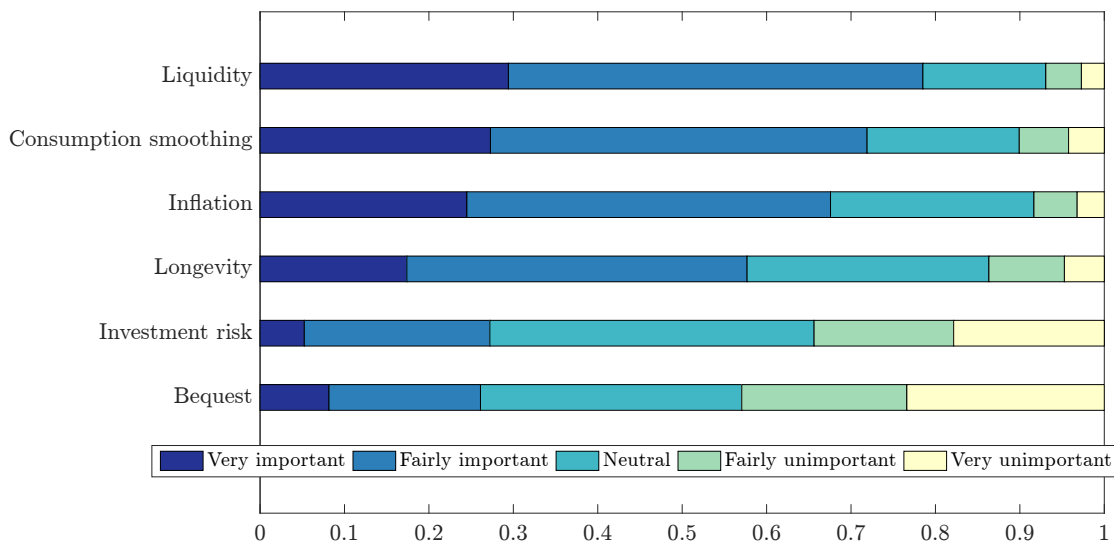
Figure 17 All participants: retirement planning and spending concerns (top to bottom: most important to least important).

Concerns change when separately considering the wealthy (i.e. "high" wealth level) and the extremely poor (i.e. liquid assets below $25,000) (see Figure 18). High wealth respondents are more concerned with home care or nursing home expenses than with longevity. Extremely low assets respondents are most concerned with consumption/income smoothing. These observations are reasonable, since wealthy respondents can potentially afford home care or nursing home services (while others cannot, hence are not too concerned); and respondents with extremely low liquid assets cannot tolerate income or consumption volatility due to having extremely limited capacity to make up for the differences.

We further quantify the relationship between the strength of the concerns and basic demographic information of the respondents. Table 21 summarizes the estimated Kendall's taus of each concern and demographic item. The strength of the concerns is measured on a scale of 1 to 5, with 1 being very unimportant and 5 being very important. Retirement,

Home/Nursing home care

5%
8%
23%
32%
32%

Consumption/Income smoothing

5% 4%
22%
37%
32%

Very unimportant
Fairly unimportant
Neutral
Fairly important
Very important

Figure 18 Retirement planning and spending concerns. Left: participants with "high" wealth. Right: participants with liquid assets below $25,000.

gender and marital status are indicator variables, with 1 being pre-retiree, female, or married, and 2 being retiree, male or single (as shown in the tables). The concerns are listed in the order of high to low average importance among all respondents. We find the following evidence:

i. **Gender:** gender has a significant impact on the level of concern respondents express. For the top 8 concerns, the estimated Kendall's tau with gender are all negative and statistically significant, indicating that female respondents tend to rate the concerns as more important than male respondents. The relationship is stronger for top concerns. Male respondents, on the other hand, tend to rate taking some investment risk with their retirement savings as more important than females do.

ii. **Assets:** as discussed previously, those with high liquid assets tend to be more concerned over nursing care/home care expenses, and less concerned over longevity risk. Specifically, respondents with higher assets (liquid and fixed) tend to consider taking some investment risk as more important, suggesting that risk preferences may be dependent on wealth. More discussion on risk preferences and decision-making under risk can be found in sections 7.6 and 7.7.

	Age	Retirement	Gender	Marital	Liquid Assets	Fixed Assets
(1: unimp 5: imp)		(1: pre 2: ret)	(1: F 2: M)	(1. mar 2: sin)		
Unforeseen exps	−0.02	−0.01	−0.20**	0.00	0.06**	0.02
Smooth income	0.02	−0.02	−0.17**	0.03	−0.05*	−0.11**
Inflation	−0.07**	−0.08**	−0.15**	0.06*	−0.02	−0.06*
Living longer	−0.02	−0.04	−0.15**	0.02	0.01	0.00
Less spending	−0.09**	−0.11**	−0.11**	−0.07*	−0.04	−0.03
Nursing Care	0.01	−0.04	−0.10**	−0.02	0.08**	0.05
More spending	0.00	−0.03	−0.09**	0.07*	−0.05*	−0.06**
Dying early	−0.08**	−0.02	−0.07**	−0.07**	−0.08**	−0.03
Taking inv risk	0.00	0.01	0.07**	−0.04	0.17**	0.10**
Bequest	0.00	−0.02	−0.05	−0.05	0.03	0.03

Table 21 Kendall's taus: relationship between concerns and demographic information.

In addition of the specific planning and spending concerns, respondents are asked to rate how concerned they are, currently, regarding the impact of aging on their and/or their spouses' ability to manage their own finances. The average response shows a lack of concern (see Figure 19, the average is "fairly unconcerned"), especially among retired respondents (see Table 22). Mild relationship between the respondent's current health status, such that those with poorer health tend to be more concerned, is found. Single respondents show higher relative concern over the issue than married ones.
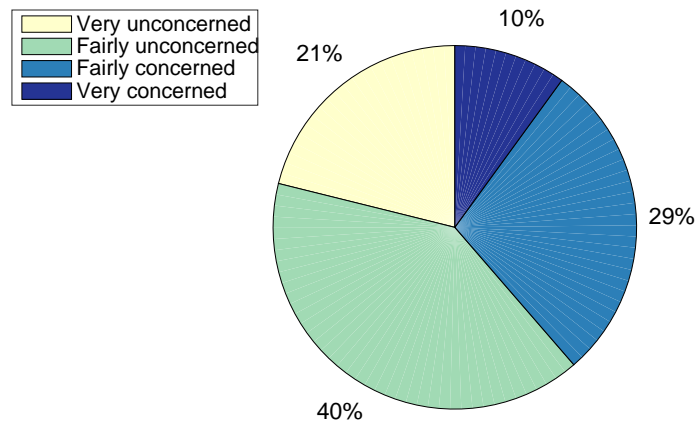
Figure 19 All participants: current concerns over the ability to manage own finances as one ages.

	Age	Retirement	Gender	Marital	Health	Liquid	Education
(1: unc 4: con)		(1: pre 2: ret)	(1: F 2: M)	(1. mar 2: sin)	(1: Exc 5: Poor)		
Aging	-0.06^*	-0.22^{**}	-0.06	0.07^*	0.08^{**}	-0.06^*	-0.04

Table 22 Kendall's taus: relationship between current concerns over the impact of aging on the capability of managing finances and demographic information.

7.5.2 Attitude towards professional advice

Figure 20 summarizes responses on seeking professional financial advice (henceforth advice). Overall, attitude towards seeking advice is positive: 60% indicate that it plays a role in future planning, a majority of which have sought advice, implying a comparably positive experience. A majority of those who will not be seeking advice have not had the experience of doing so in the past (i.e. "No/No").

Attitude is found to be strongly related the level of actual/expected liquid assets at retirement. Those with very low liquid assets (i.e. below $25,000, a total of 210 respondents) have dramatically different attitudes from the rest: 80% of these respondents report no interest in seeking advice in the future (34% for the rest). This finding is reasonable, as these respondents have little assets to manage. The following discussion excludes the 210 respondents with liquid retirement assets below $25,000.

Figure 21 summarizes the results: concerns are shown from top left to bottom right in the order of high to low average importance. Table 24 outlines the relationship between concerns and demographic information. We highlight the following findings:

i.   **The general concern is high:** respondents on average show high concerns over all issues raised, with the top two being 'having access to quality service' and 'conflicts of interest'.

ii. **Age:** a mild relationship is found between age and concerns over quality assessment and conflict of interest, such that younger subjects are more concerned. Pre-retirees (who are on average younger) are more concerned about conflicts of interest.

iii. **Written comments:**   A total of 84 respondents provided written comments on additional concerns (on top of those shown in Figure 21) over seeking advice or financial advisors in general, among which only 52 are relevant to the question. Top comments/concerns are recorded in Table 23. Interestingly, the most prevalent response is expressing trust in the current advisors (due to long-term relationships). Other concerns center around the fiduciary duties of financial advisors (i.e. conflicts of interest, fees transparency, and government oversight).

| Top comments/concerns	Frequency	Percentage
"I trust my advisor"	11	21%
Conflict of Interest	7	13%
Affordability/cost	7	13%
Negative past experience	5	10%
Government oversight	5	10%
Fees transparency	4	7%

Table 23 Top comments/concerns towards seeking professional financial advice (collected from written responses).
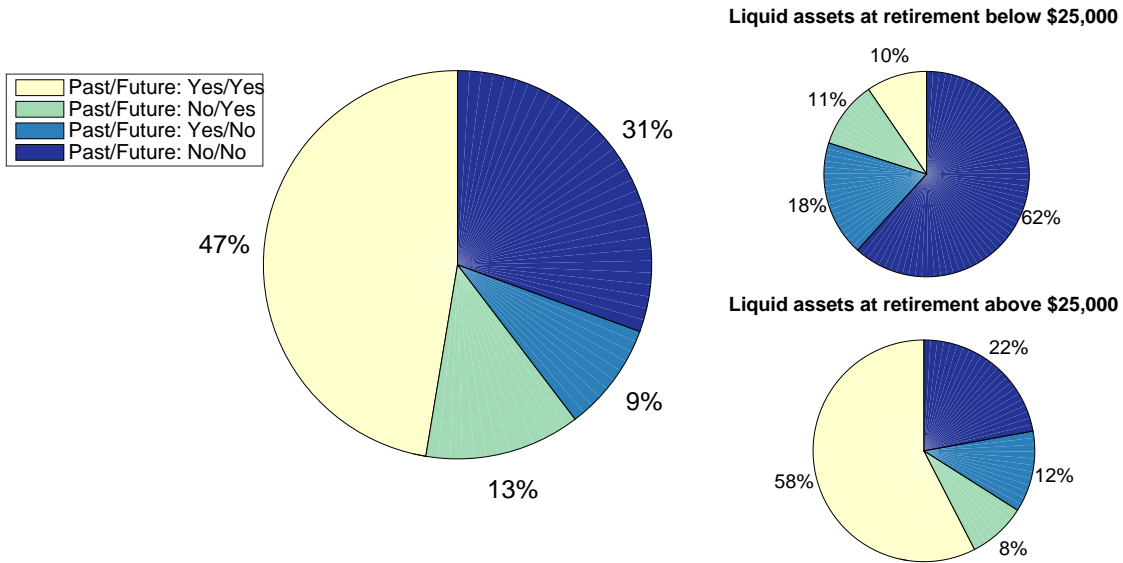
Figure 20 All participants: attitude towards seeking professional financial advice.

	Age	Retirement	Gender	Marital	Liquid	Fixed
(1: uncon 5: con)		(1: pre 2: ret)	(1: F 2: M)	(1. mar 2: sin)		
Access quality service	0.04	0.03	−0.06	−0.02	0.04	0.03
Victim of fraud	−0.05	−0.03	−0.02	−0.02	−0.04	0.00
Unable to assess quality	−0.06*	−0.06	−0.05	−0.03	−0.04	−0.01
Incapable advisors	−0.02	−0.02	−0.03	0.01	−0.01	−0.02
Self-serving advisors	−0.06*	−0.08*	−0.04	0.00	−0.04	0.00

Table 24 Kendall's taus: seeking professional financial advice (excluding participants with liquid assets below \$25,000).
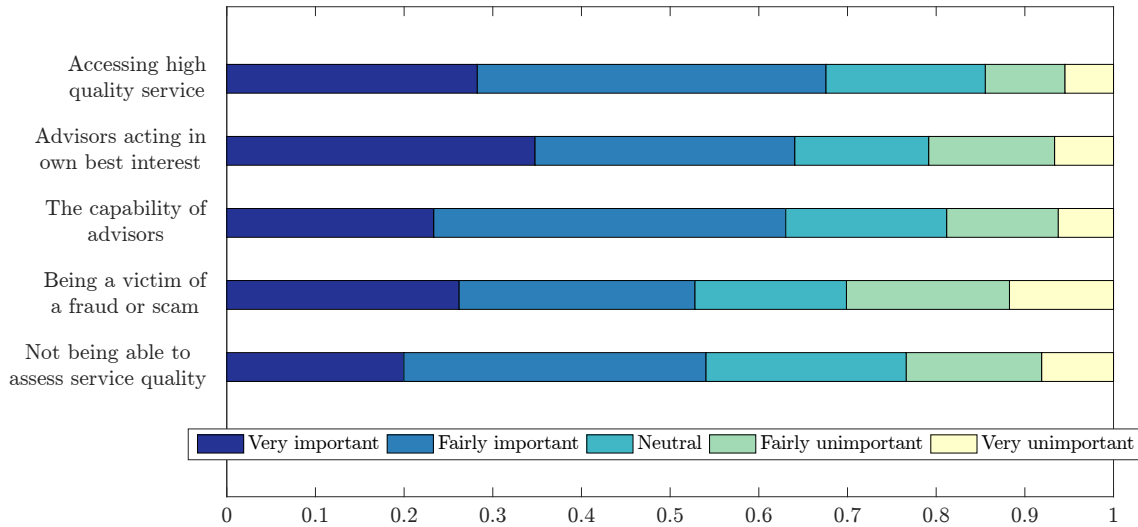
Figure 21 Concerns regarding professional financial advisors (excluding participants with liquid assets below $25,000). From top to bottom: high to low average importance.

7.5.3 Bequest motives

In the beginning of section 7.7, bequest motives are found to play the least important role in dictating retirement planning and spending decisions. However, bequest motives are common assumptions in traditional life-cycle models, and are often quantified by a utility function multiplied by a strength parameter, which governs the willingness to bequest. For example, an agent who more strongly values bequest would have a higher strength parameter. Consequently, the utility derived from bequest is more amplified, resulting in bequest playing a significant role in retirement decision-making in the academic literature. To date, the strength parameters used in these models are constant throughout an agent's remaining lifetime. We postulate that bequest motives vary, at the very least with age which broadly measures personal circumstances. For example, younger individuals are more likely to have dependents, hence should have stronger bequest motives if they were to die within the next couple of years than older individuals with grown children (i.e. fewer or no dependents). Younger individuals may also have younger dependents, who need more sizeable financial support, hence influencing the size of the bequest.

The survey collects responses on how important bequest is if respondents were to die within the next 10 years, 10 to 20 years and over 20 years from now. We are interested in exploring whether the strength of bequest changes with age, or other personal circumstances. Results are summarized in Figure 22 and Table 25. We report the following findings:

i.   **Overall:** the average importance of bequest is between "fairly unimportant" and

"neutral". This is consistent with our previous findings. The average level of importance *drops* when death is more distant: some of this difference may be due to myopia. Additionally, little evidence suggests that the strength of bequest motives is related to current health, or the amount of liquid assets.

ii. **Dependents[15]:** the number of dependents is found to have the strongest relationship with bequest motives, in that those with more dependents tend to value bequests more strongly. This finding implies that bequest motives are more strongly driven by financial than emotional needs (i.e. leaving a legacy to one's heirs).

iii. **Marital status:** married respondents tend to have stronger bequest motives than single respondents, regardless of when death might occur.

iv. **Gender:** women tend to have stronger bequest motives than men, regardless of when death might occur. This is consistent with the previous findings that women tend to be more concerned over retirement planning and spending issues than men.

v. **Fixed assets:** respondents with higher fixed assets (i.e. properties) tend to consider bequest as more important. Interestingly no such relationship is observed for liquid assets. This implies that, potentially, respondents view properties as their major source of bequest.

vi. **Retirement and age:** since retirement and age are both negatively related[16] to the number of dependents (i.e. younger or pre-retirees tend to have more dependents), we find a mild relationship between each of the two factors and bequest.

(1: unimp 5: imp)	Age	Retirement (1: pre 2: ret)	Gender (1: F 2: M)	Marital (1. mar 2: sin)	Dependents (1: 1 5: ≥ 5)	Liquid	Fixed
< 10	-0.05^*	-0.10^{**}	-0.11^{**}	-0.13^{**}	0.21^{**}	0.02	0.07^{**}
$10 - 20$	-0.05^*	-0.06^*	-0.09^{**}	-0.12^{**}	0.20^{**}	0.02	0.07^{**}
> 20	-0.06^*	-0.06	-0.09^{**}	-0.11^{**}	0.20^{**}	0.02	0.06^*

Table 25 Kendall's taus: relationship between bequest motives and demographic information.

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[15] Q10 collects responses on the number of people the household income supports in 2015 (for pre-retirees) and in the first year of retirement (for retirees). The average is 2.19 for pre-retirees and 1.98 for retirees (the Mann-Whitney U-test is performed with $p = 0.0116$. The null hypothesis of equal distribution is rejected at the 5% level.). Since no data is collected on the number of dependents retirees currently have, we make the assumption that the number of current dependents is equal to that at retirement.

[16] The estimated Kendall's tau for age and retirement, against the number of dependents are -0.14^{**} and -0.07^*.
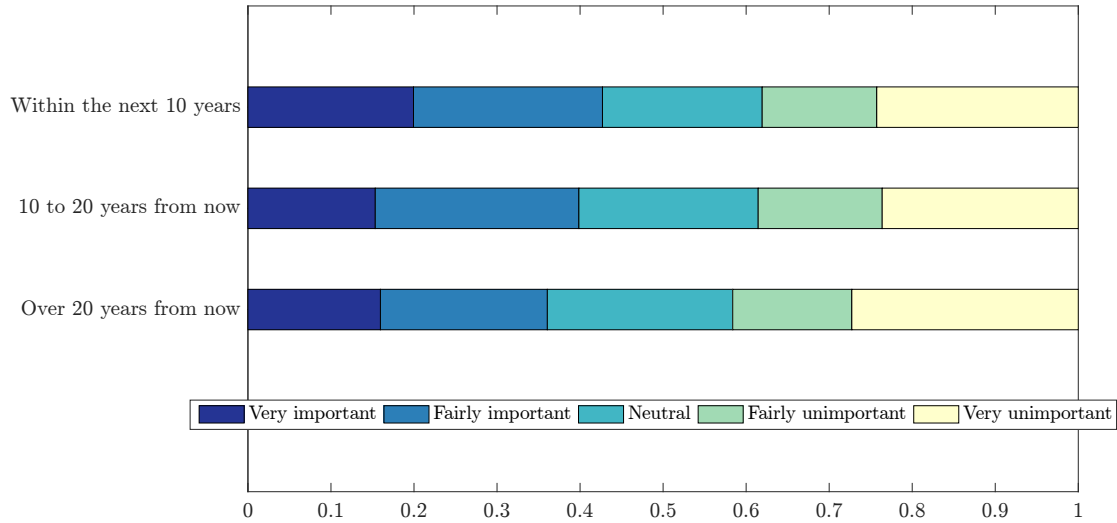
Figure 22 All participants: the importance of bequest if respondents were to die within different time periods.

7.6 Risk and time preferences

7.6.1 Risk preferences

We elicit risk preferences both qualitatively and quantitatively. Qualitative results are summarized in Figures 23 and 24, quantitative results in Figures 25, and 26 and Table 26.
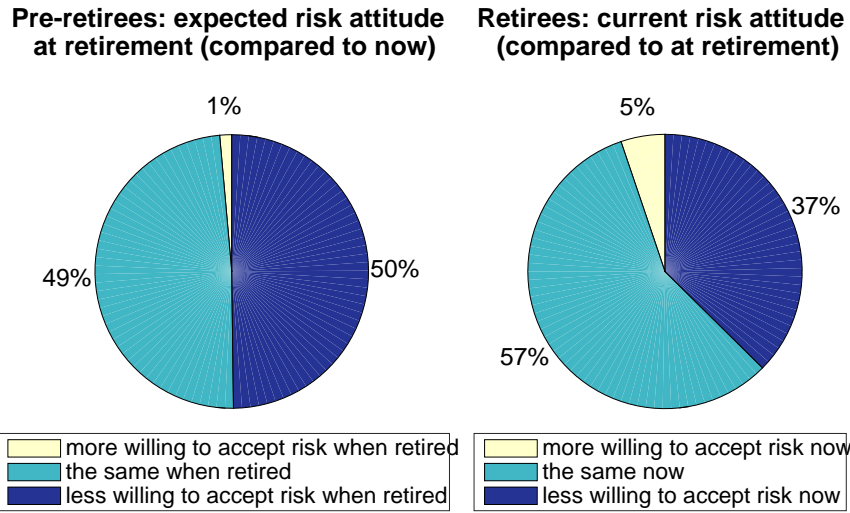
i. **Average risk aversion is "moderate":** For pre-retirees, the median description for current risk attitude with respect to managing assets is that "I am willing to accept moderate risk". The same median is observed for retirees when asked to state their risk attitude when first retired. The distributions of risk attitude for pre-retirees and retirees show strong similarities (see Figure 23).

ii. **Risk aversion over time:** When asked to compare risk attitude across time (see Figure 24), almost all respondents expect/express that their risk tolerance level will be/is no greater than when they were younger. In other words, there is strong evidence that risk aversion is perceived to either stay the same or increase with age. This perception is consistent with empirical research findings such as Eckel and Grossman (2008) and Halek and Eisenhauer (2001). An interesting observation is that pre-retirees have a very reasonable expectation as to how their risk attitude would change entering retirement.

iii. **CRRA parameter:** The median implied CRRA range for pre-retirees is $1.74 < \rho < 2.48$ under *lower stakes* and $2.48 < \rho < 3.74$ under *higher stakes*. For retirees, the range is $2.48 < \rho < 3.74$ under both cases. Close to 90% of respondents have an implied CRRA parameter greater than zero (i.e. risk averse). There is strong depen-

dency between the implied CRRA range under the lower and higher stake options (see Figure 26). We highlight the following implications and findings:

- For pre-retirees, the CRRA parameter is dependent on the level of consumption, such that the higher the stakes, the higher the aversion to risk. This is consistent with findings by Harrison et al. (2007), which offered evidence of lower estimates of relative risk aversion when the stakes are reduced significantly. These empirical observations question the validity of the restrictive representation of the CRRA utility function. Nonetheless, we find no such evidence for retirees. It could be that the difference exists but is too small to be detected. We postulate that this difference may reduce with age.

- Relative risk aversion is related to age, retirement status, gender, education, and wealth (see Table 26), such that the *retired/female/less educated/poorer* are more risk averse. Risk aversion has the strongest relationship with wealth and retirement.

Risk attitude with respect to managing assets
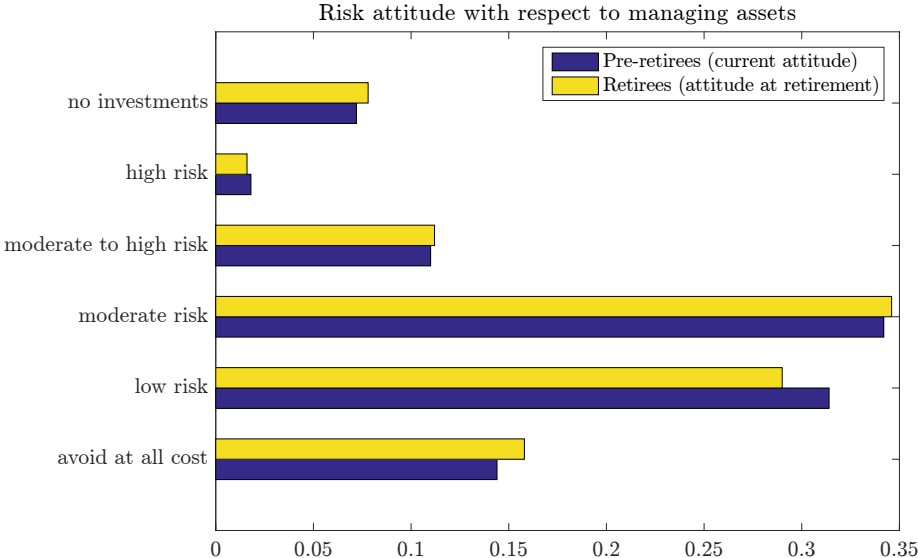
Figure 23 All participants: risk attitude (the amount of risks willing to accept).

Pre-retirees: expected risk attitude at retirement (compared to now)

Retirees: current risk attitude (compared to at retirement)

Figure 24 All participants: risk attitude (compared to current (pre-retirees) and at retirement (retirees)).
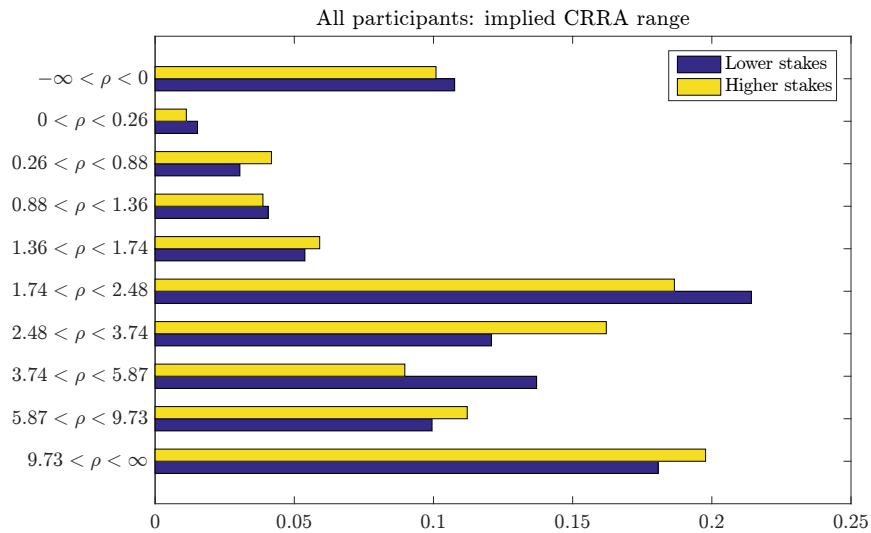
Figure 25 All participants: implied CRRA range for choices under lower and higher stakes.

51
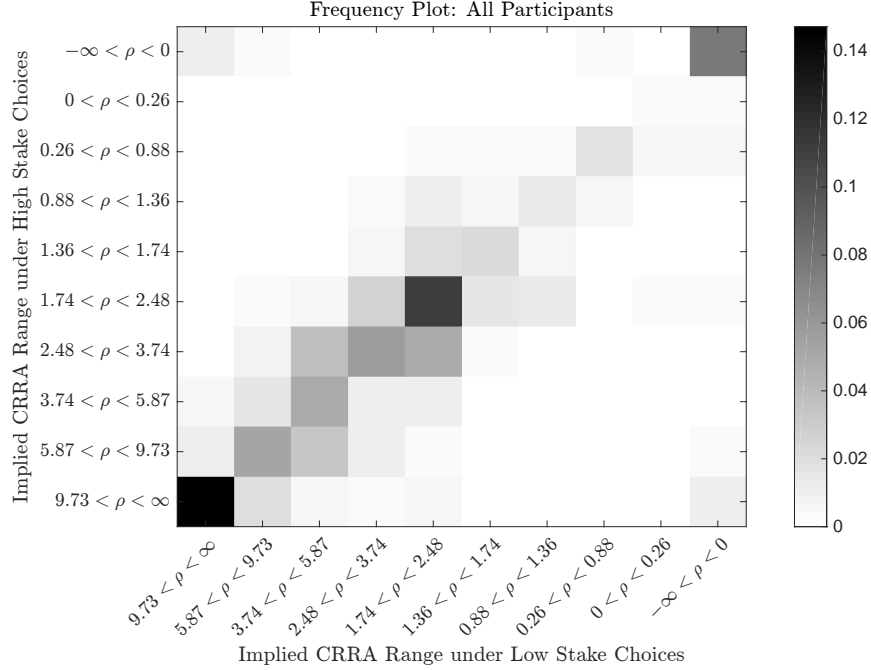
Figure 26 All participants: the relationship between the implied CRRA range under lower and higher stakes. Kendall's tau: 0.69**.

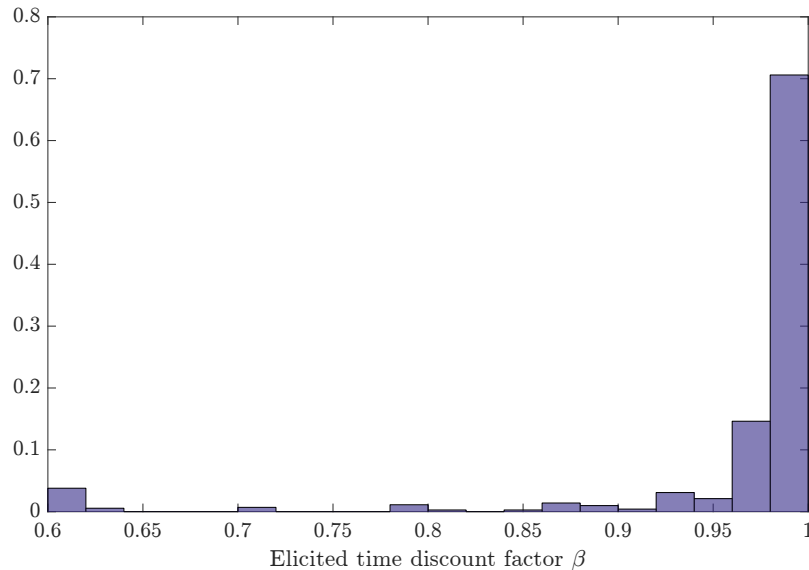|	Age	Retirement	Gender	Marital	Education	Liquid	Fixed
(1: low 10: high)		(1: pre 2: ret)	(1: F 2: M)	(1. mar 2: sin)	(1: low 6: high)		
Lower stakes	0.06^*	0.09^{**}	-0.06^*	0.05	-0.06^*	-0.08^{**}	-0.10^{**}
Higher stakes	0.05^*	0.10^{**}	-0.05	0.06^*	-0.06^*	-0.07^{**}	-0.07^{**}

Table 26 Kendall's taus: relationship between risk aversion and demographic information.

7.6.2 Time preferences

Similar to risk, time preferences are elicited through hypothetical monetary choices. Participants are asked to make 7 choices with binary payoff options, with a lower more immediate payoff and a higher payoff made in the distant future. The goal is to elicit the annual time discount factor β.

As described in section 4.2, β can only be obtained from consistent choices. Consistent choices include three cases 1) consistently choose Option A, 2) consistently choose Option B, and 3) switching from A to B, once only. Among all participants, 715 made consistent choices. We obtain 711 time discount factors due their entanglement with the parameter of risk aversion ρ (see Equation 4 and 5). Here, we use the ρ obtained from the higher

stake options, and assume a background consumption[17] of \$172 which is the average daily consumption of Ontario residents in 2015. A histogram of elicited[18] discount factors is shown in Figure 27.

Figure 27 All participants: elicited annual time discount factor β.

	Age	Retirement	Gender	Marital	Education	Liquid	Fixed	Risk aversion
		(1: pre 2: ret)	(1: F 2: M)	(1. mar 2: sin)	(1: low 6: high)			
β	0.02	0.09**	−0.04	0.03	−0.01	−0.05	−0.04	0.86**

Table 27 Kendall's taus: relationship between elicited time discount factor and demographic information.

We find the following:

i.   **Average discount factor above 0.96:** the median elicited β is 0.997, and the mean is 0.965. 85% of the elicited β are greater than 0.96, 71% are greater than 0.98. The

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[17]The assumption of background consumption ω impacts the elicited time discounting parameter β. A lower ω gives rise to a higher β. However, this impact is small within reasonable bounds. We repeated the calculations assuming an average daily background consumption of \$55 and \$300 (i.e. an average yearly consumption of \$20,075 and \$109,500) and found negligible differences. The average household consumption for Ontario residents is \$62,719 in 2015 (Source: Statistics Canada, CANSIM, table 203-0021 and Catalogue no. 62F0026M).

[18]We obtain the discount factors by taking the midpoint of the elicited range. For those who provide boundary responses (i.e. consistent choice of A or B), the elicited factor is taken as the upper or lower bound. This avoids having discount factors that imply extreme myopia.

two discount factors, 0.96 and 0.98, are commonly used in the retirement planning literature, and imply much stronger myopia in long-term problems than our empirical findings.

ii. **Retirement:** the elicited discount factor is related to the retirement status (see Table 16) in that retirees tend to have higher discount factors than pre-retirees. This implies that retirees may be more forward thinking in terms of financial planning and spending, due to lower income compared to pre-retirees.

iii. **Other demographic factors:** there is no evidence that the discount factor is dependent on age, gender, marital status, education, health, or asset levels. There is a strong positive relationship between β and ρ since the boundaries of β are increasing functions of ρ (see Equation 4 and 5).

7.7 Retirement planning under risky scenarios

7.7.1 The annuity puzzle

In the retirement planning literature, life annuities are shown to significantly improve the welfare of an individual in retirement (see Yaari, 1965; Davidoff et al., 2005; Peijnenburg et al., 2016). Despite these theoretical findings, there is ample evidence that, in practice, annuity sales are extremely low (with the exception of a few countries, such as the United Kingdom which until recently mandates partial annuitization of pension funds). This contrast is referred to as the *Annuity Puzzle*. To explore this puzzle, we construct a hypothetical annuity[19] product of \$100 per month and ask respondents to 1) value its worth, 2) make purchasing decisions, and 3) explain the reasons behind these decisions. We first ask respondents to specify the maximum amount that they are willing to pay for this product, followed by a question that offers the annuity at the selected price[20] and solicits responses on the number of units they are willing to purchase. Respondents are then asked to rate how important certain considerations are in their choices. Results are summarized in Figures 28, 29, and 30, and Tables 28 and 29. We highlight the following findings:

i. **Extreme undervaluation of annuities:** Overall, 66% of respondents report that the maximum price is below 3,000, 79% report below 6,000 and 84% report below 9,000 which is approximately half of the average market price in 2015. The 2015 average market quote for a life annuity of \$100 per month for a life aged 65 is \$19,776 for male and \$21,202 for female. This suggests that annuity products have extremely low value to respondents. Figure 28 plots the relationship between liquid assets and the reported maximum prices. We observe that the majority of the choices are concentrated on "Below 3,000", regardless of the level of liquid funds. This is an interesting

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[19]The annuity product is presented under the name "guaranteed income for life" to avoid any pre-existent negative sentiment towards the word annuity.

[20]If the previous question is skipped, the 2015 market price is shown.

observation, since for a price of $3,000 the break-even point for purchasing the annuity is roughly 3 years. A financially literate respondent should be willing to purchase at this price if they believe that survival for another 3 years is highly likely.

ii. **Extremely low interest in purchasing annuities at any price:** Since respondents reported extremely low prices, the annuities are correspondingly offered at extremely low prices (e.g. a price of $1,500 is offered for those who chose "Below 3,000" in the valuation question). Surprisingly, 53% still choose not to purchase. The average offering price for these respondents is extremely low at $3,530, which is less than one fifth of the market price.

iii. **Liquid assets, gender and education:** We find that the maximum price is more strongly impacted by the amount of liquid assets, gender and the highest level of education, all of which have been shown to be strongly related to financial literacy (see, e.g., Lusardi and Mitchell, 2007b; Lusardi and Mitchell, 2007a). Male, more educated and those with higher liquid assets tend to value annuities more highly. The impact of gender is particularly interesting since females are more exposed to longevity risk than males, and should theoretically value annuities more highly.

iv. **Retirement status:** We find that pre-retirees tend to purchase more units than retirees. This mirrors the fact that pre-retirees have on average lower retirement income than retirees due to decreasing defined benefit workplace pensions.
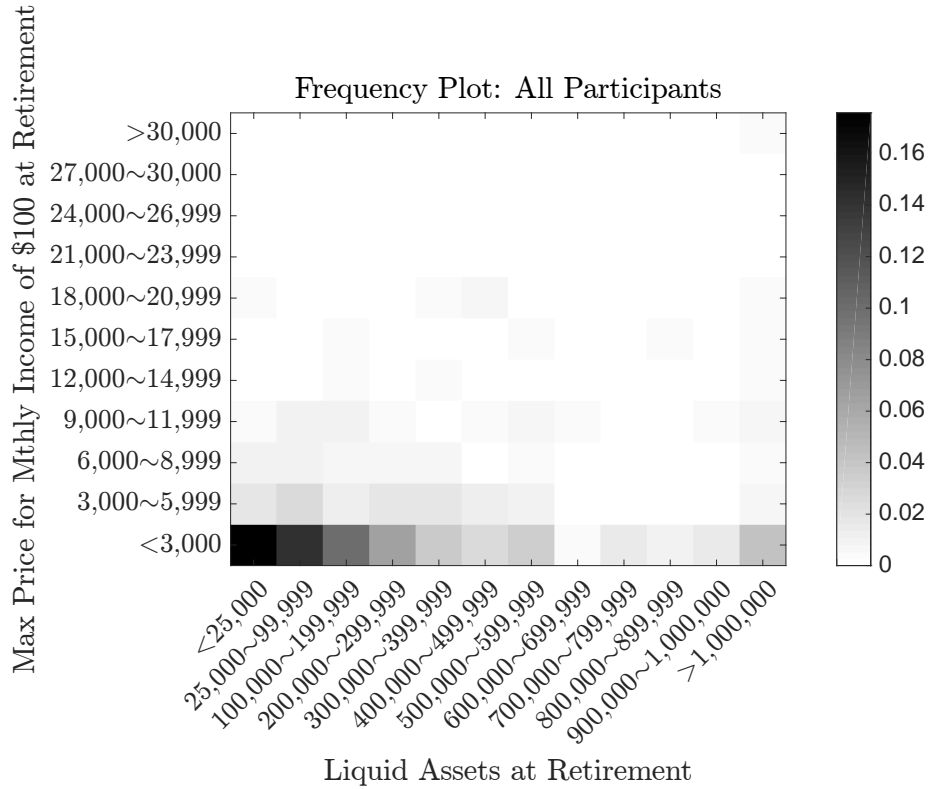
Figure 28 All participants: liquid assets and the maximum prices willing to pay for a monthly (annuity) income of $100.

Further evidence (summarized in Figure 30) suggests that the **top three concerns** over annuity purchases are:

- Credit risk (default of the annuity provider)
- Loss of flexibility and control of personal finances
- Loss of financial security

The above findings shed important light on the annuity puzzle. In the current literature, full annuitization is considered optimal when retirement planning (or welfare maximization) is based solely on maximizing the CRRA utility derived from consumption and bequest. We are not aware of any quantitative model that considers utility derived from *holding* wealth, which appears to have high psychological importance to individuals (i.e. a sense of control, liquidity and security). The fear of provider default, which can be argued to be rational or irrational, is also rarely considered in modelling descriptive decision-making. In fact, Canadian annuitants face very limited credit default risk due to the protection provided by Assuris – a Canadian consumer protection agency that insures full or partial annuity payments in the event of provider default. The strong concern demonstrated by

respondents regarding provider default points to a lack of understanding of this protection. It should be highlighted that there is some framing effect at play, since the option of provider default is presented as a possible concern.

In making the annuity purchase decision, respondents show low concerns over longevity risk, possibly due to existing access to public/workplace pension income which provides some longevity protection. Respondents are least concerned over the possibility of family facing hardship if they were to die early, which gives rise to three possible explanations: 1) they do not consider dying early as a plausible scenario; 2) there are no significant financial consequences; 3) there might be significant financial consequence, but the respondent fails to foresee, or chooses to ignore them in the present (i.e. myopia). This, combined with the findings of low bequest motives in the section 7.5.3, suggests that the financial consequences in the event of death play an unimportant role in respondents' retirement planning and spending decisions.
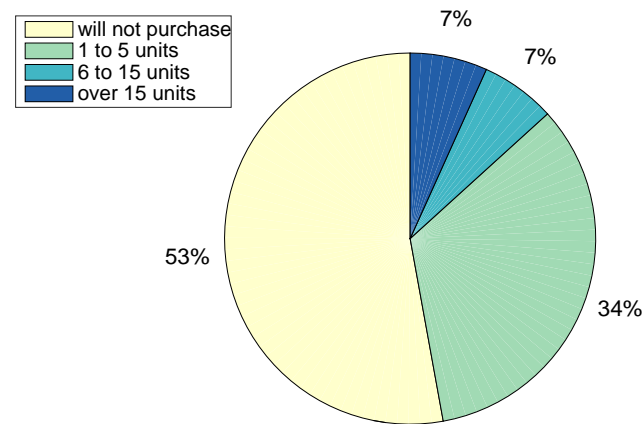
Figure 29 All participants: units of purchase when annuities are offered at agreeable prices.

	Maximum price	Units of purchase
Credit risk	0.01	0.04
Loss of flexibility and control	0.05	0.01
Loss of financial security	-0.07^{**}	-0.10^{**}
Longevity risk	0.07^{**}	0.07^{**}
Family hardship	0.00	0.03

Table 28 Kendall's taus: the relationship between maximum price/units of purchase and concerns.
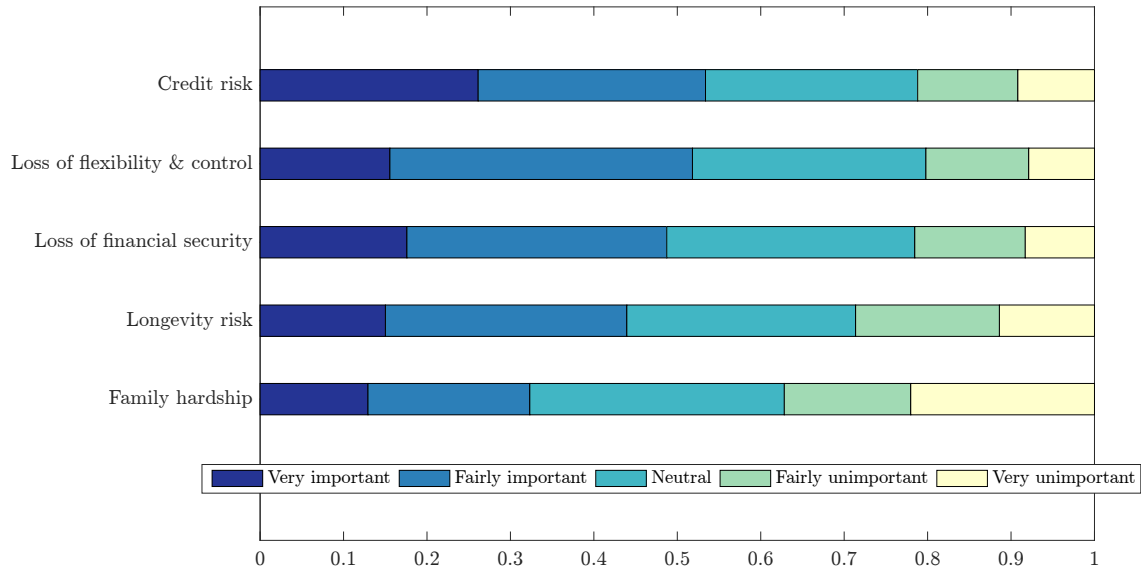
Figure 30 Concerns about purchasing annuities. From top to bottom: high to low average importance.

	Retirement	Gender	Marital	Health	Education	Liquid
	(1: pre 2: ret)	(1: F 2: M)	(1. mar 2: sin)	(1: exc 5: poor)	(1: low 6: high)	
Price	0.05	0.17**	−0.10**	−0.07*	0.17**	0.23**
Units	−0.12**	0.05	−0.01	−0.03	0.08**	0.09**
Credit risk	−0.10**	−0.10**	−0.04	0.03	−0.03	−0.01
Loss of flexibility	−0.09**	−0.08**	−0.01	0.05	−0.02	0.02
Loss of security	−0.09**	−0.16**	−0.03	0.07**	−0.06**	−0.09**
Longevity	−0.17**	−0.17**	0.00	0.06*	−0.06**	−0.08**
Family hardship	−0.08**	−0.02	−0.18**	0.08**	−0.11**	−0.08**

Table 29 Kendall's taus: relationship between annuity purchases, concerns and demographic information.

7.7.2 Decision-making under risky pension scenarios

The purpose of this section is to assess the descriptive validity of the traditional life-cycle investment approach to retirement planning, which is to maximize welfare measured by the expected discounted lifetime utility (EDLU) derived from real consumption. In this section, we compare the pension choices implied under the EDLU approach, and the actual

choices made by survey subjects. The maximized EDLU is expressed mathematically as

$$\max_{p \in \mathcal{P}} \mathbb{E} \left\{ \sum_{t=0}^{\infty} \beta^t u \left(c_t(p) \right) \right\} \tag{18}$$

where $\mathcal{P} = \{$"pension option 1", "pension option 2"$\}$, and $\{c_t(p)\}_{t=0}^{\infty}$, real consumption, is a function of p. The implied decision under EDLU is that the subject should choose "pension option i" if

$$\mathbb{E} \left\{ \sum_{t=0}^{\infty} \beta^t u \left(c_t(i) \right) \right\} > \mathbb{E} \left\{ \sum_{t=0}^{\infty} \beta^t u \left(c_t(j) \right) \right\}, \qquad i \neq j. \tag{19}$$

Under the CRRA assumption, the utility function is $u(c) = \dfrac{(\omega + c)^{1-\rho}}{1 - \rho}$. In our analysis, we compute the pension choices implied under the EDLU maximization method using elicited time and risk preference parameters $\widehat{\beta}$ and $\widehat{\rho}$. We additionally assume zero background consumption and that the monthly pension income is fully consumed. In reality, individuals may choose to save, invest or borrow, but data on such specific behaviour is not collected (and would be extremely difficult to do so, especially in a cross-sectional survey). The assumption simplifies the problem and the results should be interpreted accordingly.

The elicited time discount rates are based on short-term choices (i.e., 1 year) and are being applied to longer term problems (i.e., 30+ years). The assumption is that intertemporal choice is time-consistent, meaning that preferences do not change over time. This is referred to as time-consistent discounting, or exponential discounting. Though widely used in the economic and retirement planning literature, there exists evidence that exponential time discounting does not reflect the observed behaviour of individuals (Loewenstein and Prelec, 1992). A prominent alternative to exponential discounting is hyperbolic discounting, under which the discounting effect declines for longer periods (i.e., β in more distant periods becomes closer to 1), and choice becomes time-inconsistent (see Laibson, 1997). Our current study restricts the investigation to the time-consistent model described in Equation 18, which is commonly adopted in the retirement planning literature to date. Investigations of alternative decision-making models are reserved for future studies.

One may be interested in the implication of hyperbolic discounting on long-term decision-making investigated in this study. For this we provide the following comments. If the observed preferences are well-described by hyperbolic discounting, then future gratifications would be discounted less heavily (compared to exponential discounting), which would potentially impact decision-making at the present. This effect would be more prominent for those who exhibit stronger hyperbolic preferences. Potentially, agents with a lower short-term discount factor β. Overall, most of the elicited β's are very close to unity, meaning that very little short-term discounting is observed. This implies that for most surveyed individuals, even under the assumption of exponential discounting (where the future is more heavily discounted than in hyperbolic discounting), time discounting does not have a dom-

inant impact on decision-making. The implication is that if preferences follow hyperbolic discounting, most of the differences in model-implied choice would be quite small.

i. Inflation-indexed pension (with subjective beliefs)

Respondents are first asked to choose between Match-inflation pension (MIP,"pension option 1") and Steady pension (SP, "pension option 2") without any given information on future inflation outlook. The breakdown of choices for all six cases is summarized in Figure 31. The relationships between pension choices and certain decision-making factors are presented in Table 30. We highlight the following findings:

i.   **Consistency:** respondents on average make consistent choices. The proportion of MIP choices increases for succeeding choices, which is reasonable since the next MIP choice gives strictly higher income. This is also observed in the next section when objective inflation information is provided.

ii. **Low expectation of cumulative inflation impact in the long term:** when provided with no information on inflation outlook, respondents place lower value on the MIP. Comparing Figure 31 to Figures 32 and 33, the percentage of those who prefer the MIP increases dramatically, implying that the subjects either 1) believe that inflation has a lower impact on the cost of living than described (i.e. on average 2% per annum with some variations), or 2) lack the understanding of cumulative inflation impact on the cost of living. A combination of both factors is also likely.

iii. **Financial literacy:** certain choices are quite strongly clouded by low financial literacy. Certain respondents with low financial literacy may not grasp the concept of inflation or be able to quantify its cumulative impact in the long term. This is clearly observed in Figure 31, where 31% choose SP over MIP when MIP gives strictly higher income in all scenarios. This is strongly related to subjects' understanding of the MIP option: Table 30 shows an increasing estimated Kendall's tau for "MIP is difficult to understand", suggesting that those who find the MIP difficult to understand are far more likely to choose the steady option regardless of the case.

iv. **Other relationships:** respondents concerned with inflation impact on living standard tend to identify, correctly, that the MIP provides inflation protection, and are willing to "trade" such protection with lower income in the earlier years. Those not concerned with inflation risk are more likely to choose the SP in all cases. However, both relationships are rather mild. An interesting observation is that "maintaining a stable living standard" is not associated with either pension choice, as one would expect. The implication is that that respondents may fail to recognize that the MIP is the option that provides "steady" purchasing power.

ii. Inflation-indexed pension (with objective information)

In the second part of this section, participants are asked to remake the six choices between Match-inflation pension (MIP,"pension option 1") and Steady pension (SP, "pension option
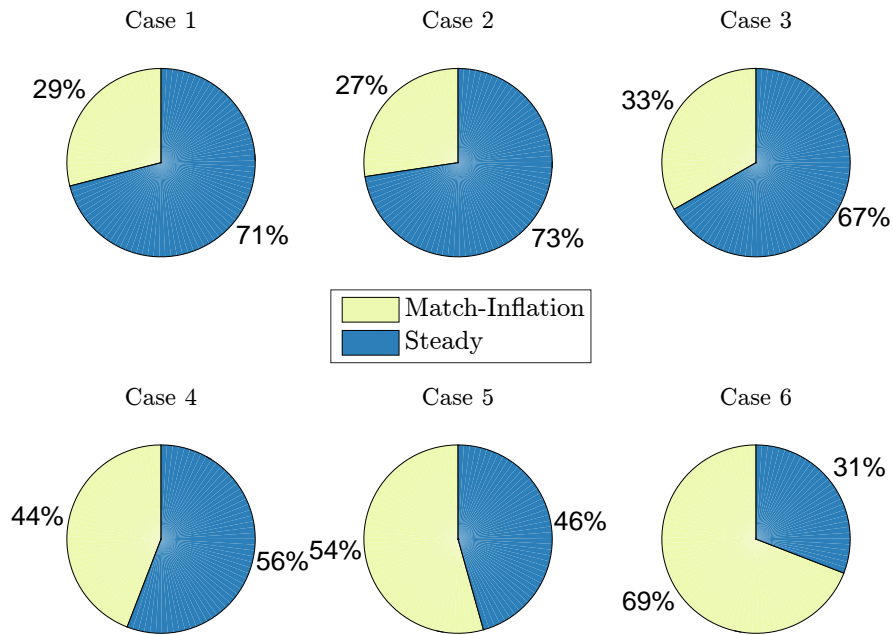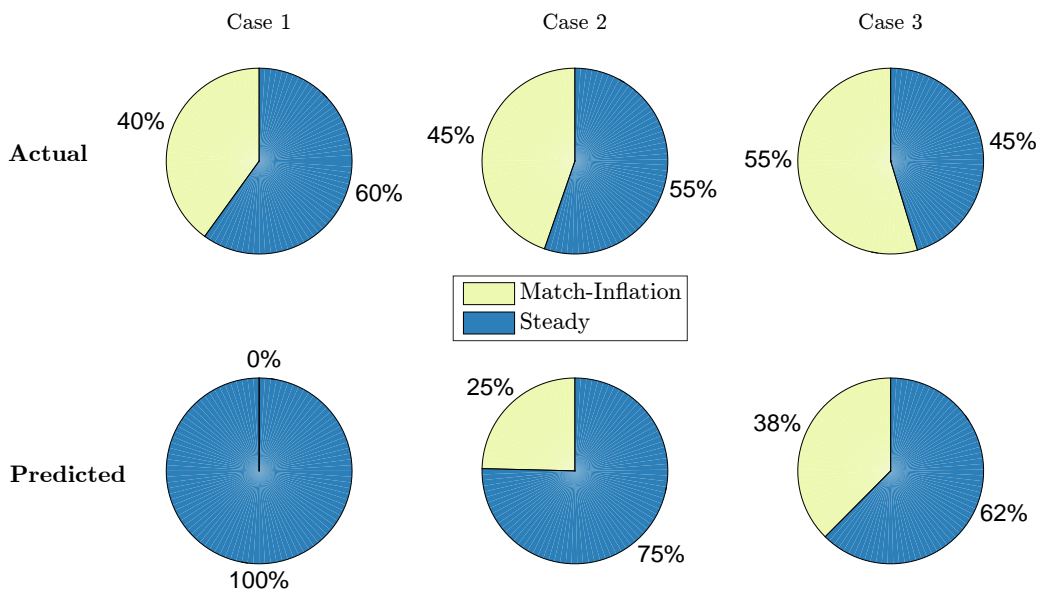
Figure 31 All participants: choices under match-inflation pension (subjective beliefs on future inflation).

(1: unimp 5: imp) \ (1: MI 2: S)	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Stable living standard	0.05	0.04	0.04	0.05	0.06	0.02
Inflation impact	-0.11^{**}	-0.10^{**}	-0.10^{**}	-0.08^{*}	-0.03	-0.05
Inflation risk is low	0.04	0.02	0.07^{*}	0.09^{**}	0.08^{**}	0.08^{**}
MIP difficult to understand	0.03	0.05	0.10^{**}	0.17^{**}	0.22^{**}	0.20^{**}

Table 30 Kendall's taus: relationship between match-inflation pension choices and retirement planning concerns (subjective beliefs on future inflation).

2"), but this time with objective information on inflation provided. Participants are told that inflation is on average 2% per year, but can vary between 1% and 3% from year to year (i.e. is risky). A graph on the cost of living for the next 35 years is provided, along with a chart that depicts the income paths for options 1 and 2. For a detailed description of the survey questions, see Section 4.3.

Figures 32 and 33 compare the actual choices made by subjects and the implied (or "predicted") choices under the EDLU maximization approach. The relationships between pension choices and selected demographic factors, retirement income and planning concerns are summarized in Tables 31, 33 and 34, respectively. The importance of concerns are summarized in Figure 34. We additionally analyze the point at which subjects switch from SP to MIP, as it reveals important insight on the perceived "cost" of inflation protection. The switching point is defined as the pension scenario where the respondent selects the MIP for the first time. Those who select SP for all six cases are ignored (83 individuals). The relationships between the switching points and subjective survival beliefs are summarized in Table 32.

Figure 32 All participants: choices under match-inflation pension scenarios 1 to 3 (inflation information provided).

We highlight the following findings:

i. **Dramatic differences between actual and implied choices when the MIP is costly:** when the MIP is more "costly" (cases 1, 2 and 3), we observe stronger preferences towards the MIP than those implied under the EDLU maximization approach. This suggests that inflation protection in retirement income is valued much more strongly than the model predicts. Note that in case 1, where the MIP is offered
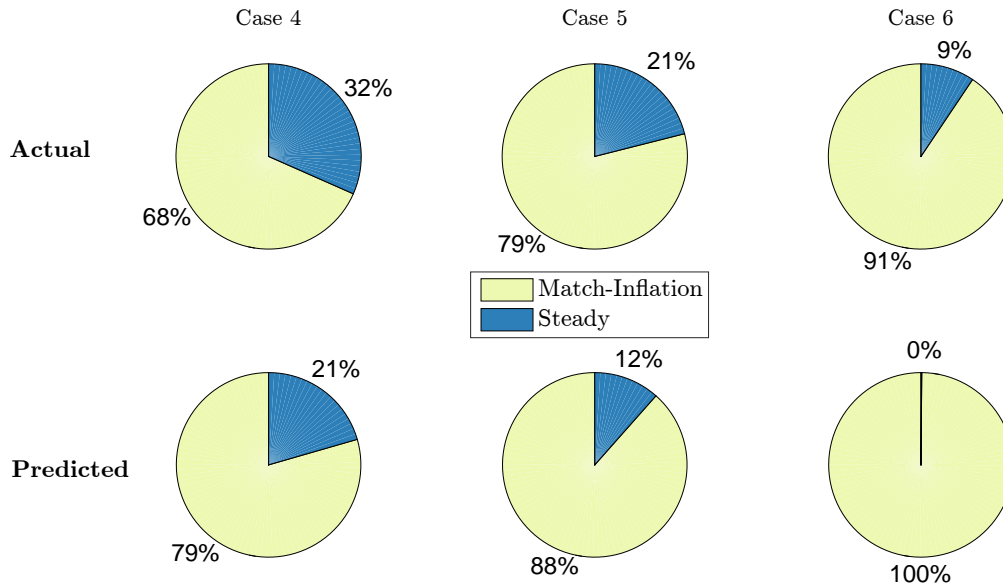
Figure 33 All participants: choices under match-inflation pension scenarios 4 to 6 (inflation information provided).

at a higher price than the average 2016 market price for inflation-indexed annuities, 40% still prefer the MIP to the SP. The differences are smaller for higher MIP benefits (cases 4, 5 and 6), as the appeal of MIP become more apparent to the participants. Nonetheless, 9% of participants prefer the SP when the MIP gives less risky and strictly higher real payments. This may be a result of extreme risk-seeking behaviour, irrationality, mindless decision-making or confusion/misinterpretation.

ii. **Average switching points:** the mean and median switching point to the MIP are 2.84 and 3, respectively. Both suggest a higher starting value than the average 2016 market starting value for inflation-indexed annuities, implying that the average price is moderately higher than what an average individual would accept (in the presence of a fixed annuity).

iii. **The cost of inflation protection related to subjective longevity beliefs:** the switching point is found to be related to age, subjective expected age at death, and subjective beliefs of survival rate to an extreme old age of 95. The impact of age in decision-making is evident, since older participants have lower uncertainties regarding future longevity (since age 65, as the hypothetical scenario describes). Those who believe that they would live longer (measured by subjective expected age at death and survival rate to 95), are more likely to choose the MIP due to the stronger long term impact of inflation. The switching point is also found to be unrelated to retirement status, gender, marital status, education, assets or risk aversion.

iv. **The impact of retirement savings:** subjects with lower retirement liquid assets

tend to prefer the MIP when the MIP is more expensive. This is a reasonable observation since lower liquid assets are less likely to provide a long-lasting income stream that protects against declining purchasing power. As the MIP becomes less costly, the relationship with savings changes. This is due to the fact that the group of subjects who consistently choose the SP (even when the MIP is quite attractive) are increasingly dominated by subjects with lower financial literacy. These individuals tend to have lower assets and are less educated (see column "Education" in Table 31).

v. **Retirement income has little impact:** we observe little significant relationship between pension choices and retirement income. It is unclear whether respondents, while making the hypothetical pension choices, take existing retirement income into consideration.

(1: MI 2: S)	Age	Retirement (1: pre 2: ret)	Gender (1: F 2: M)	Marital (1. mar 2: sin)	Education (1: low 6: high)	Liquid	Fixed	Risk aversion
Case 1	−0.04	−0.02	0.03	0.04	−0.01	0.07**	0.05	−0.02
Case 2	−0.06*	−0.03	0.06*	0.02	−0.01	0.09**	0.05	−0.01
Case 3	−0.08**	−0.05	0.07*	0.01	−0.02	0.02	0.01	0.01
Case 4	−0.11**	−0.10**	−0.01	0.01	−0.08**	−0.08**	−0.06*	0.03
Case 5	−0.09**	−0.04	−0.04	0.00	−0.12**	−0.12**	−0.09**	0.07*
Case 6	−0.06*	0.00	−0.01	−0.03	−0.07*	−0.07**	−0.07*	0.06*

Table 31 Kendall's taus: relationship between match-inflation pension choices and demographic information (inflation information provided).

	Age	Expected age at death	Subjective survival rate to age 95	Time discounting
Switch	−0.06*	−0.11**	−0.12**	−0.06

Table 32 Kendall's taus: relationship between match-inflation pension choices and age, subjective survival and time discounting (inflation information provided).

(1: MI 2: S)	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Defined Benefit	−0.05	−0.04	−0.05	−0.06*	−0.01	0.01
Public pension	−0.07*	−0.08**	−0.04	0.00	0.01	−0.02
Life annuities	−0.07*	−0.07*	−0.05	0.01	0.03	0.04
Withdrawals	0.02	0.03	0.01	−0.02	−0.05	0.00
Other income	−0.01	0.00	0.00	−0.01	−0.02	−0.01

Table 33 Kendall's taus: relationship between match-inflation pension choices and retirement income (inflation information provided).

(1: unimp 5: imp) \ (1: MI 2: S)	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Stable living standard	-0.03	-0.04	-0.05	-0.01	0.00	-0.04
Inflation impact	-0.20^{**}	-0.21^{**}	-0.20^{**}	-0.15^{**}	-0.11^{**}	-0.05
Inflation risk is low	-0.01	-0.02	0.02	0.05	0.07^{*}	0.08^{**}
MIP difficult to understand	-0.06^{*}	-0.07^{*}	-0.03	0.05	0.10^{**}	0.16^{**}

Table 34 Kendall's taus: relationship between match-inflation pension choices and retirement planning concerns (inflation information provided).
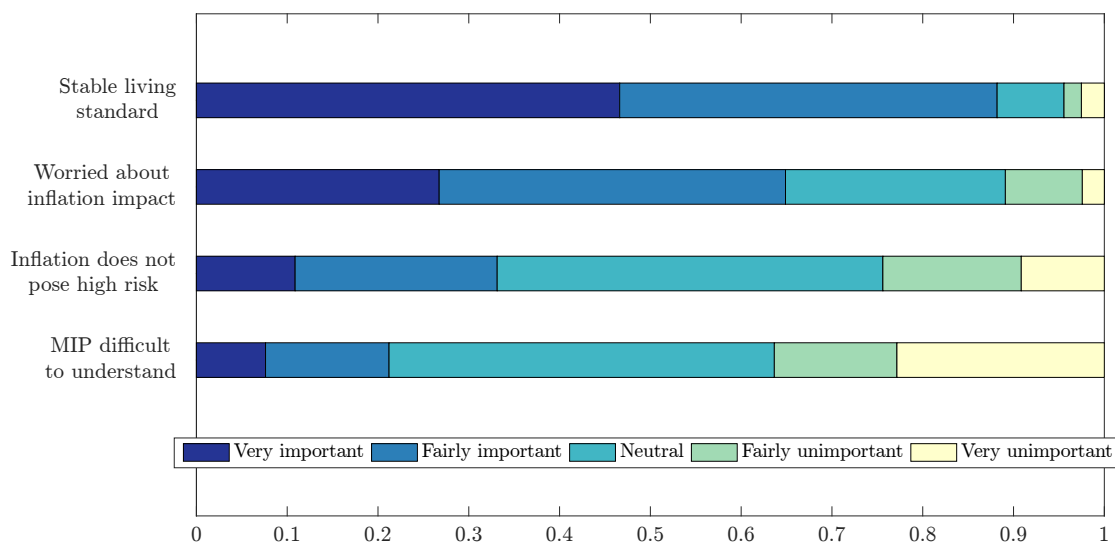
Figure 34 Importance of concerns when making choices between MIP and SP (top to bottom: high to low average importance).

iii. Equity-linked pension

In this section of the survey, participants consider a slightly different hypothetical pension scenario. The format is similar to the previous section on inflation-indexed pension with inflation information provided. Here, participants are provided with six cases. In each, participants are asked to choose between an Equity-Linked pension (ELP, "pension option 1") and the Steady pension (SP, "pension option 2"). The six scenarios vary in the starting pension incomes and the level of risk exposed in the ELP. For a detailed description of the survey question, see Section 4.3. The goal is to study the perception of the risk and return tradeoff in retirement income. In Section 7.5, we observe that subjects report low interest in taking investment risk in retirement, and a high preference for a smooth consumption/income stream. We are interested in the consistency of these responses. Participants' choices, along with implied (predicted) choices under the EDLU maximization approach are summarized in Figures 35 and 36. The relationships between the pension choices and demographic information, retirement income, and concerns are included in Tables 35, 36 and 37.

We highlight the following key findings:

i. **Dramatic differences between actual and predicted choices:** similar to MIP, we observe dramatic differences between the actual choices made by subjects and the predicted choices implied by the EDLU maximization approach. In particular, we note the following:

- **The upside gain drives decision-making:** as the ELP becomes riskier, the percentage of ELP choices increases. This has an important implication, that the main driving force behind decision-making in risky scenarios is the *upside gain.* The predicted choices imply the opposite, that fewer subjects should prefer the ELP as risk grows higher. Note that the worst case scenario (i.e. the purple path) becomes increasingly worsened. Regardless, this does not seem to, on average, discourage participants from choosing the ELP.

- **Downside protection induces more risk-taking behaviour:** a close examination of the relationship with existing pension income shows that those with higher social insurance pensions exhibit higher risk-taking behaviour. A social insurance pension acts as a minimum income guarantee: the higher the guarantee, the lower the impact of downside scenarios on living standard, hence, the lower the downside consequences for choosing the riskier workplace pension (with the upside gain unaffected). This observation has important implications on the design of retirement income products, especially those with some form of guarantee structures, such as variable payout annuities, hybrid pension plans and segregated funds products.

- **Stronger implied preferences towards the ELP by EDLU maximization:** the EDLU maximization approach suggests stronger preferences for the ELP than observed (see Figures 35 and 36), except for the case 2C where the risk is at its highest. We postulate that EDLU over-predicts risk-taking behaviour when the

risk/return is lower, and under-predicts when risk/return is higher. This may imply some form of S-shaped preference model, such as those described in Cumulative Prospect Theory (see Tversky and Kahneman, 1992).

ii. **Consistency with risk aversion:** choices are consistent with the elicited relative risk aversion, such that those with higher CRRA parameters tend to prefer the SP. Particularly, female or lower wealth subjects tend to be less risk-taking and show stronger preferences towards the SP (see Table 35).

iii. **Perception of risk and return:** Respondents report that the two most important deciding factors are:

- Old-age financial security[21]
- Persistently poor stock performance[22].

The two least important concerns are:

- Incomprehensible pension choices[23]
- Risk-taking for long term gains[24]

Additionally, Table 37 shows that the top two important concerns are associated with a preference for the SP, along with the fear of stock market crashes and a preference for choices that are comprehensible (i.e. the implication is that the SP is easier to understand than the ELP, hence more preferable). In particular for the most important concern, the association shows *farsightedness*, as respondents tend to recognize the long term risk in the extremely low income paths. This is consistent with the high average elicited time discount factor.

Although risk-taking for long term gains is rated as the least important on average, those who believe in its importance show a very strong preference for the ELP. A contradiction is observed for "changing risk attitude"[25], as those who consider this an important reason tend to choose the ELP. Recall that in Section 7.6, almost half of subjects report that aversion to risk will increase as they age. This implies that these respondents should, theoretically, prefer the SP as the ELP has higher volatility and downside consequences as they age. This brings about important questions about how respondents perceive risk and return. We postulate that respondents may perceive the SP as "risky" as it would provide "insufficient" income when compared to the highly attractive upside of the ELP, hence putting their financial security at risk.

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[21]I want to make sure I have enough income later in life.

[22]I am worried about persistent poor stock market performance and deteriorating income stream.

[23]The concept of the Equity-Linked pension option is difficult to understand.

[24]I expected to take some risk to gain exposure of possible higher income in the long term.

[25]I expect my risk attitude to change as I grow older.
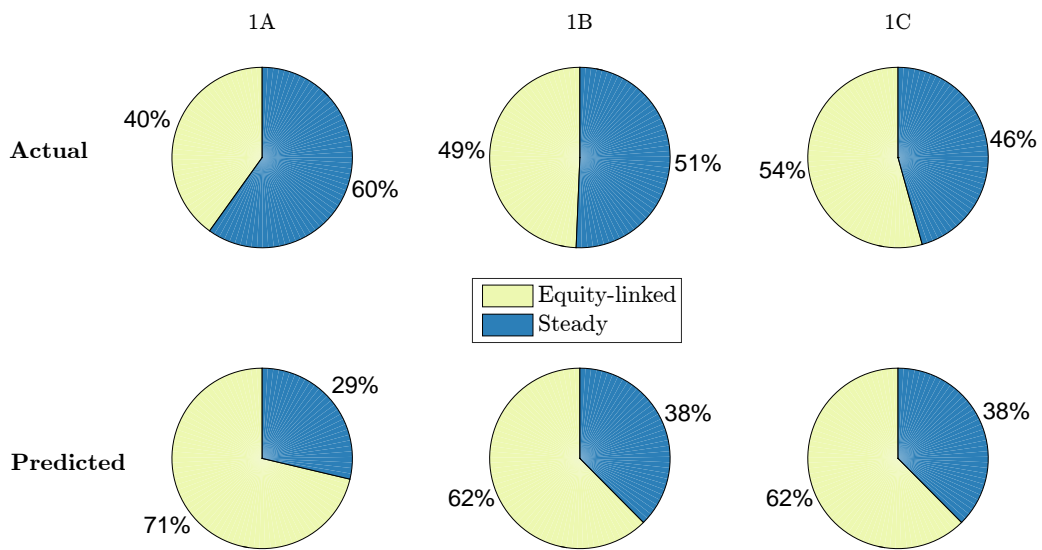
Figure 35 All participants: choices under risk pension scenarios 1A to 1C.
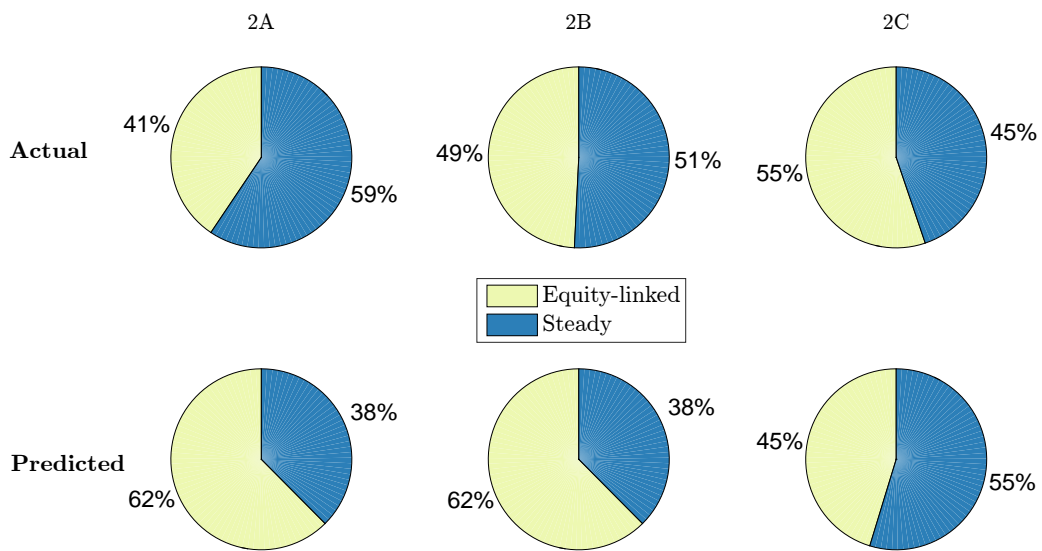
Figure 36 All participants: choices under risk pension scenarios 2A to 2C.

| (1: EL 2: S)	Age	Retirement (1: pre 2: ret)	Gender (1: F 2: M)	Marital (1. mar 2: sin)	Education (1: low 6: high)	Liquid	Fixed	Risk aversion
1A	-0.06^*	-0.03	-0.18^{**}	0.03	-0.08^{**}	-0.10^{**}	-0.08^{**}	0.14^{**}
1B	-0.05	0.01	-0.14^{**}	0.03	-0.07^*	-0.08^{**}	-0.07^*	0.18^{**}
1C	-0.03	0.03	-0.14^{**}	0.04	-0.07^*	-0.07^{**}	-0.07^*	0.16^{**}
2A	-0.01	0.03	-0.11^{**}	0.03	-0.03	-0.09^{**}	-0.06^*	0.12^{**}
2B	-0.05	-0.02	-0.10^{**}	0.02	-0.06^*	-0.08^{**}	-0.06^*	0.16^{**}
2C	-0.05	-0.01	-0.14^{**}	0.03	-0.05	-0.08^{**}	-0.06^*	0.19^{**}

Table 35 Kendall's taus: relationship between equity-linked pension choices and demographic information.

| (1: EL 2: S)	1A	1B	1C	2A	2B	2C
Defined Benefit	0.05	0.02	0.00	0.04	0.00	0.00
Public pension	-0.06^*	-0.10^{**}	-0.06^*	-0.06^*	-0.06^*	-0.04
Life annuities	-0.02	-0.05	-0.05	-0.03	-0.05	-0.05
Withdrawals	-0.06^*	-0.06^*	-0.04	-0.07^*	0.04	-0.03
Other income	-0.04	-0.06	-0.02	0.04	0.01	0.01

Table 36 Kendall's taus: relationship between equity-linked pension choices and retirement income.

(1: unimp 5: imp) \ (1: EL 2: S)	1A	1B	1C	2A	2B	2C
Take risk for return in long term	-0.33^{**}	-0.36^{**}	-0.36^{**}	-0.31^{**}	-0.37^{**}	-0.39^{**}
Stock market crashes	0.30^{**}	0.31^{**}	0.28^{**}	0.20^{**}	0.24^{**}	0.25^{**}
Persistently poor stock performance	0.29^{**}	0.29^{**}	0.26^{**}	0.21^{**}	0.23^{**}	0.24^{**}
Prefer understandable options	0.23^{**}	0.22^{**}	0.24^{**}	0.13^{**}	0.18^{**}	0.18^{**}
ELP difficult to understand	0.13^{**}	0.13^{**}	0.11^{**}	0.07^{**}	0.11^{**}	0.10^{**}
Changing risk attitude	-0.10^{**}	-0.10^{**}	-0.13^{**}	-0.09^{**}	-0.13^{**}	-0.12^{**}
Enough income later in life	0.10^{**}	0.11^{**}	0.10^{**}	0.09^{**}	0.07^*	0.09^{**}

Table 37 Kendall's taus: relationship between equity-linked pension choices and retirement planning concerns.
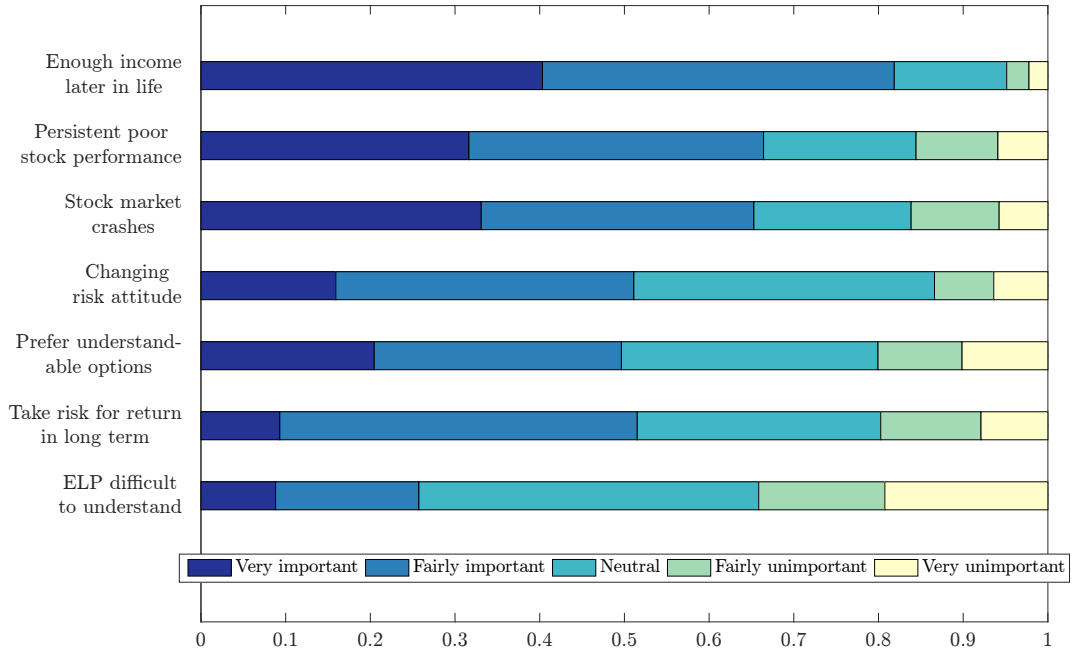
Figure 37 Importance of concerns when making choices between ELP and SP (top to bottom: high to low average importance).
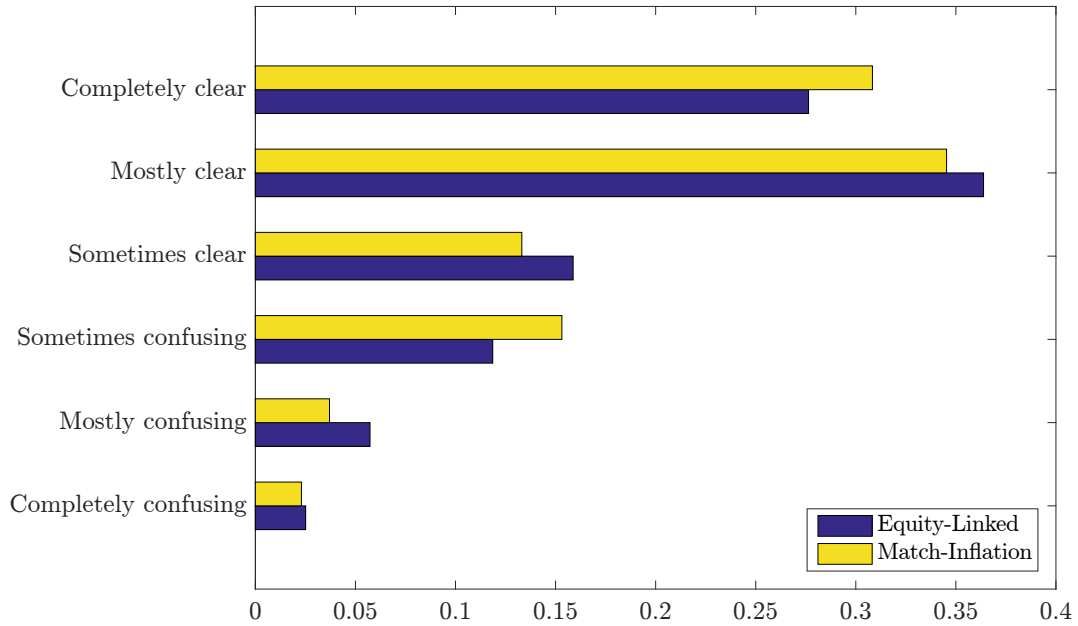
Figure 38 Reported clarity of the questions involving the Match-Inflation and Equity-Linked pension options.

8 Conclusions

This report presents the findings of the Ontario Retirement Survey, which studies retirement consumption, wealth, income, risk perception, decision-making, and planning objectives of Canadian pre-retirees and retirees. Specifically, following the footsteps of Beshears et al. (2014), we study the decision-making process of participants facing longevity, inflation and investment risks. It should be noted that these choices are hypothetical in nature, and the results should be interpreted with caution.

The study reveals several interesting findings. All of them have important implications on the design of retirement income and pension solutions, and the quantitative literature on retirement planning, especially those with a focus on the decumulation phase.

The study finds that while (pre-)retirees have reasonable beliefs for their own life expectancies, the meaning of life expectancies may be wrongly interpreted. It is possible that individuals believe that expected age at death is the maximum age achievable. This manifested in the severe underestimation of survival probabilities to an extreme old age of 95. Almost a third believe that they have zero chance of surviving to age 95 – such beliefs have important implications on retirement planning behaviours may result in severe financial consequences at an extreme old age.

There has been a strong emphasis on bequest motives in the retirement planning literature. Our study shows that leaving a bequest is, in general, unimportant; the degree of its importance is linked to the number of dependents, implying that bequest motives are more strongly driven by financial than emotional needs.

The study confirms the widespread aversion for life annuities, which results in a profound subjective undervaluation of their monetary worth, and extreme reluctance in purchasing annuities at any price. Such aversion is mainly grounded on a general fear for provider default, which is also found by Beshears et al. (2014). Although theoretically, annuities provide longevity protection, they tend to be perceived as a risky 'gamble' of whether a retiree can 'win' by outliving the pool of annuitants. The lump sum purchase, on the other hand, results in the perception of losing financial flexibility, control and security; none of which, to our knowledge, is currently incorporated in descriptive retirement decision-making models.

We find that a moderate level of risk aversion is measured by a constant relative risk aversion parameter (ρ) between 1.74 to 3.74. This is significantly lower than what is commonly assumed in the literature (i.e. $\rho = 5$). We also find that (pre-)retirees are less myopic than typically assumed. This is manifested in the high time discount factors elicited, which is very close to 1, suggesting close to zero discounting for future gratifications.

Out study on decision-making under risk pension scenarios invalidates the CRRA utility maximization approach as a descriptive model in the context of long-term retirement planning. We find dramatic differences between the actual and implied choices under the utility maximization approach. Our investigation reveals that when facing investment risks, the potential for the upside gain drives decision-making, and that having a higher minimum income protection (often provided by public pension income) induces more risk-taking be-

haviour. Further, when facing inflation risks, participants in general lack the understanding of its long-term cumulative impact on the cost of living. These findings highlight the complexity of the interplay among various retirement income sources and decision-making. They also have important implications on the design of retirement income products, especially those with embedded choices, guarantee structures, such as hybrid pension plans and segregated funds products.

As with most survey studies, the ORS has some limitations. But the study was conducted following best practices in statistical sampling. General limitations and errors present in survey studies are well-described in Fowler Jr (2013). Specific limitations in the survey design and the analysis of results are discussed as they emerge in the main text. The conclusions should be interpreted with these limitations in mind.

9 Improvements to the Survey Design

We discuss the participants' feedback on the survey design and propose some improvements to those who wish to extend the research.

i. A number of participants indicate that they would like to have the option of selecting $0, or "do not have" when asked about wealth and income. Note that the option of $0 is included in the option "Below $X", but respondents may interpret "Below $X" as a strictly positive response. These respondents believe that they are not given a selectable option, hence, may randomly select or skip the question altogether.

ii. The hypothetical annuity purchase question can be improved. In the follow-up question on annuity purchases, instead of offering the annuity at the midpoint of the selection, it may be more realistic to offer them at the lower bound of the selection. This way, the offer prices will be strictly below or at the maximum specified price.

iii. Immigration status: immigrants who arrived in Canada after adulthood face challenges when it comes to retirement planning and savings in three ways: 1) disruptive careers and differences in the nature and characteristics of employment, hence reduced capacity and incentives to save privately for retirement, 2) OAS eligibility, 3) CPP contributions.

iv. Future work may include survey questions that explore Canadians' attitude towards purchasing reverse mortgage, term and whole life insurance products.

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A Survey

Introduction

You are invited to participate in a research study conducted by Mary Hardy, David Saunders and Saisai Zhang at the Department of Statistics and Actuarial Science, University of Waterloo.

The objective of this study is to develop a better understanding of the concerns and risk preferences of individuals who are either close to retirement, or who are already retired. This will allow us to assess whether the retirement income plans offered by insurance companies, or provided through occupational pension plans, are adequately meeting the needs of retirees.

The on-line survey should take about 20 to 30 minutes to complete. We are not asking for money or selling anything. The survey includes questions about your assets, income, and some demographic information, as these are important considerations in assessing appropriate retirement income plans.

The on-line survey data is being collected by the Survey Research Centre at the University of Waterloo, on behalf of the Investigators. All survey data will be anonymous to the Investigators as they are not provided with any names or identifying information of respondents. No individual information, including participation status, will be shared with the researchers or with any other institution. When analyzed, all of the data will be summarized and no individual could be identified from these summarized results. Furthermore, the web site is programmed to collect responses alone and will not collect any information that could potentially identify you (such as machine identifiers). An analysis of the results will be published in Saisai Zhang's PhD thesis; the Investigators also intend to summarize the results in a report that will be made available to participants on request, and may include some analysis in scientific journal articles.

Participation in this study is voluntary. You can decline to respond to any question by leaving it blank, with the exception of the first two questions that determine whether you qualify to complete the survey. The first two questions are about your age and retirement status, as the Investigators are interested in the changing attitude to financial security as people transition from work to retirement. You may withdraw from participating in the survey by simply closing the browser without submitting your responses. However, once you have submitted your responses it is not possible to withdraw your consent to participate, as we have no way of knowing which responses are yours. By indicating your consent you are not waiving your legal rights or releasing the investigators or involved institutions from their legal and professional responsibilities.

The Survey Research Centre has complete control over data security and participant anonymity. The data collected from this study, with no personal identifiers, will be maintained on a password-protected computer database in a restricted access area of the university. The data will be electronically archived after completion of the study and retained for a minimum of 7 years.

There are no known or anticipated risks from participating in this study.

The survey has been partially funded by a research grant from the Canadian Institute of Actuaries. The Canadian Institute of Actuaries is the national organization of the actuarial profession, with a mission to serve the public through actuarial education and research, and is independent of the commercial interest of any financial institutions. The funders of this study have no influence over the analysis of the survey responses or the dissemination of the survey results.

We would like to assure you that this study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact the Chief Ethics Officer, Office of Research Ethics, at 519-888-4567, Ext. 36005 or ore-ceo@uwaterloo.ca.

Should you have any questions about the study, please contact Mary Hardy at mrhardy@uwaterloo.ca. If you would like to receive a copy of the results of this study, please contact Saisai Zhang at s288zhan@uwaterloo.ca. If you are experiencing technical issues when completing the survey, please contact srccinb@uwaterloo.ca.

Thank you for considering participating in this study.

[Button] I CONSENT TO PARTICIPATE

NOTES

- Texts in square brackets [marked in blue] are notes for the programmer and are not shown to the respondents. Further, section/subsection titles are not shown to the respondents.

- Respondents are gradually divided into 24 categories based on,

  a) Gender (Female, Male), determined in Q3.

  b) Marital status (Married, Single), determined in Q4.

  c) Retirement status (Pre-Retiree, Retiree), determined in Q2.

  d) Wealth status (Low, Medium, High), determined in Q11.

- Questions are presented to respondents based on their specified category. For example, a question labeled [Retiree, Single] is shown to a respondent identified as single and retired, regardless of gender and wealth status.

- In particular in Section A.4, respondents will see charts and monetary values based on their Gender and Wealth category (e.g. Female and High Wealth Status). These adaptive figures are highlighted in magenta.

- Adaptive income figures for the last section are included in Table 40 and Table 41.

A.1 Preliminary

Q1 In what year were you born?

_____

[Determine Age = 2016−Entry]

[IF Age < 50 OR IF Age > 80, THEN SHOW "Thank you but to qualify to complete this survey, we require a different age group. Thank you for your time."]

[IF SKIPPED, THEN SHOW "In order to present you with the remaining questions, please provide an answer to this question. Please click the PREVIOUS button to go back to provide an answer to continue, or the NEXT button to exit the survey."]

Q2 Which one of the statements best describes your current work/retirement status?

☐ I work full-time and I do NOT consider myself retired [→ Pre-retiree]

☐ I work full-time and I consider myself retired [→ Retiree]

☐ I work part-time and I do NOT consider myself retired [→ Pre-retiree]

☐ I work part-time and I consider myself retired [→ Retiree]

☐ I do NOT work (outside the home) and I do NOT yet consider myself retired [→ Pre-retiree]

☐ I do NOT work (outside the home) and I consider myself retired [→ Retiree]

[Determine Retirement Status]

[IF SKIPPED, THEN SHOW "In order to present you with the remaining questions, please provide an answer to this question. Please click the PREVIOUS button to go back to provide an answer to continue, or the NEXT button to exit the survey."]

Q3 How do you identify your gender?

☐ Female [→ Female]

☐ Male [→ Male]

☐ Other [→ Male]

☐ Prefer not to say [→ Male]

[Determine Gender]

[IF SKIPPED, THEN → Male]

Q4 Do you currently have a spouse or common-law partner?

☐ Yes [→ Married, SHOW Q4a]

☐ No [→ Single, SKIP Q4a]

[Determine Marital Status]

[IF SKIPPED, THEN → Single]

Q4a Is your spouse/partner...

☐ Working full-time

☐ Working part-time

☐ Not Working (outside the home)

A.2 Expectations and Experience

A.2.1 Retirement Age

Q5 [Pre-Retirees] At what age do you expect to retire?

_____ [RESTRICTION: ENTRY $\geq$ Age -1]

[Retirees] At what age did you retire?

_____ [RESTRICTION: ENTRY $\leq$ Age]

A.2.2 Life Expectancy

Q6 Approximately what age do you expect to live to?

_____ [RESTRICTION: ENTRY $\geq$ Age]

Q7 On a scale of 0% to 100%, where 0% means absolutely no chance and 100% means absolutely certain, **what do you think is the chance that you will live to be [SHOW:Age + 10] or more**?

_____% [RESTRICTION: $0 \leq$ ENTRY ≤ 100]

Q8 On a scale of 0% to 100%, where 0% means absolutely no chance and 100% means absolutely certain, **what do you think is the chance that you will live to be** 95 **or more**?

_____% [RESTRICTION: $0 \leq$ ENTRY ≤ 100]

A.2.3 Wealth

Q9 [Pre-Retirees, Married] What was your and your spouse/partner's total income in 2015? (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

[Pre-Retirees, Single] What was your income in 2015? (Please note that in this survey,

all monetary values are expressed in Canadian Dollars $)

[Retirees, Married] What was your and your spouse/partner's total income, **in the year prior to your retirement**? (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

[Retirees, Single] What was your income, **in the year prior to your retirement**? (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

☐ Below $25,000

☐ $25,000 to $49,999

☐ $50,000 to $74,999

☐ $75,000 to $99,999

☐ $100,000 to $124,999

☐ $125,000 to $149,999

☐ $150,000 to $174,999

☐ $175,000 to $199,999

☐ $200,000 to $224,999

☐ $225,000 to $250,000

☐ Above $250,000

Q10 [Pre-Retirees] How many people did this income support?

[Retirees] How many people was this income supporting at the time?

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5 or more

Q11 [Pre-Retirees, Married] **When you retire**, approximately how much money do you and your spouse/partner *expect* to have in the following savings and investment categories: (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

[Pre-Retirees, Single] **When you retire**, approximately how much money do you *expect* to have in the following savings and investment categories: (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

[Retirees, Married] **Part a**: **When you first retired**, approximately how much money did you and your spouse/partner have in the following savings and investment categories: (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

[Retirees, Single] **Part a**: **When you first retired**, approximately how much money did you have in the following savings and investment categories:(Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

a. **Liquid assets**, including Registered Retirement Savings Plan (RRSP), Registered Retirement Income Fund (RRIF), Defined Contribution Pension Fund, Tax-Free Savings Account (TFSA), Guaranteed Income Certificates (GICs), chequing and savings accounts, and any other savings in which you can decide how the money is invested (*please do not include the value of your home or other investment properties*).

☐ Below $25,000 [IF Married, Wealth Status→ Low; IF Single, Wealth Status→ Low]

☐ $25,000 to $99,999 [IF Married, Wealth Status→ Low; IF Single, Wealth Status→ Low]

☐ $100,000 to $199,999 [IF Married, Wealth Status→ Low; IF Single, Wealth Status→ Low]

☐ $200,000 to $299,999 [IF Married, Wealth Status→ Low; IF Single, Wealth Status→ Medium]

☐ $300,000 to $399,999 [IF Married, Wealth Status→ Medium; IF Single, Wealth Status→ Medium]

☐ $400,000 to $499,999 [IF Married, Wealth Status→ Medium; IF Single, Wealth Status→ High]

☐ $500,000 to $599,999 [IF Married, Wealth Status→ Medium; IF Single, Wealth Status→ High]

☐ $600,000 to $699,999 [IF Married, Wealth Status→ Medium; IF Single, Wealth Status→ High]

☐ $700,000 to $799,999 [IF Married, Wealth Status→ High; IF Single, Wealth Status→ High]

☐ 800,000 to 899,000 [IF Married, Wealth Status→ High; IF Single, Wealth Status→ High]

☐ 900,000 to 1,000,000 [IF Married, Wealth Status→ High; IF Single, Wealth Status→ High]

☐ Above 1,000,000 [IF Married, Wealth Status→ High; IF Single, Wealth Status→ High]

[Determine Wealth Status]

[IF SKIPPED, THEN → Medium]

b. **Real Estate**, including the value of your primary home and other investment properties, minus any outstanding mortgage amounts.

☐ Do not [IF Retiree, Did not] own any property

☐ Below $25,000

☐ $25,000 to $99,999

☐ $100,000 to $199,999

☐ $200,000 to $399,999

☐ $400,000 to $599,999

81

☐ $600,000 to $799,999

☐ $800,000 to $999,999

☐ $1,000,000 to $1,299,999

☐ $1,300,000 to $1,599,999

☐ $1,600,000 to $1,999,999

☐ $2,000,000 to $3,000,000

☐ Above $3,000,000

[IF GO BACK, THEN SHOW "Sorry, your answers up to this point have been saved. They are being used to determine the remaining survey questions and therefore, cannot be changed. Please click "Next" to continue the survey."]

[Retirees, Married] **Part b**: **CURRENTLY**, approximately how much money do you and your spouse/partner have in the following savings and investment categories: (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

[Retirees, Single] **Part b**: **CURRENTLY**, approximately how much money do you have in the following savings and investment categories: (Please note that in this survey, all monetary values are expressed in Canadian Dollars $)

a. **Liquid Assets**, including Registered Retirement Savings Plan (RRSP), Registered Retirement Income Fund (RRIF), Defined Contribution Pension Fund, Tax-Free Savings Account (TFSA), Guaranteed Income Certificates (GICs), chequing and savings accounts, and any other savings in which you can decide how the money is invested (*please do not include the value of your home or other investment properties*).

☐ Below $25,000

☐ $25,000 to $99,999

☐ $100,000 to $199,999

☐ $200,000 to $299,999

☐ $300,000 to $399,999

☐ $400,000 to $499,999

☐ $500,000 to $599,999

☐ $600,000 to $699,999

☐ $700,000 to $799,999

☐ $800,000 to $899,000

☐ $900,000 to $1,000,000

☐ Above $1,000,000

b. **Real Estate**, including the value of your primary home and other investment properties, minus any outstanding mortgage amounts.

☐ Do not own any property

☐ Below $25,000

☐ $25,000 to $99,999

☐ $100,000 to $199,999

☐ $200,000 to $399,999

☐ $400,000 to $599,999

☐ $600,000 to $799,999

☐ $800,000 to $999,999

☐ $1,000,000 to $1,299,999

☐ $1,300,000 to $1,599,999

☐ $1,600,000 to $1,999,999

☐ $2,000,000 to $3,000,000

☐ Above $3,000,000

A.2.4 Income and Consumption

Q12 [Pre-Retirees, Married] Please indicate the approximate amount you and your spouse/partner *expect* to receive, **in the first year of your retirement**, from the following sources:

[Pre-Retirees, Single] Please indicate the approximate amount you *expect* to receive, **in the first year of your retirement**, from the following sources:

[Retirees, Married] **Part a**: Please indicate the approximate amount you and your spouse/partner received from the following sources **in the first year of your retirement**:

[Retirees, Single] **Part a**: Please indicate the approximate amount you received from the following sources **in the first year of your retirement**:

a. Defined Benefit Pension Plan
(A defined benefit pension plan provides members with a defined pension income when they retire. The formula used to determine a member's benefit usually involves factors such as years of membership in the pension plan and the member's salary, and is not dependent on the investment returns of the plan fund.)

☐ Do not have Defined Benefit Pension Plans

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $79,999 [IF Married, $140,000 to $159,999]

☐ $80,000 to $89,999 [IF Married, $160,000 to $179,999]

☐ $90,000 to $100,000 [IF Married, $180,000 to $200,000]

☐ Above $100,000 [IF Married, Above $200,000]

b. Government Pension Provisions, including Old Age Security (OAS) Pension, Guaranteed Income Supplement (GIS), and Canada Pension Plan (CPP)

☐ Below $3,000 [IF Married, Below $6,000]

☐ $3,000 to $5,999 [IF Married, $6,000 to $11,999]

☐ $6,000 to $8,999 [IF Married, $12,000 to $17,999]

☐ $9,000 to $11,999 [IF Married, $18,000 to $23,999]

☐ $12,000 to $14,999 [IF Married, $24,000 to $29,999]

☐ $15,000 to $17,999 [IF Married, $30,000 to $35,999]

☐ $18,000 to $20,999 [IF Married, $36,000 to $41,999]

☐ $21,000 to $23,999 [IF Married, $42,000 to $47,999]

☐ $24,000 to $26,999 [IF Married, $48,000 to $53,999]

☐ $27,000 to $30,000 [IF Married, $54,000 to $60,000]

☐ Above $30,000 [IF Married, Above $60,000]

c. Life Annuities, privately purchased from an annuity provider (e.g. a life insurance company)

(Life annuities guarantee you a predetermined income for as long as you live, in exchange for a lump-sum payment upfront.)

☐ [Pre-Retirees: Do not plan to not purchase life annuities when I retire. Retirees: Do not have life annuities.]

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $80,000 [IF Married, $140,000 to $160,000]

☐ Above $80,000 [IF Married, Above $160,000]

d. Withdrawals from Liquid Assets, including for example, Registered Retirement Savings Plan (RRSP), Registered Retirement Income Fund (RRIF), Defined Contribution Pension Plan, Tax-Free Savings Account (TFSA), or other savings and chequing accounts.

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $79,999 [IF Married, $140,000 to $159,999]

☐ $80,000 to $89,999 [IF Married, $160,000 to $179,999]

☐ $90,000 to $100,000 [IF Married, $180,000 to $200,000]

☐ Above $100,000 [IF Married, Above $200,000]

e. Other Income Sources, including for example, full-time or part-time employment [IF Married, of you and your spouse/partner], property investment, etc.

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $79,999 [IF Married, $140,000 to $159,999]

☐ $80,000 to $89,999 [IF Married, $160,000 to $179,999]

☐ $90,000 to $100,000 [IF Married, $180,000 to $200,000]

☐ Above $100,000 [IF Married, Above $200,000]

Please specify these income sources _____

[Retirees, Married] **Part b**: Please indicate the approximate amount you and your spouse/partner received from the following sources **in the year 2015**:

[Retirees, Single] **Part b**: Please indicate the approximate amount you received from the following sources **in the year 2015**:

a. Defined Benefit Pension Plan
(A defined benefit pension plan provides members with a defined pension income when they retire. The formula used to determine a member's benefit usually involves factors such as years of membership in the pension plan and the member's salary, and is not dependent on the investment returns of the plan fund.)

☐ Do not have Defined Benefit Pension Plans

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $79,999 [IF Married, $140,000 to $159,999]

☐ $80,000 to $89,999 [IF Married, $160,000 to $179,999]

☐ $90,000 to $100,000 [IF Married, $180,000 to $200,000]

☐ Above $100,000 [IF Married, Above $200,000]

b. Government Pension Provisions, including Old Age Security (OAS) Pension, Guaranteed Income Supplement (GIS), and Canada Pension Plan (CPP)

☐ Below $3,000 [IF Married, Below $6,000]

☐ $3,000 to $5,999 [IF Married, $6,000 to $11,999]

☐ $6,000 to $8,999 [IF Married, $12,000 to $17,999]

☐ $9,000 to $11,999 [IF Married, $18,000 to $23,999]

☐ $12,000 to $14,999 [IF Married, $24,000 to $29,999]

☐ $15,000 to $17,999 [IF Married, $30,000 to $35,999]

☐ $18,000 to $20,999 [IF Married, $36,000 to $41,999]

☐ $21,000 to $23,999 [IF Married, $42,000 to $47,999]

☐ $24,000 to $26,999 [IF Married, $48,000 to $53,999]

☐ $27,000 to $30,000 [IF Married, $54,000 to $60,000]

☐ Above $30,000 [IF Married, Above $60,000]

c. Life Annuities, privately purchased from an annuity provider (e.g. a life insurance company)

(Life annuities guarantees you a predetermined income for as long as you live, in exchange for a lump-sum payment upfront.)

☐ Do not have life annuities.

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $80,000 [IF Married, $140,000 to $160,000]

☐ Above $80,000 [IF Married, Above $160,000]

d. Withdrawals from Liquid Assets, including for example, Registered Retirement Savings Plan (RRSP), Registered Retirement Income Fund (RRIF), Defined Contribution Pension Plan, Tax-Free Savings Account (TFSA), or other savings and chequing accounts.

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $79,999 [IF Married, $140,000 to $159,999]

☐ $80,000 to $89,999 [IF Married, $160,000 to $179,999]

☐ $90,000 to $100,000 [IF Married, $180,000 to $200,000]

☐ Above $100,000 [IF Married, Above $200,000]

e. Other Income Sources, including for example, full-time or part-time employment [IF Married, of you and your spouse/partner], property investment, etc.

☐ Below $10,000 [IF Married, Below $20,000]

☐ $10,000 to $19,999 [IF Married, $20,000 to $39,999]

☐ $20,000 to $29,999 [IF Married, $40,000 to $59,999]

☐ $30,000 to $39,999 [IF Married, $60,000 to $79,999]

☐ $40,000 to $49,999 [IF Married, $80,000 to $99,999]

☐ $50,000 to $59,999 [IF Married, $100,000 to $119,999]

☐ $60,000 to $69,999 [IF Married, $120,000 to $139,999]

☐ $70,000 to $79,999 [IF Married, $140,000 to $159,999]

☐ $80,000 to $89,999 [IF Married, $160,000 to $179,999]

☐ $90,000 to $100,000 [IF Married, $180,000 to $200,000]

☐ Above $100,000 [IF Married, Above $200,000]

Please specify these income sources _____

Q13 Please indicate how important the following considerations are in making retirement savings and spending decisions. Please select one importance rating that best represents your opinion.

	Very Unim-portant	Fiarly Unim-portant	Neu-tral	Fairly Impor-tant	Very Impor-tant
Setting money aside for nursing home or home care expenses	☐	☐	☐	☐	☐
Leaving a bequest	☐	☐	☐	☐	☐
Setting money aside to access quickly when unforeseen expenses arise	☐	☐	☐	☐	☐
The impact of inflation on my standard of living	☐	☐	☐	☐	☐
The possibility of living longer than expected	☐	☐	☐	☐	☐
The possibility of dying early	☐	☐	☐	☐	☐
Taking some investment risk with my savings during retirement	☐	☐	☐	☐	☐
Avoiding ups and downs in my income; having a smooth income stream during retirement	☐	☐	☐	☐	☐
Expecting my spending needs in the future to be less than at retirement	☐	☐	☐	☐	☐
Expecting my spending needs in the future to be more than at retirement	☐	☐	☐	☐	☐
Please specify any other important considerations in your retirement savings and spending decisions					

Q14 [Pre-Retirees] Consider the following hypothetical situation. **At the time of your retirement**, you are given an option by your financial service provider (e.g. bank, financial advisor, or insurance company) to purchase a product that guarantees you a **monthly** income of \$100 for the rest of your life. This income will stop when you die.

Please indicate the **maximum** amount of money you are willing to pay for this product (Note that this is a one-time purchase).

☐ Below \$3,000 $[P \rightarrow \$1,500]$

☐ \$3,000 to \$5,999 $[P \rightarrow \$4,500]$

☐ \$6,000 to \$8,999 $[P \rightarrow \$7,500]$

☐ \$9,000 to \$11,999 $[P \rightarrow \$10,500]$

☐ \$12,000 to \$14,999 $[P \rightarrow \$13,500]$

☐ \$15,000 to \$17,999 $[P \rightarrow \$16,500]$

☐ \$18,000 to \$20,999 $[P \rightarrow \$19,500]$

☐ \$21,000 to \$23,999 $[P \rightarrow \$22,500]$

☐ \$24,000 to \$26,999 $[P \rightarrow \$25,500]$

☐ $27,000 to $30,000 $[P \to \$28,500]$

☐ Above $30,000 $[P \to \$31,500]$

[Determine: $P =$ Midpoint value of selection]

[IF SKIPPED AND MALE, THEN $P = \$19,776$. IF SKIPPED AND FEMALE, THEN $P = \$21,202$]

[Pre-Retirees] Now assume that **at the time of your retirement**, you can purchase multiple units of the product.

For example, if you purchase 2 units, you will receive a guaranteed income of $200 per month for the rest of your life, and pay twice the price.

If the price for each $100 per month is [SHOW P], how many units of the product would you purchase?

I will purchase _____ unit(s). (Indicate 0 if you are unwilling to purchase the product.)

[Retirees] **Part a**: Consider the following hypothetical situation. **When you retired**, you were given an option by your financial service provider (e.g. bank, financial advisor, or insurance company) to purchase a product that guaranteed you a **monthly** income of $100 for the rest of your life. This income will stop when you die.

Please indicate the ***maximum*** amount of money you would have been willing to pay for this product. (Note that this is a one-time purchase)

☐ Below $3,000 $[P_a \to \$1,500]$

☐ $3,000 to $5,999 $[P_a \to \$4,500]$

☐ $6,000 to $8,999 $[P_a \to \$7,500]$

☐ $9,000 to $11,999 $[P_a \to \$10,500]$

☐ $12,000 to $14,999 $[P_a \to \$13,500]$

☐ $15,000 to $17,999 $[P_a \to \$16,500]$

☐ $18,000 to $20,999 $[P_a \to \$19,500]$

☐ $21,000 to $23,999 $[P_a \to \$22,500]$

☐ $24,000 to $26,999 $[P_a \to \$25,500]$

☐ $27,000 to $30,000 $[P_a \to \$28,500]$

☐ Above $30,000 $[P_a \to \$31,500]$

Now assume that **at the time of your retirement**, you could purchase multiple units of the product.

For example, if you purchase 2 units, you will receive a guaranteed income of \$200 per month for the rest of your life, and pay twice the price.

If the price for each \$100 per month is [SHOW P_a], how many units of the product would you purchase?

I would purchase _____ unit(s). (Indicate 0 if you would be unwilling to purchase the product.)

[Retirees] **Part b**: Now, imagine that you are **CURRENTLY** given an option by your financial service provider (e.g. bank, financial advisor, or insurance company) to purchase a product that guarantees you a **monthly** income of \$100 for the rest of your life. This income will stop when you die.

Please indicate the *maximum* amount of money you are willing to pay for this product. (Note that this is a one-time purchase)

☐ Below \$3,000 [$P_b \rightarrow$ \$1,500]

☐ \$3,000 to \$5,999 [$P_b \rightarrow$ \$4,500]

☐ \$6,000 to \$8,999 [$P_b \rightarrow$ \$7,500]

☐ \$9,000 to \$11,999 [$P_b \rightarrow$ \$10,500]

☐ \$12,000 to \$14,999 [$P_b \rightarrow$ \$13,500]

☐ \$15,000 to \$17,999 [$P_b \rightarrow$ \$16,500]

☐ \$18,000 to \$20,999 [$P_b \rightarrow$ \$19,500]

☐ \$21,000 to \$23,999 [$P_b \rightarrow$ \$22,500]

☐ \$24,000 to \$26,999 [$P_b \rightarrow$ \$25,500]

☐ \$27,000 to \$30,000 [$P_b \rightarrow$ \$28,500]

☐ Above \$30,000 [$P_b \rightarrow$ \$31,500]

Now assume that **CURRENTLY**, you can purchase multiple units of the product.

For example, if you purchase 2 units, you will receive a guaranteed income of $200 per month for the rest of your life, and pay twice the price.

If the price for each $100 per month is [SHOW P_b], how many units of the product would you purchase?

I will purchase _____ unit(s). (Indicate 0 if you are unwilling to purchase the product.)

Q14a Please indicate how important the following considerations were in answering the previous question.

	Very Unim- portant	Unim- por- tant	Neu- tral	Im- por- tant	Very Impor- tant
I am concerned that I might outlive my assets	☐	☐	☐	☐	☐
I am concerned that I would lose flexibility and control in some of my own finances	☐	☐	☐	☐	☐
I am concerned that the financial service provider might not honour this guarantee	☐	☐	☐	☐	☐
I am concerned that spending on this type of product would lead to a loss of financial security	☐	☐	☐	☐	☐
I am concerned that my family would face hardship if I were to die early	☐	☐	☐	☐	☐
Please specify any other important considerations					

A.2.5 Financial Management and Advice

Q15 [Pre-Retirees] As you age, there might come a time when it becomes difficult for you and/or your spouse to manage your own finances. Please indicate how concerned you are about this.

☐ Very Unconcerned

☐ Fairly Unconcerned

☐ Fairly Concerned

☐ Very Concerned

[Retirees] **Part a**: As you age, there might come a time when it becomes difficult for you and/or your spouse to manage your own finances. Please indicate how concerned you were about this when you **first retired**.

☐ Very Unconcerned

☐ Fairly Unconcerned

☐ Fairly Concerned

☐ Very Concerned

[Retirees] **Part b**: How concerned are you about this, **CURRENTLY**?

☐ Very Unconcerned

☐ Fairly Unconcerned

☐ Fairly Concerned

☐ Very Concerned

Q16 Some people seek professional financial advice to assist in their retirement planning.Which of the following best represents your situation?

☐ I have consulted with a financial advisor in the past and I will continue to do so in the future.

☐ I have consulted with a financial advisor in the past but I do NOT plan to do so in the future.

☐ I have NOT consulted with a financial advisor in the past but I intend to in the future.

☐ I have NOT consulted with a financial advisor in the past and I do NOT intend to in the future.

Q16a Please indicate how concerned you are about each of the following regarding professional financial advisors. Please select the one rating that best represents your opinion.

	Very Uncon-cerned	Fairly Uncon-cerned	Neu-tral	Fairly Con-cerned	Very Con-cerned
Accessing high quality services	☐	☐	☐	☐	☐
Being a victim of a fraud or scam	☐	☐	☐	☐	☐
Not being able to assess the quality of the service	☐	☐	☐	☐	☐
The capability of financial advisors to address my concerns or improve my financial welfare	☐	☐	☐	☐	☐
Professional financial advisors acting in their own best interest rather than mine	☐	☐	☐	☐	☐
Please specify any other important considerations					

Q17 Please indicate how important it is to leave money for your heirs (select one importance rating for each option)

If you were to die...	Very Unim-portant	Fairly Unimportant	Neu-tral	Fairly Important	Very Important
Within the next 10 years from now	☐	☐	☐	☐	☐
10 to 20 years from now	☐	☐	☐	☐	☐
Over 20 years from now	☐	☐	☐	☐	☐

A.3 Preferences

A.3.1 General

The following questions are related to your **risk attitude**. Your risk attitude describes your willingness to accept risk of gaining or losing money when managing your finances and investments.

Q18 [Pre-Retirees] **CURRENTLY**, how would you describe your **risk attitude** with respect to managing your investable assets?

☐ I avoid risk at all cost

☐ I am only willing to accept low risk

☐ I am willing to accept moderate risk

☐ I can live with moderate to high risk

☐ I feel comfortable with high risk

☐ I do not have any investments

[Retirees] **When you first retired**, how would you describe your **risk attitude** with respect to managing your investable assets?

☐ I avoided risk at all cost

☐ I was only willing to accept low risk

☐ I was willing to accept moderate risk

☐ I could live with moderate to high risk

☐ I felt comfortable with high risk

☐ I did not have any investments

Q19 [Pre-Retirees] **When you retire**, how do you expect your **risk attitude** to change?

☐ I expect to be more willing to accept risk when I retire.

☐ I expect my risk attitude to stay the same when I retire.

☐ I expect to be less willing to accept risk when I retire.

[Retirees] Which one of the following statements best describes your **CURRENT risk attitude** compared to when you first retired?

☐ I am more willing to accept risk now than when I first retired.

☐ My risk attitude is the same compared to when I first retired.

☐ I am less willing to accept risk now than when I first retired.

A.3.2 Elicitation

Q20 In the following task, you will be presented with a list of hypothetical options. Each option has a **50/50 chance** of giving either a high payoff or a low payoff. We are interested in which option you prefer the most.

First, take a look at the following example. You do not need to make a choice in this example.

Option	Low Payoff	High Payoff	[Expected Return]	[Standard Deviation]	[Implied CRRA range]
1	$10.00	$10.00	$10.00	$0.00	$9.72 < \rho < \infty$
2	$9.50	$11.00	$10.25	$0.75	$-\infty < \rho < 9.72$

[NOTE TO PROGRAMMER: The last three columns are not shown to the respondents.]

- If you choose Option 1, there is a **50% chance** that you will receive $10.00, and a **50% chance** that you will receive $10.00 (in this special case, you will receive $10.00 for certain).

- If you choose Option 2, there is a **50% chance** that you will receive $9.50, and a **50% chance** that you will receive $11.00.

- Choosing any one of the options will not cost you any money.

- Your task is to choose the ONE option you prefer the most.

Now it is time to choose. Consider the 10 options listed below. Remember that the chances are 50/50.

Option	Low Payoff	High Payoff	[Expected Return]	[Standard Deviation]	[Implied CRRA range]
1	$10.00	$10.00	$10.00	$0.00	$9.73 < \rho < \infty$
2	$9.50	$11.00	$10.25	$0.75	$5.87 < \rho < 9.73$
3	$9.20	$12.00	$10.60	$1.40	$3.74 < \rho < 5.87$
4	$8.90	$13.00	$10.95	$2.05	$2.48 < \rho < 3.74$
5	$8.30	$15.00	$11.65	$3.35	$1.74 < \rho < 2.48$
6	$7.70	$17.00	$12.35	$4.65	$1.36 < \rho < 1.74$
7	$7.10	$19.00	$13.05	$5.95	$0.88 < \rho < 1.36$
8	$6.00	$22.00	$14.00	$8.00	$0.26 < \rho < 0.88$
9	$4.00	$25.00	$14.50	$10.50	$0 < \rho < 0.26$
10	$2.00	$27.00	$14.50	$12.50	$-\infty < \rho < 0$

[NOTE TO PROGRAMMER: The last three columns are not shown to the respondents.]

Among options 1 to 10, which do you prefer the most? Please indicate ONE option using the number 1 to 10.

_____[RESTRICTION: Number 1 to 10]

Now, consider an alternative set of 10 options listed below. Remember that the chances are 50/50.

Option	Low Payoff	High Payoff	[Expected Return]	[Standard Deviation]	[Implied CRRA range]
11	$5,000	$5,000	$5,000	$0	$9.73 < \rho < \infty$
12	$4,750	$5,500	$5,125	$375	$5.87 < \rho < 9.73$
13	$4,600	$6,000	$5,300	$700	$3.74 < \rho < 5.87$
14	$4,450	$6,500	$5,475	$1,025	$2.48 < \rho < 3.74$
15	$4,150	$7,500	$5,825	$1,675	$1.74 < \rho < 2.48$
16	$3,850	$8,500	$6,175	$2,325	$1.36 < \rho < 1.74$
17	$3,550	$9,500	$6,525	$2,975	$0.88 < \rho < 1.36$
18	$3,000	$11,000	$7,000	$4,000	$0.26 < \rho < 0.88$
19	$2,000	$12,500	$7,250	$5,250	$0 < \rho < 0.26$
20	$1,000	$13,500	$7,250	$6,250	$-\infty < \rho < 0$

[NOTE TO PROGRAMMER: The last three columns are not shown to the respondents.]

Among options 11 to 20, which do you prefer the most? Please indicate ONE option using the number 11 to 20.

_____[RESTRICTION: Number 11 to 20]

Q21 In the following task, instead of payoffs with chances, please consider these hypothetical payoffs that are made with certainty. **This means that there is NO risk associated with the payoffs.**

This task has 7 scenarios. For each scenario, you are given the option to choose between

- Payoff Option A: a lower payoff to be paid **1 month from today**, or
- Payoff Option B: a higher payoff to be paid **13 months from today**.

First, consider the following example. You do not need to make a choice in this example.

Scenario	Payoff Option A (pays 1 month from today)	Payoff Option B (pays 13 months from today)	I prefer: **Option A**	I prefer: **Option B**
1	$1,000	$1,020	☐	☐

- If you choose Option A, you will receive a payoff of $1,000 **1 month from today**.
- If you choose Option B, you will receive a payoff of $1,020 **13 months from today**.
- Choosing any one of the options will not cost you any money.
- Again, there is NO risk associated with any of these payoffs.

Now it is time to choose. For each scenario below, **please choose either Option A or B**.

Scenario	Payoff Option A (pays 1 month from today)	Payoff Option B (pays 13 months from to-day)	I prefer: **Option A**	I prefer: **Option B**
1	$1,000	$1,020	☐	☐
2	$1,000	$1,040	☐	☐
3	$1,000	$1,080	☐	☐
4	$1,000	$1,140	☐	☐
5	$1,000	$1,240	☐	☐
6	$1,000	$1,340	☐	☐
7	$1,000	$1,440	☐	☐

A.4 Retirement Planning Objectives

A.4.1 Inflation Risk

i. Subjective Inflation Beliefs

Q22 For this section, please consider the following hypothetical situation: Suppose that you are 65 years old and you are JUST about to retire. Your employer will pay you monthly pension income payments for the rest of your life. The pension will stop when you die. Your employer presents you with the following pension options:

1. **Match-Inflation Pension Option**

   This option pays a monthly pension that *increases at a rate that exactly matches inflation (i.e. the increase in the cost of living).*

2. **Steady Pension Option**

   This option pays a constant monthly pension that *does not change.*

In each of the following six scenarios, which option would you choose, assuming that you are 65 and JUST about to retire?

[EXAMPLE: HIGH, FEMALE. SEE APPENDIX FOR OTHER CATEGORIES.]

| First Monthly Income Payment		I would choose...	
Match-Inflation Option	Steady Option	**Match-Inflation Option**	**Steady Option**
This option provides income payments that increase at the rate of inflation	This option provides income payments that do not change		
$1,551	$2,358	☐	☐
$1,650	$2,358	☐	☐
$1,752	$2,358	☐	☐
$1,857	$2,358	☐	☐
$1,965	$2,358	☐	☐
$2,358	$2,358	☐	☐

ii. Objective Inflation Information

Q23 Consider the same hypothetical situation where you are 65 years old and JUST about to retire. This time, you will be provided with more information on what inflation will look like in the future.

Suppose the Canadian government targets inflation to be 2% per year, but the actual inflation in each year can be anywhere between 1% to 3%. You can expect inflation to be 2% per year on average for the rest of your life, but you do not know for certain what the actual future inflation rates will be.

To help you make a decision, the chart below presents 10 possible paths of how much things that cost $1 today could cost you in the next 35 years. Keep in mind there is an equal chance for any one of these paths to happen.

[INSERT GRAPH COLA]

Future Cost of Something Worth $1 Today
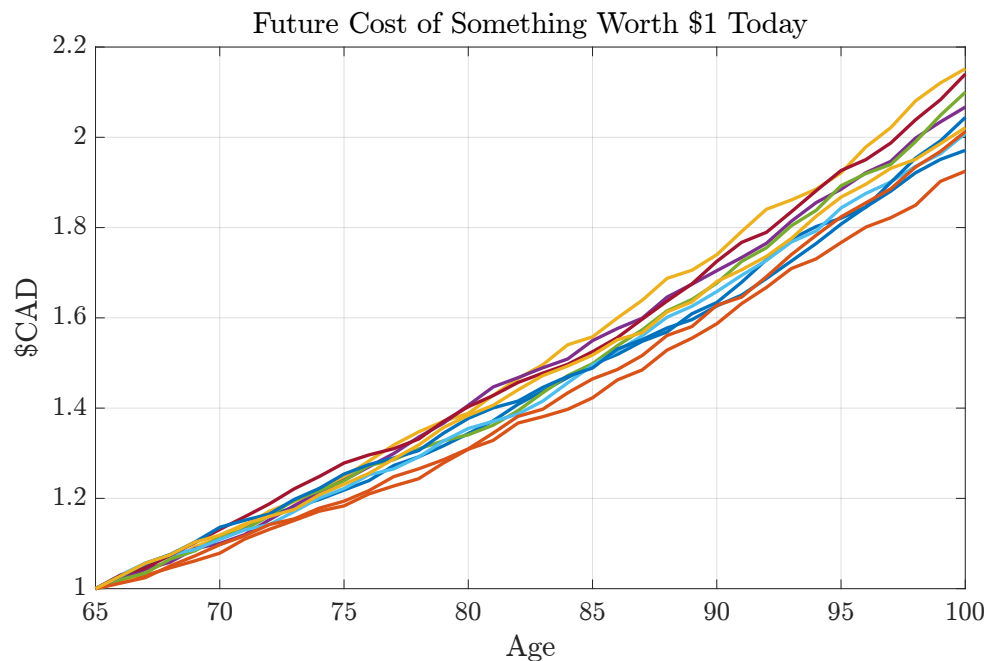
Now, consider again the two pension options your employer presents you:

1. **Match-Inflation Pension Option**

   This option pays a monthly pension that *increases at a rate that exactly matches inflation (i.e. the increase in the cost of living).*
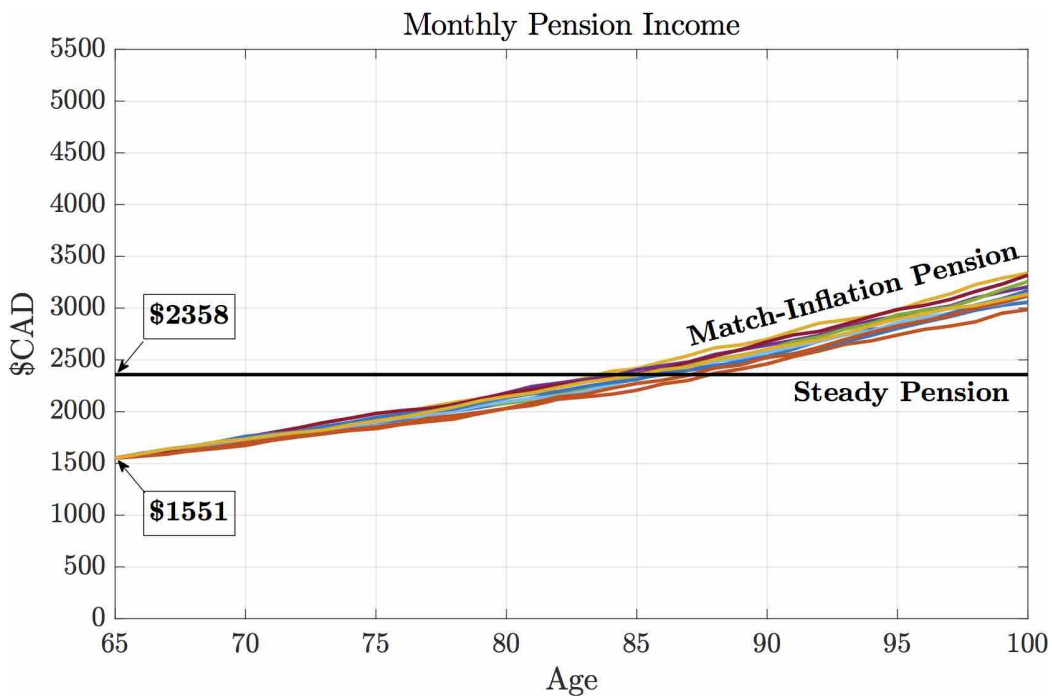
2. **Steady Pension Option**

   This option pays a constant monthly pension that *does not change.*

Consider Case 1.

- If you choose the **Match-Inflation Pension** Option,

  ▸ Your first monthly income payment will be ***$1,551***.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension** Option,

  ▸ Your first monthly income payment will be ***$2,358***.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

[INSERT PLOT MI1] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Match-Inflation Pension Option
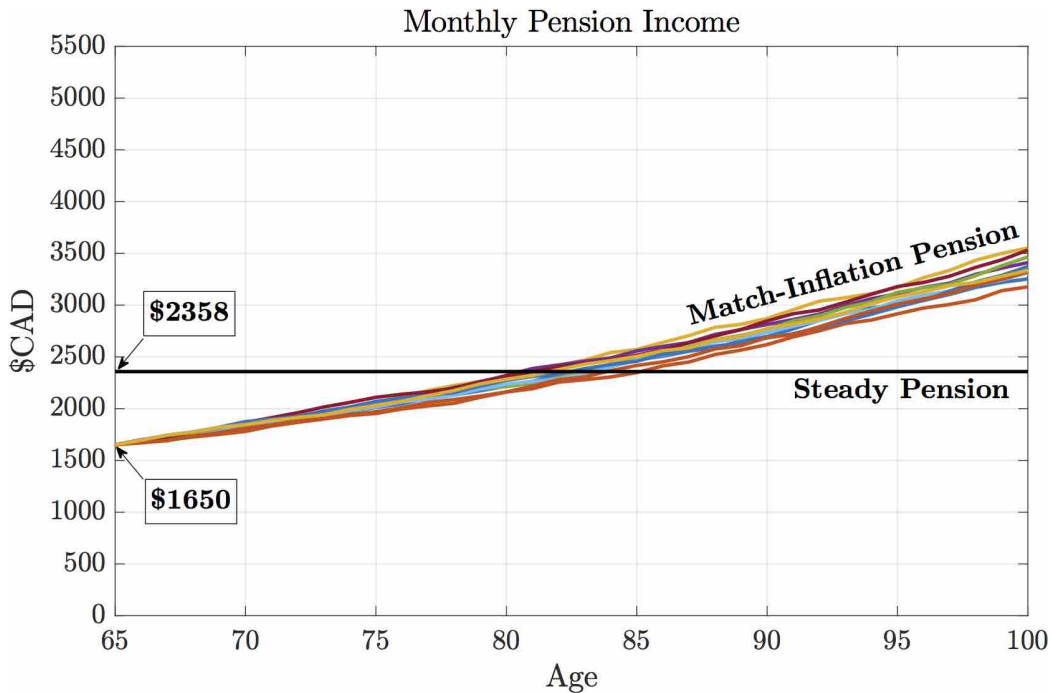
☐ Steady Pension Option

[IF CHOICE = "Match-Inflation Pension Option", SKIP TO Q23A]
[IF CHOICE = "Steady Pension Option", SHOW NEXT CASE]

Consider Case 2.

- If you choose the **Match-Inflation Pension Option**,

  ▸ Your first monthly income payment will be **$1,650**.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be **$2,358**.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

[INSERT PLOT MI2] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?
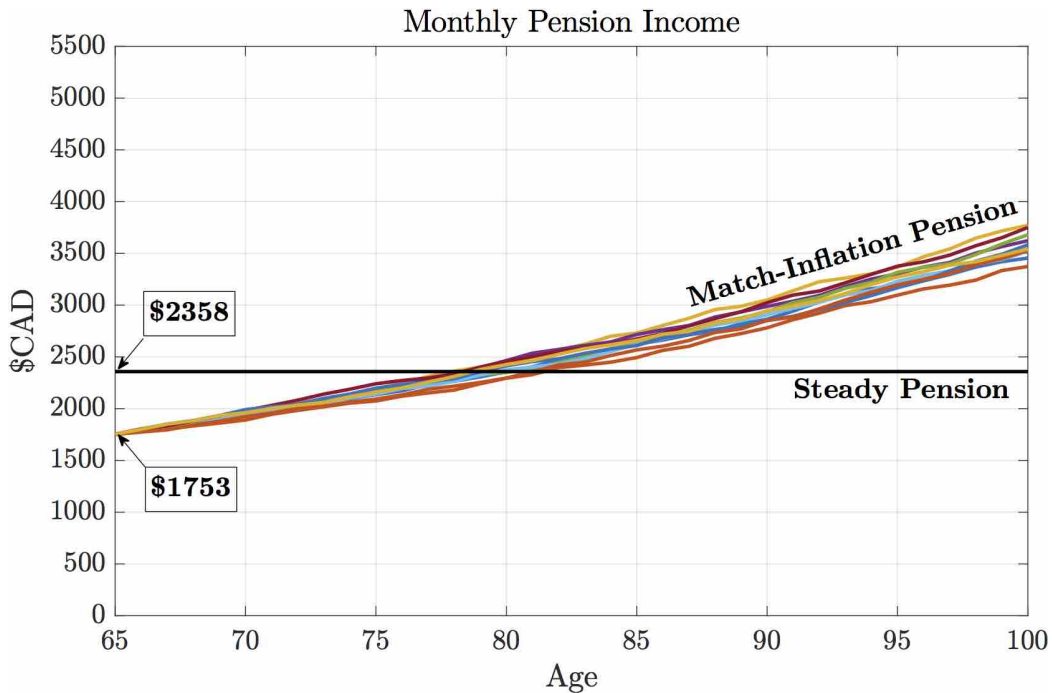
☐ Match-Inflation Pension Option

☐ Steady Pension Option

[IF CHOICE = "Match-Inflation Pension Option", SKIP TO Q23A]
[IF CHOICE = "Steady Pension Option", SHOW NEXT CASE]

Consider Case 3.

- If you choose the **Match-Inflation Pension Option**,

  ▸ Your first monthly income payment will be ***$1,753***.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be ***$2,358***.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

[INSERT PLOT MI3] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

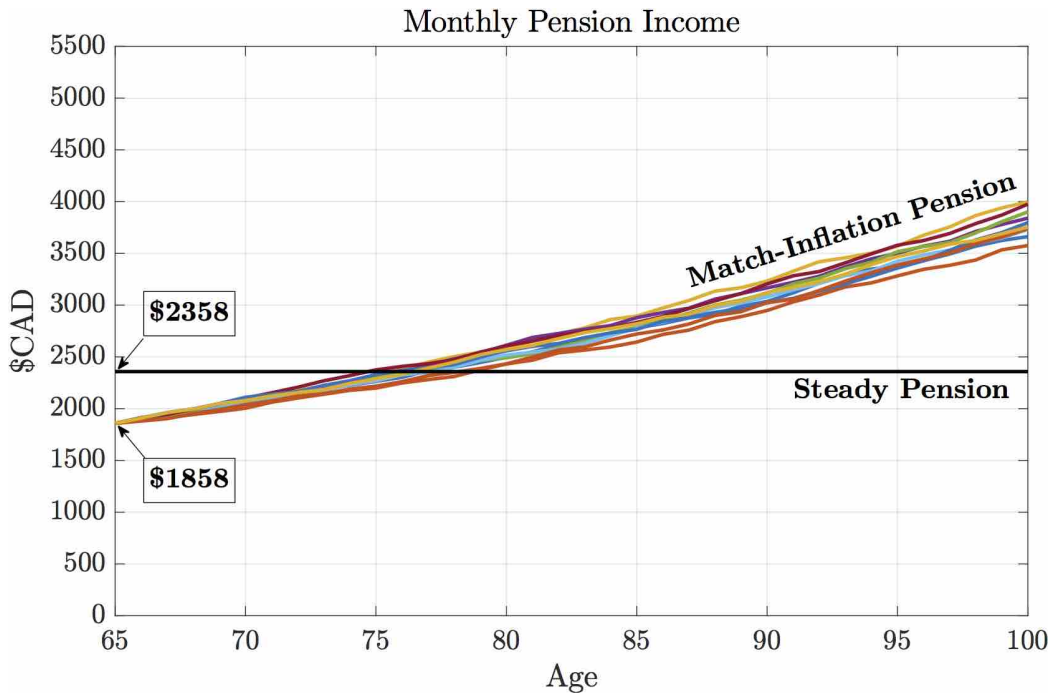☐ Match-Inflation Pension Option

☐ Steady Pension Option

[IF CHOICE = "Match-Inflation Pension Option", SKIP TO Q23A]
[IF CHOICE = "Steady Pension Option", SHOW NEXT CASE]

Consider Case 4.

- If you choose the **Match-Inflation Pension Option**,

  ‣ Your first monthly income payment will be *$1,858*.

  ‣ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension Option**,

  ‣ Your first monthly income payment will be *$2,358*.

  ‣ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

[INSERT PLOT MI4] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Match-Inflation Pension Option

☐ Steady Pension Option

[IF CHOICE = "Match-Inflation Pension Option", SKIP TO Q23A]
[IF CHOICE = "Steady Pension Option", SHOW NEXT CASE]

Consider Case 5.

- If you choose the **Match-Inflation Pension Option**,

  ‣ Your first monthly income payment will be ***$1,966***.

  ‣ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension Option**,

  ‣ Your first monthly income payment will be ***$2,358***.

  ‣ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

[INSERT PLOT MI5] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Match-Inflation Pension Option

☐ Steady Pension Option

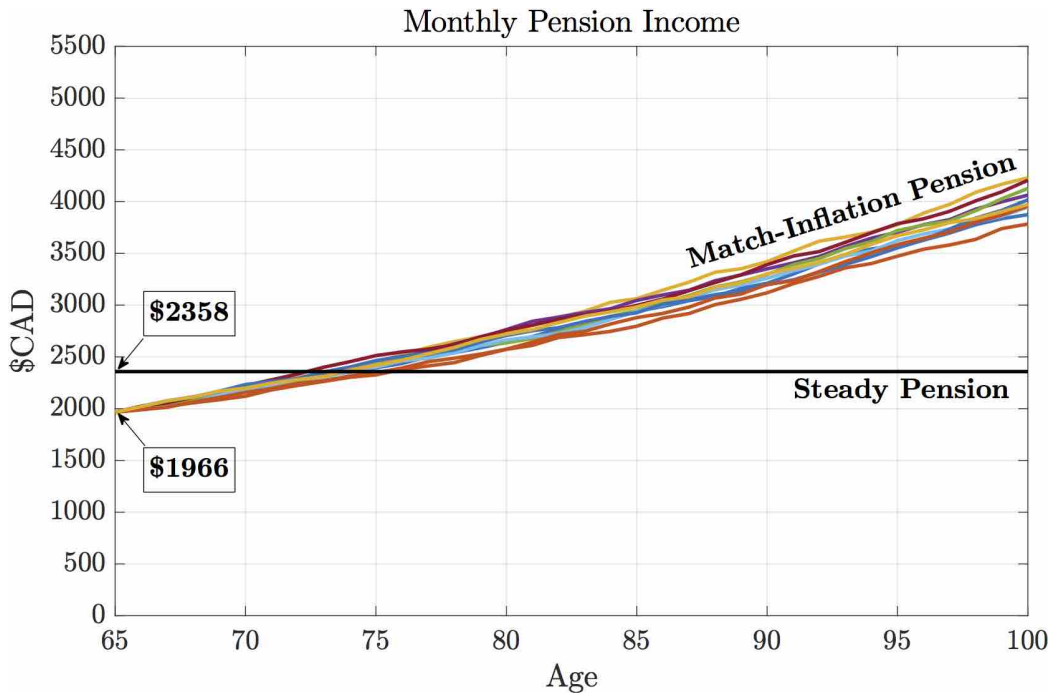[IF CHOICE = "Match-Inflation Pension Option", SKIP TO Q23A]
[IF CHOICE = "Steady Pension Option", SHOW NEXT CASE]

Consider **Case 6**.

- If you choose the **Match-Inflation Pension Option**,

  ▸ Your first monthly income payment will be *$2,358*.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be *$2,358*.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

[INSERT PLOT MI6] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

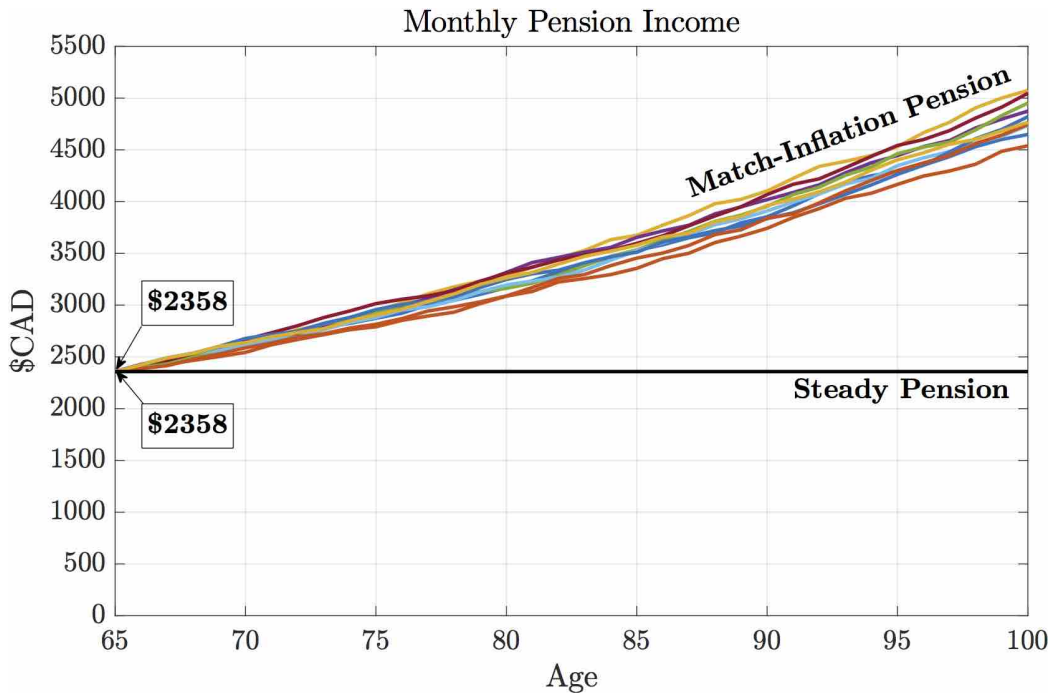**Which option would you choose, assuming that you are 65 and JUST about to retire?**

☐ Match-Inflation Pension Option

☐ Steady Pension Option

Q23A Please rate the importance of the following reasons behind your choices between **match-inflation** and **steady** pension options.

For each reason, please select the one importance rating that best represents your opinion.

	Very Unimportant	Fairly Unimportant	Neutral	Fairly Important	Very Important
I want to maintain a stable and adequate living standard	☐	☐	☐	☐	☐
I am worried that inflation will have a severe impact on living standards	☐	☐	☐	☐	☐
I do not believe inflation poses high risk to my retirement financial security	☐	☐	☐	☐	☐
The concept of the match-inflation income option is difficult to understand	☐	☐	☐	☐	☐
Please specify any other important considerations					

Q23B Please indicate how you feel about the clarity of questions involving the **match-inflation pension**.

☐ Completely clear

☐ Mostly clear

☐ Sometimes clear

☐ Sometimes confusing

☐ Mostly confusing

☐ Completely confusing

A.4.2 Investment Risk

Q24 For this section, please consider a similar hypothetical situation.

Suppose that you are 65 years old and you are JUST about to retire. Your employer will pay you monthly pension income payments for the rest of your life. The pension will stop when you die. Your employer presents you with the following pension options:

1. **Equity-Linked Pension Option**

   This option pays a monthly pension with payments linked to stock market performance. Every year your pension will be re-evaluated based on the performance of the stock market. *This means that your pension income payments are uncertain and will experience some ups and downs.*

2. **Steady Pension Option**

   This option pays a constant monthly pension that *does not change.*

To help you make a decision, for each case, we will present you *10 possible future paths of what your future monthly pension will look like under the Equity-Linked Pension Option.*

Keep in mind there is an *equal chance* for any one of the paths to happen.

i. Fair AIRs

Consider Case 1A.

- If you choose the **Equity-Linked Pension Option**,

  ▸ Your first monthly income payment will be *$2,516*.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be *$2,358*.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

Note the difference in the first monthly income payments.

[INSERT PLOT EL1A] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?
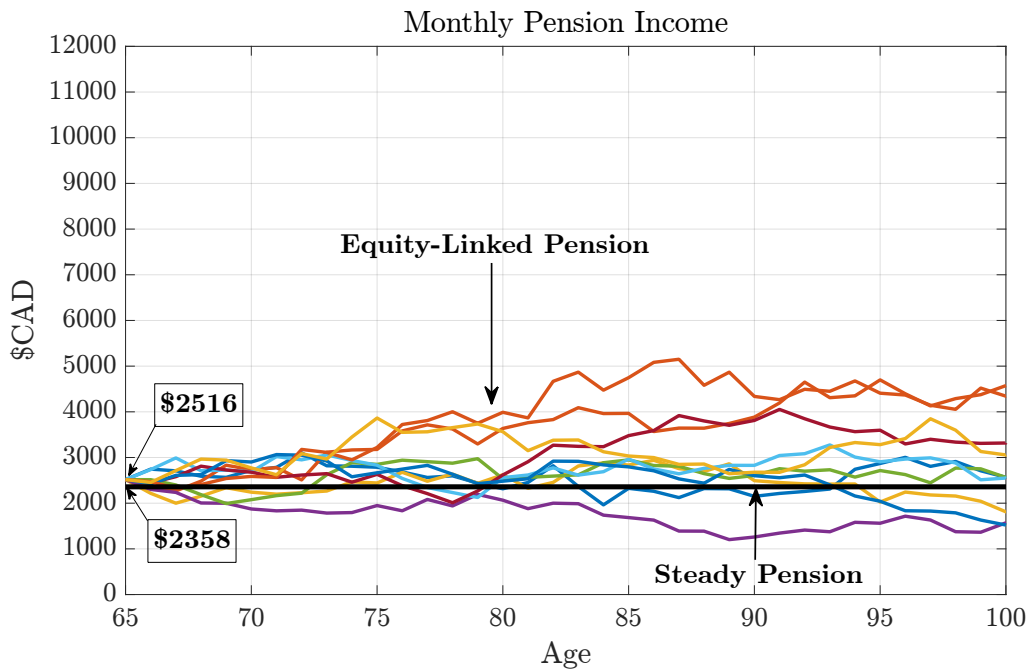
☐ Equity-Linked Pension Option

☐ Steady Pension Option

Consider Case 1B.

- If you choose the **Equity-Linked Pension Option**,

    ▸ Your first monthly income payment will be ***$2,675***.

    ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

    ▸ Your first monthly income payment will be ***$2,358***.

    ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

Note the difference in the first monthly income payments.

[INSERT PLOT EL1B] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Equity-Linked Pension Option

☐ Steady Pension Option

Consider Case 1C.

- If you choose the **Equity-Linked Pension Option**,

  ▸ Your first monthly income payment will be *$2,808*.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be *$2,358*.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

Note the difference in the first monthly income payments.

[INSERT PLOT EL1C] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

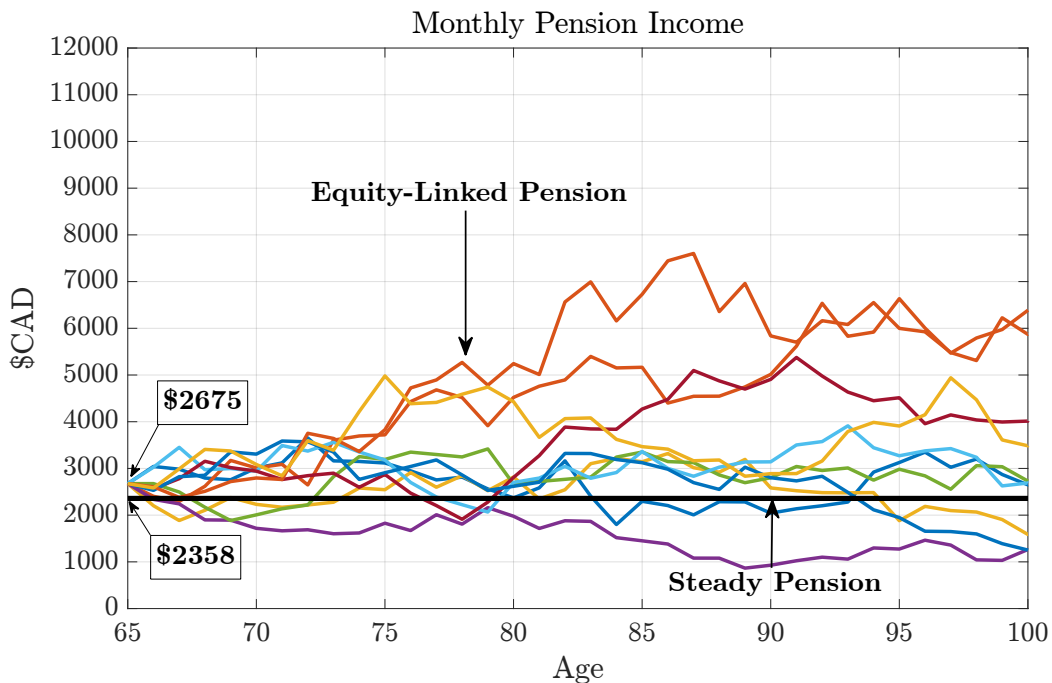**Which option would you choose, assuming that you are 65 and JUST about to retire?**

☐ Equity-Linked Pension Option

☐ Steady Pension Option

ii. High AIRs

Consider Case 2A.

- If you choose the **Equity-Linked Pension Option**,

  ▸ Your first monthly income payment will be ***$2,891***.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be ***$2,358***.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

Note the difference in the first monthly income payments.

[INSERT PLOT EL2A] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

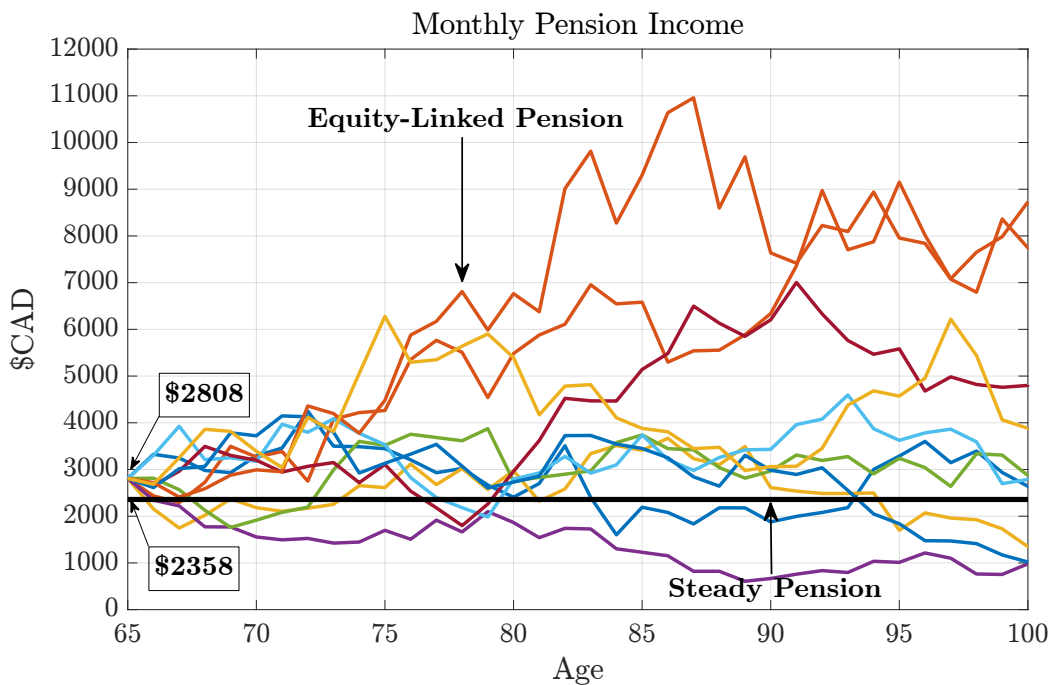**Which option would you choose, assuming that you are 65 and JUST about to retire?**

☐ Equity-Linked Pension Option

☐ Steady Pension Option

Consider Case 2B.

- If you choose the **Equity-Linked Pension Option**,

  ▸ Your first monthly income payment will be ***$3,122***.

  ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

  ▸ Your first monthly income payment will be ***$2,358***.

  ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

*Note the difference in the first monthly income payments.

[INSERT PLOT EL2B] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Equity-Linked Pension Option
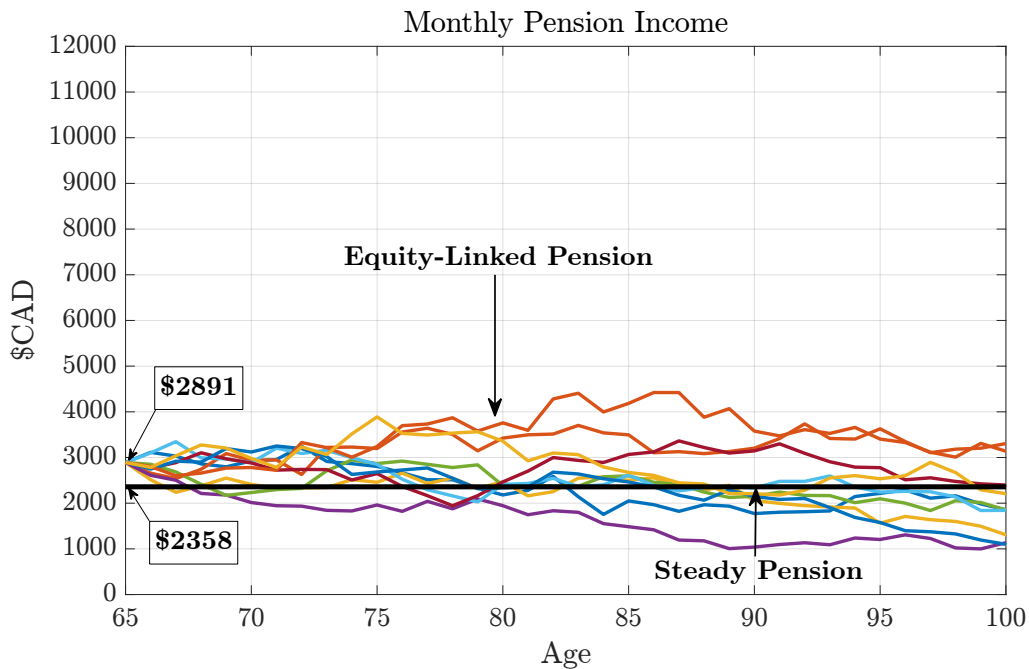
☐ Steady Pension Option

Consider Case 2C.

- If you choose the **Equity-Linked Pension Option**,

  - ▸ Your first monthly income payment will be **$3,317**.

  - ▸ Your future monthly pension has an equal chance of being any one of the 10 coloured pension paths as shown in the chart below.

- If you choose the **Steady Pension Option**,

  - ▸ Your first monthly income payment will be **$2,358**.

  - ▸ Your future monthly pension will stay the same for the rest of your life, as shown by the black line in the chart below.

Note the difference in the first monthly income payments.

[INSERT PLOT EL2C] [EXAMPLE: HIGH, FEMALE, SEE GRAPH BELOW]

Which option would you choose, assuming that you are 65 and JUST about to retire?

☐ Equity-Linked Pension Option
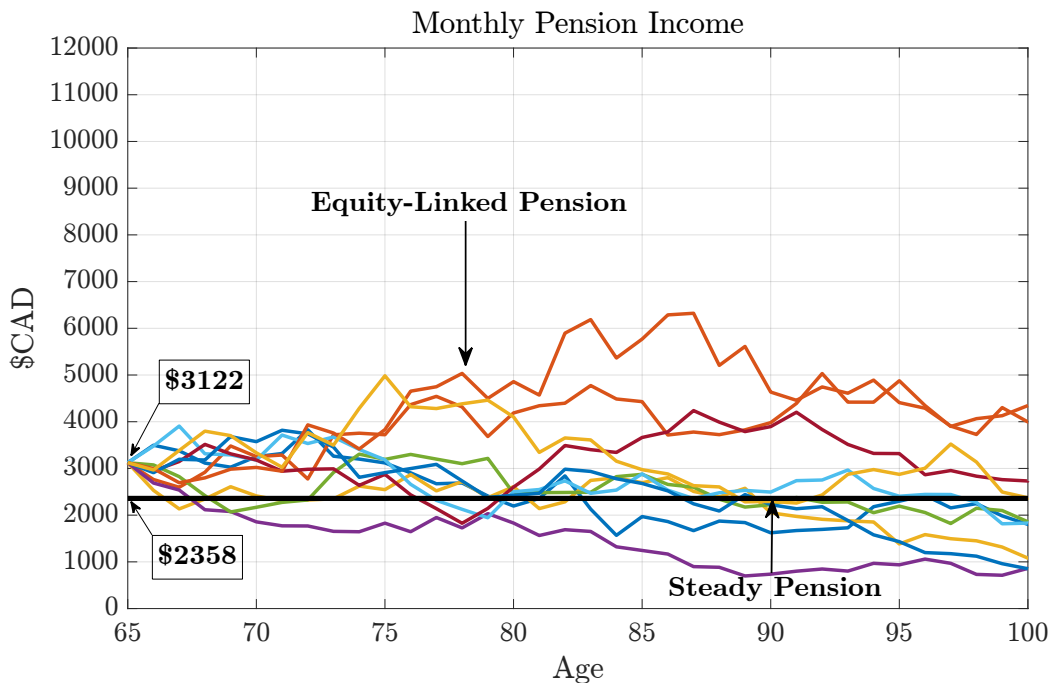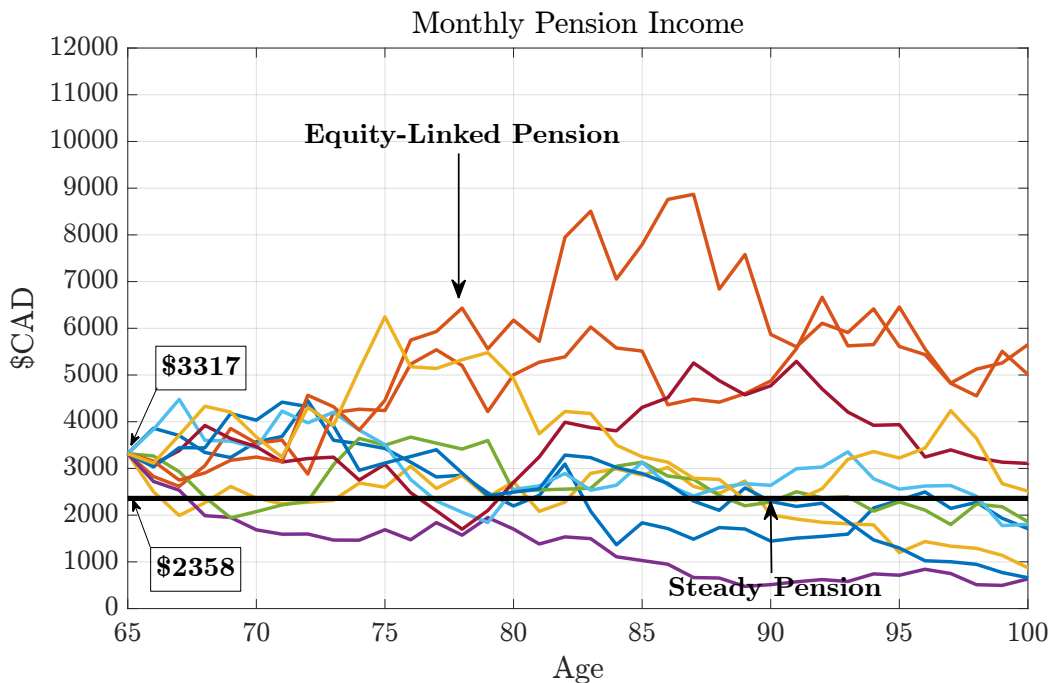
☐ Steady Pension Option

Q24A Please rate the importance of the following reasons behind your choices between the **equity-linked** and **steady** pension options.

For each reason, please select the one importance rating that best represents your opinion.

	Very Unim- portant	Fairly Unim- portant	Neu- tral	Fairly Impor- tant	Very Impor- tant
I am worried about stock market crashes	☐	☐	☐	☐	☐
I am worried about persistent poor stock market performance and deteriorating income stream	☐	☐	☐	☐	☐
The concept of the Equity-Linked pension option is difficult to understand	☐	☐	☐	☐	☐
I prefer income payment options that are easier for me to understand	☐	☐	☐	☐	☐
I expect to take some risk to gain exposure of possible higher income in the long term	☐	☐	☐	☐	☐
I want to make sure I have enough income later in life	☐	☐	☐	☐	☐
I expect my risk attitude would change as I grow older	☐	☐	☐	☐	☐
Please specify any other important considerations					

Q24B Please indicate how you feel about the clarity of the questions involving the **equity-linked pension**.

☐ Completely clear

☐ Mostly clear

☐ Sometimes clear

☐ Sometimes confusing

☐ Mostly confusing

☐ Completely confusing

A.5 Demographic Information

Q25 What is the highest level of education you completed?

☐ Some high school or less

☐ High school graduate

☐ Trades or college certificate or diploma

☐ University certificate or diploma below the bachelor level

☐ Bachelor's Degree

☐ Graduate or Postgraduate Degree

☐ Other professional degree

Q26 In general, would you say your health is ...?

☐ Excellent

☐ Good

☐ Fair

☐ Poor

☐ Very Poor

Q27 Do you own a home that you currently reside in?

☐ Yes

☐ No

Q28 Where is your permanent residence?

☐ In an area with a population of 1,000 or over

☐ In an area with a population under 1,000

Q29 Please explain what, if anything, you found to be unclear or confusing about the questions in this survey.

_____

_____

_____

_____

Thank you for participating in the survey! Your feedback is extremely valuable.

If you would like to receive a copy of the results of this study, please contact Saisai Zhang at s288zhan@uwaterloo.ca.

We would like to assure you that this project has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. Should you have any comments or concerns resulting from your participation in this study, please contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

If you have any general comments or questions related to this study, please contact Mary Hardy at mrhardy@uwaterloo.ca.

[**Exit**]

B Economic and Pension Scenarios

This section reports the economic scenarios used in projecting future Match-Inflation and Equity-Linked pension options.

Scenario	1	2	3	4	5	6	7	8	9	10
$t = 1$	0.2564	−0.1299	−0.2911	−0.1796	0.0528	0.2483	−0.0169	−0.0403	0.0100	−0.0068
$t = 2$	0.0203	−0.0254	−0.2177	−0.0174	−0.0645	0.2605	0.1819	0.2270	−0.1021	0.2843
$t = 3$	−0.0577	0.2615	0.2279	−0.2377	−0.1893	−0.2063	0.2518	0.0699	0.1389	0.2594
$t = 4$	0.0310	0.3510	0.2458	0.0479	−0.1909	0.0662	−0.0207	0.3063	0.1808	0.0358
$t = 5$	0.1925	−0.0347	−0.0537	−0.1128	0.1535	0.0210	0.0107	0.0287	0.0982	−0.0989
$t = 6$	0.1107	0.0945	0.0058	0.0004	0.1539	0.3206	−0.0532	0.1834	0.0332	−0.0860
$t = 7$	0.3007	−0.2151	0.0888	0.0749	0.1143	−0.0051	0.1005	0.0444	0.5157	0.4137
$t = 8$	−0.1975	0.5197	0.0954	−0.0344	0.4234	0.1403	0.0828	−0.0534	0.0028	−0.0451
$t = 9$	0.0462	0.0927	0.2510	0.0697	0.2759	−0.0478	−0.1358	−0.2867	−0.0828	0.3903
$t = 10$	0.0352	0.0634	0.0294	0.2451	0.0210	−0.0347	0.2135	0.1344	0.2590	0.3130
$t = 11$	−0.0398	0.3265	0.2656	−0.1001	0.1306	−0.2342	−0.2080	0.1256	0.3775	−0.1662
$t = 12$	−0.0624	0.1417	−0.1429	0.3407	0.0271	−0.1582	−0.1425	0.1256	0.1104	0.0629
$t = 13$	0.0880	−0.0068	0.1982	−0.1279	0.0265	−0.0672	−0.1941	−0.1293	0.1712	0.1157
$t = 14$	−0.1075	−0.1955	−0.1529	0.3313	0.1357	−0.0712	0.3275	−0.1580	−0.1123	0.1065
$t = 15$	−0.0787	0.2795	0.2270	−0.0982	−0.3970	0.4607	0.3756	0.1079	0.2000	−0.0624
$t = 16$	0.1916	0.1362	−0.2682	−0.1929	0.0864	0.1082	0.2944	0.1061	−0.0236	−0.2810
$t = 17$	0.3660	0.0981	0.1824	0.1994	0.0800	0.1904	0.3206	0.3711	0.4648	0.2182
$t = 18$	−0.4468	0.2088	0.3607	0.0410	0.0803	−0.0956	0.0355	0.0513	0.1550	0.0586
$t = 19$	−0.4837	−0.0253	0.1118	−0.3147	0.2762	0.1226	0.0493	−0.0131	−0.1662	−0.1519
$t = 20$	0.4270	0.0570	0.0141	−0.0231	0.1059	0.2791	0.2227	0.0170	0.1939	−0.0207
$t = 21$	−0.0151	−0.2269	0.1408	−0.0287	−0.0527	−0.1419	0.1295	−0.0237	0.2143	0.0266
$t = 22$	−0.1083	0.1053	−0.1102	−0.3925	0.0410	−0.0446	0.2572	−0.1197	0.0868	−0.0749
$t = 23$	0.2602	0.0535	−0.0010	0.0511	−0.0978	0.1599	−0.0219	−0.0407	−0.2611	0.0610
$t = 24$	0.0494	0.1217	0.1959	−0.3409	−0.0469	0.1109	−0.0085	0.3203	0.1974	−0.1454
$t = 25$	−0.1372	0.1417	−0.3253	0.1646	0.1150	0.0546	0.1229	−0.0778	−0.2558	0.0843
$t = 26$	0.1251	0.2333	0.0139	0.2091	0.1850	0.2257	0.1987	0.0120	0.0139	0.0532
$t = 27$	0.1014	0.2908	0.0254	0.1685	0.0053	0.0861	−0.0771	0.1102	0.1773	0.1953
$t = 28$	0.1103	−0.1430	0.0498	−0.0115	0.0823	0.1968	−0.0679	−0.1709	0.0306	0.3370
$t = 29$	0.4325	0.0775	0.0561	0.3684	−0.1011	−0.1670	−0.0155	−0.2307	0.1724	0.1339
$t = 30$	0.1621	0.2339	−0.4552	0.0226	0.1834	−0.0329	0.0761	−0.0857	−0.0969	0.0201
$t = 31$	0.1628	−0.1172	0.2895	0.2713	−0.0290	0.1037	−0.1739	−0.2314	0.0323	0.1495
$t = 32$	−0.1207	−0.1058	−0.0173	−0.0725	−0.1285	0.0763	0.1280	0.0456	−0.0791	0.3253
$t = 33$	0.1440	0.1453	0.0278	−0.4301	0.3343	−0.0413	0.0088	0.0006	0.0000	−0.1181
$t = 34$	−0.1332	0.1029	−0.0846	0.0350	0.0399	−0.3200	0.0346	−0.1885	0.3023	−0.3280
$t = 35$	−0.0833	0.1600	−0.2699	0.3690	−0.1293	0.0909	0.0606	−0.1247	−0.0460	−0.0061

Table 38 Total Log Returns of Equity used in Equity-Linked Pension Options.

Scenario	1	2	3	4	5	6	7	8	9	10
$t = 1$	0.0187	0.0156	0.0133	0.0200	0.0199	0.0299	0.0296	0.0269	0.0121	0.0277
$t = 2$	0.0296	0.0135	0.0239	0.0226	0.0141	0.0257	0.0157	0.0279	0.0121	0.0277
$t = 3$	0.0234	0.0163	0.0230	0.0149	0.0300	0.0176	0.0269	0.0190	0.0253	0.0178
$t = 4$	0.0128	0.0149	0.0298	0.0283	0.0174	0.0110	0.0261	0.0258	0.0213	0.0261
$t = 5$	0.0229	0.0160	0.0182	0.0105	0.0274	0.0202	0.0266	0.0296	0.0230	0.0143
$t = 6$	0.0196	0.0289	0.0240	0.0178	0.0152	0.0191	0.0247	0.0136	0.0181	0.0217
$t = 7$	0.0254	0.0196	0.0282	0.0295	0.0279	0.0109	0.0248	0.0121	0.0223	0.0150
$t = 8$	0.0154	0.0174	0.0185	0.0273	0.0294	0.0252	0.0281	0.0277	0.0111	0.0131
$t = 9$	0.0144	0.0177	0.0184	0.0243	0.0171	0.0255	0.0221	0.0203	0.0203	0.0275
$t = 10$	0.0176	0.0101	0.0261	0.0227	0.0185	0.0175	0.0240	0.0261	0.0133	0.0195
$t = 11$	0.0171	0.0223	0.0286	0.0237	0.0271	0.0249	0.0141	0.0166	0.0195	0.0196
$t = 12$	0.0270	0.0146	0.0277	0.0233	0.0104	0.0105	0.0106	0.0116	0.0255	0.0254
$t = 13$	0.0150	0.0130	0.0220	0.0279	0.0184	0.0207	0.0162	0.0127	0.0138	0.0240
$t = 14$	0.0190	0.0281	0.0174	0.0231	0.0138	0.0274	0.0293	0.0295	0.0160	0.0294
$t = 15$	0.0207	0.0238	0.0128	0.0291	0.0102	0.0210	0.0239	0.0245	0.0188	0.0199
$t = 16$	0.0210	0.0150	0.0289	0.0289	0.0158	0.0117	0.0176	0.0169	0.0266	0.0160
$t = 17$	0.0267	0.0290	0.0258	0.0142	0.0235	0.0118	0.0204	0.0107	0.0276	0.0244
$t = 18$	0.0207	0.0103	0.0211	0.0150	0.0286	0.0207	0.0142	0.0215	0.0115	0.0219
$t = 19$	0.0208	0.0118	0.0295	0.0131	0.0264	0.0285	0.0131	0.0168	0.0259	0.0144
$t = 20$	0.0198	0.0182	0.0114	0.0269	0.0180	0.0270	0.0187	0.0127	0.0216	0.0163
$t = 21$	0.0149	0.0279	0.0268	0.0173	0.0266	0.0213	0.0205	0.0283	0.0142	0.0224
$t = 22$	0.0191	0.0152	0.0245	0.0145	0.0228	0.0218	0.0263	0.0136	0.0209	0.0100
$t = 23$	0.0135	0.0295	0.0296	0.0292	0.0268	0.0264	0.0251	0.0166	0.0293	0.0295
$t = 24$	0.0256	0.0173	0.0107	0.0173	0.0156	0.0151	0.0232	0.0117	0.0126	0.0138
$t = 25$	0.0155	0.0205	0.0202	0.0179	0.0221	0.0200	0.0298	0.0190	0.0298	0.0274
$t = 26$	0.0275	0.0282	0.0295	0.0171	0.0287	0.0217	0.0244	0.0148	0.0111	0.0155
$t = 27$	0.0298	0.0220	0.0276	0.0183	0.0176	0.0195	0.0126	0.0223	0.0275	0.0175
$t = 28$	0.0263	0.0251	0.0111	0.0276	0.0277	0.0236	0.0254	0.0228	0.0289	0.0228
$t = 29$	0.0157	0.0125	0.0129	0.0229	0.0190	0.0139	0.0254	0.0226	0.0246	0.0278
$t = 30$	0.0102	0.0209	0.0192	0.0158	0.0296	0.0284	0.0238	0.0243	0.0228	0.0232
$t = 31$	0.0136	0.0194	0.0298	0.0196	0.0142	0.0175	0.0126	0.0209	0.0171	0.0154
$t = 32$	0.0191	0.0115	0.0216	0.0130	0.0106	0.0135	0.0188	0.0295	0.0168	0.0185
$t = 33$	0.0217	0.0152	0.0294	0.0265	0.0260	0.0183	0.0259	0.0284	0.0256	0.0103
$t = 34$	0.0154	0.0286	0.0191	0.0179	0.0294	0.0144	0.0218	0.0195	0.0179	0.0178
$t = 35$	0.0103	0.0118	0.0148	0.0161	0.0248	0.0228	0.0272	0.0260	0.0223	0.0177

Table 39 Annual Inflation Rates used in Match-Inflation Pension Options.
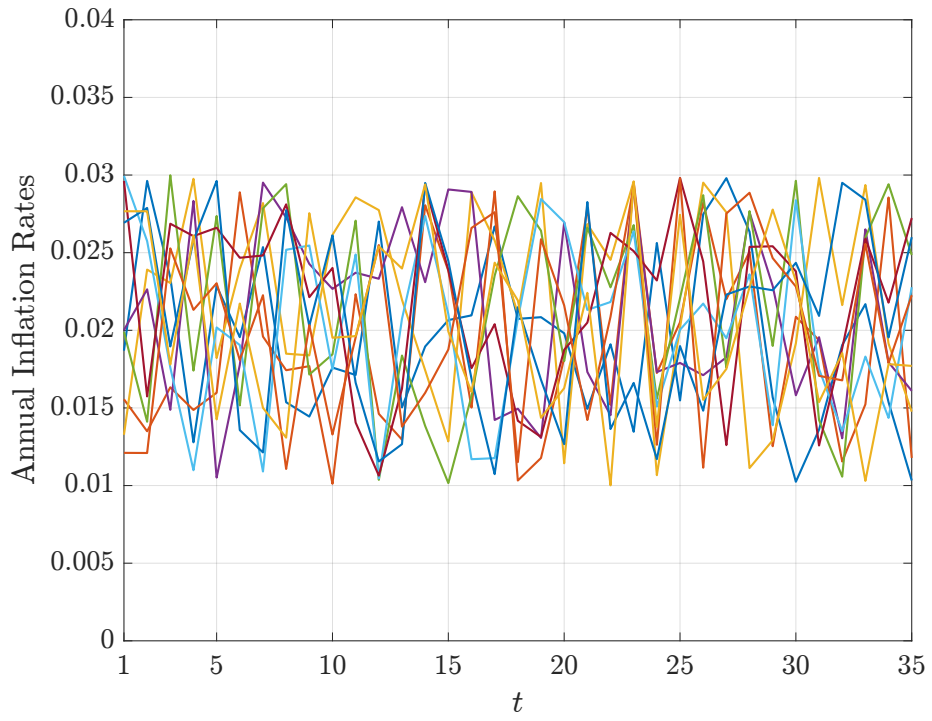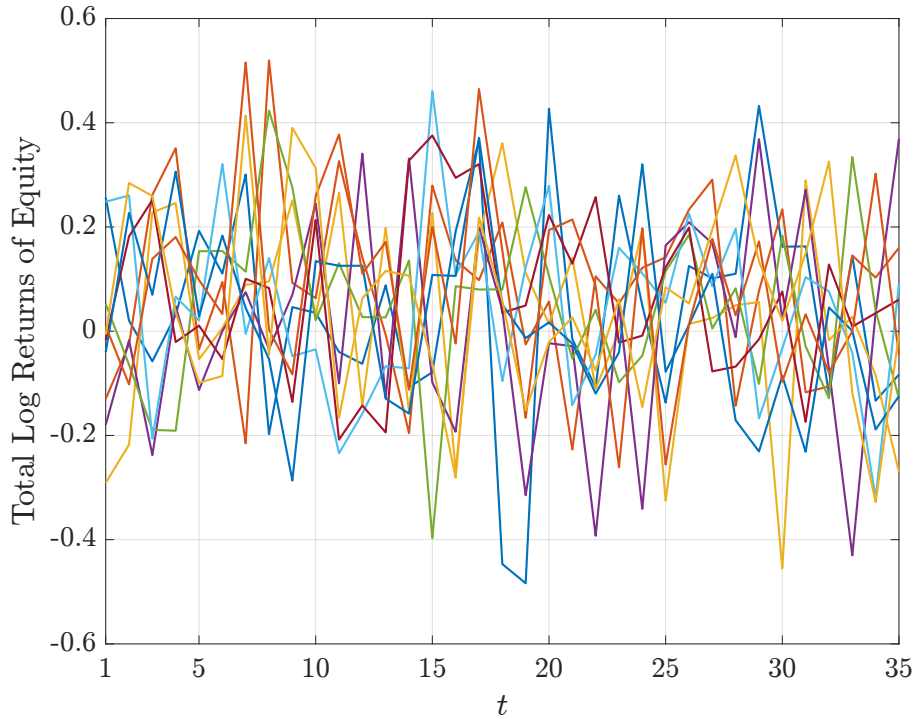
Cases	Low & Female		Low & Male	
	Match-Inflation	Steady	Match-Inflation	Steady
1	465	707	515	759
2	495	707	545	759
3	526	707	576	759
4	557	707	608	759
5	590	707	641	759
6	707	707	759	759
Cases	Med & Female		Med & Male	
	Match-Inflation	Steady	Match-Inflation	Steady
1	931	1415	1029	1517
2	990	1415	1090	1517
3	1052	1415	1152	1517
4	1115	1415	1216	1517
5	1179	1415	1281	1517
6	1415	1415	1517	1517
Cases	High & Female		High & Male	
	Match-Inflation	Steady	Match-Inflation	Steady
1	1551	2358	1715	2528
2	1650	2358	1817	2528
3	1753	2358	1920	2528
4	1858	2358	2026	2528
5	1966	2358	2135	2528
6	2358	2358	2528	2528

Table 40 First monthly pension payments for choices between Match-Inflation and Steady pension options.

Cases	Low & Female		Low & Male	
	Equity-Linked	Steady	Equity-Linked	Steady
1A	755	707	806	759
1B	802	707	853	759
1C	842	707	893	759
2A	867	707	918	759
2B	937	707	986	759
2C	995	707	1044	759
Cases	Med & Female		Med & Male	
	Equity-Linked	Steady	Equity-Linked	Steady
1A	1510	1415	1611	1517
1B	1605	1415	1706	1517
1C	1685	1415	1786	1517
2A	1735	1415	1835	1517
2B	1873	1415	1973	1517
2C	1990	1415	2088	1517
Cases	High & Female		High & Male	
	Equity-Linked	Steady	Equity-Linked	Steady
1A	2516	2358	2686	2528
1B	2675	2358	2844	2528
1C	2808	2358	2976	2528
2A	2891	2358	3058	2528
2B	3122	2358	3288	2528
2C	3317	2358	3480	2528

Table 41 First monthly pension payments for choices between Equity-linked and Steady pension options.