A case study on how prepared Canadians are for retirement

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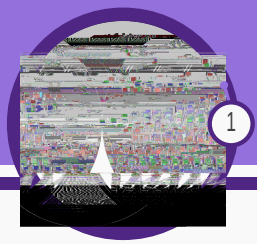
Introduction
Background



- We consider retirement goals such as the importance of being able to

Introduction
Description of the data

Trade and transaction tables:

- These tables are utilized for modelling the withdrawals and deposits;
- All trades and transactions are in the period between July 15, 2019 and September 15, 2022 (3 years and 2 months);
- There are two distinct patterns for deposits and withdraws in the data: In the trades table, there are less frequent transactions with larger amounts while in the transaction table, the transactions are more frequent with smaller amounts.

Conclusions from a preliminary analysis:

- Clients need to be grouped by gender and by risk tolerance.

Introduction
Descriptive analysis

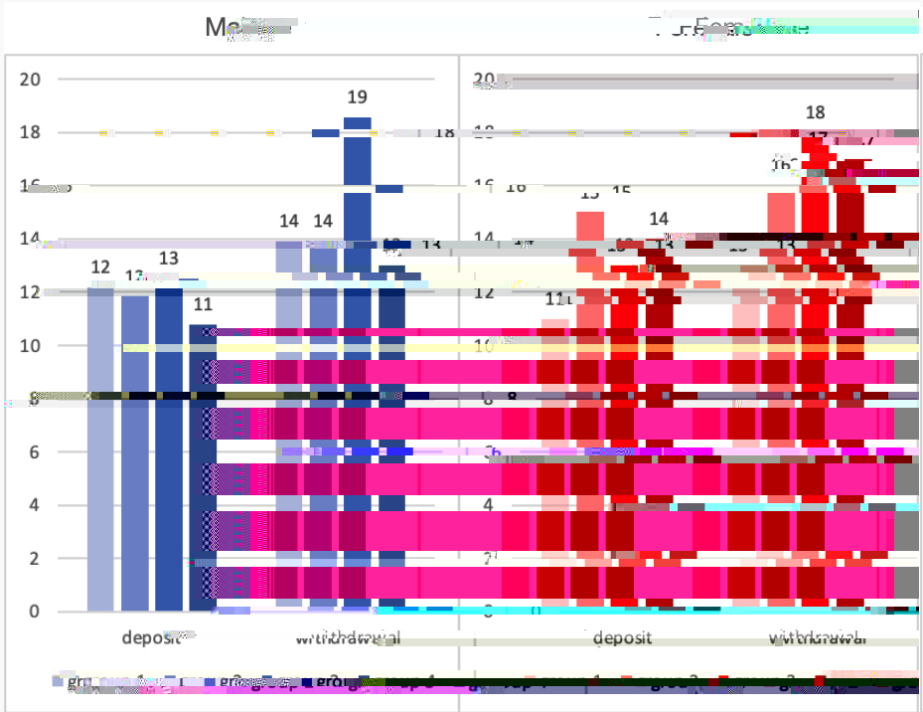
Grouping the clients based on gender and risk tolerance:

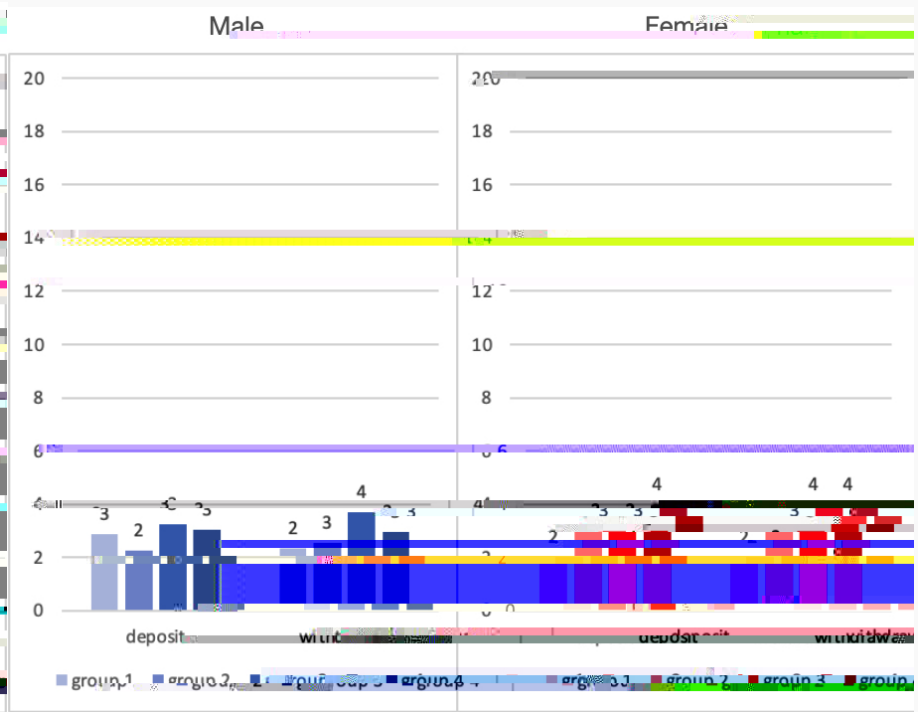
- First, dividing based on gender;
- Second, grouping based on “risk tolerance" using K-Means clustering algorithm.

Gender	Group	Risk tolerance	Count	Percentage
Male	1	[1,000, 1,600]	105	5%
	2	(1,600, 2,600]	353	16%
	3	(2,600, 3,500]	1,344	62%
	4	(3,500, 5,000]	365	17%
Female	1	[1,000, 1,600]	135	6%
	2	(1,600, 2,600]	412	17%
	3	(2,600, 3,200]	1,305	55%
	4	(3,200, 5,000]	527	22%

Introduction
Descriptive analysis

Average number of deposits and withdrawals per year:





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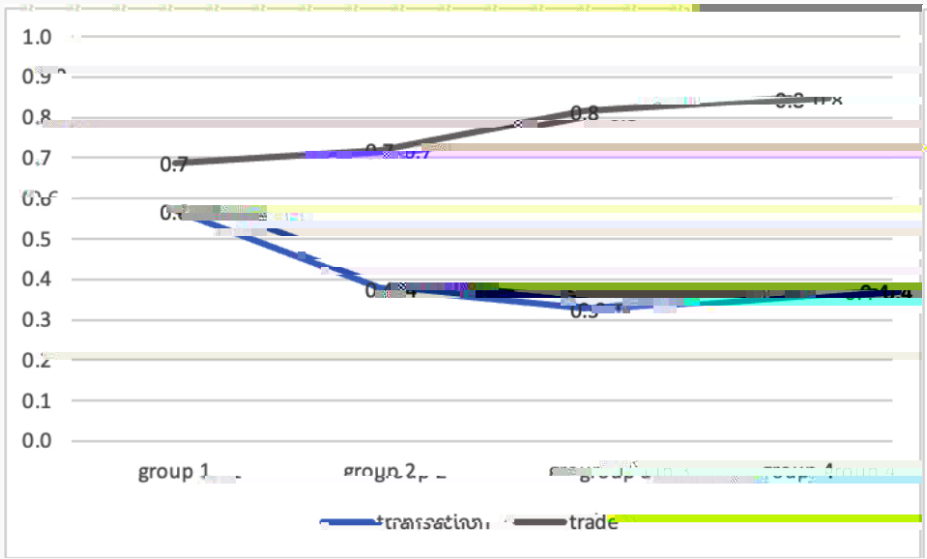
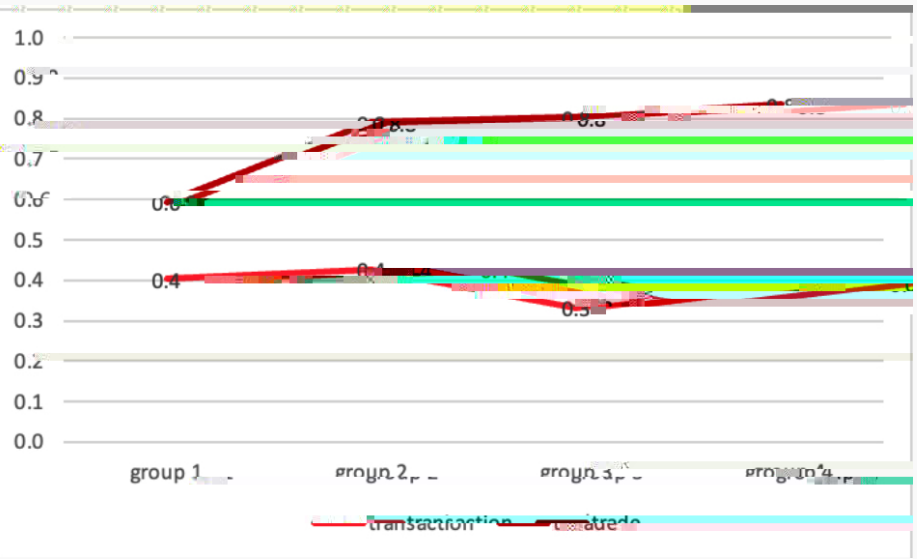
Correlation between annual number of deposits and withdrawals:





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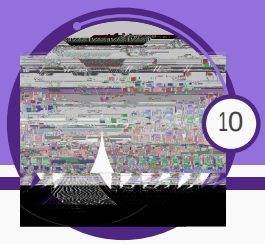
Average amounts of deposits and withdrawals per year:

Model

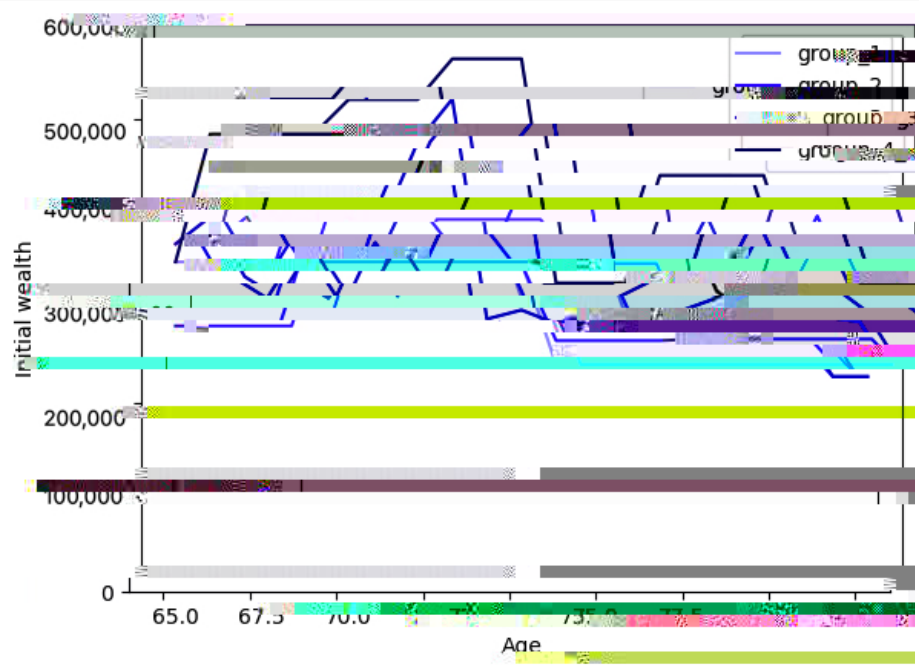
A ruin-theory approach

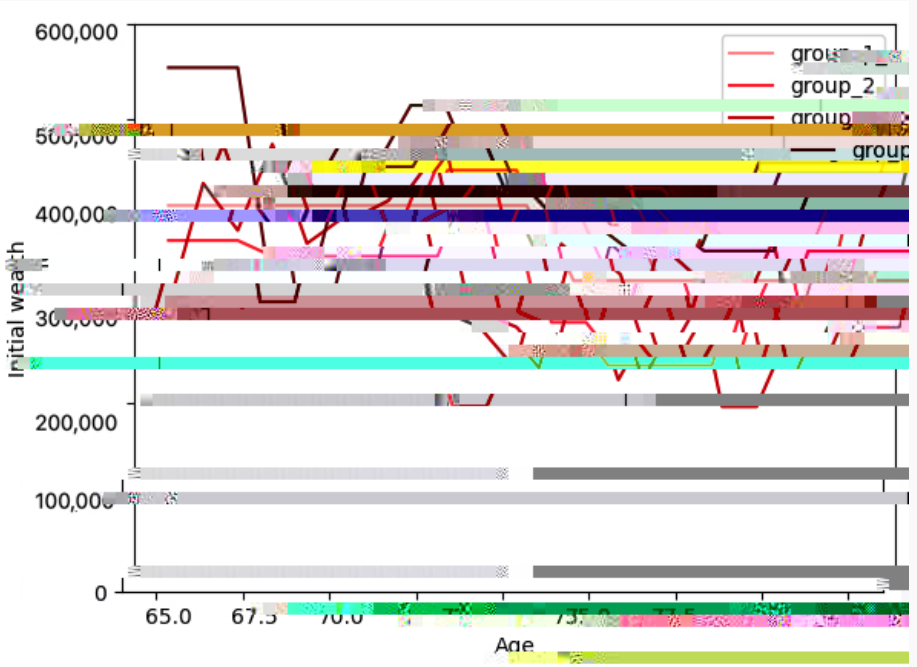


We implement a ruin-theory approach to modelling the evolution of wealth of our clients:

$$U(t) = u + \underbrace{\sum_{i=1}^{N_1(t)} X_{1i} - \sum_{j=1}^{M_1(t)} Y_{1j}}_{\text{Trades: less frequent but larger amounts}} + \underbrace{\sum_{k=1}^{N_2(t)} X_{2k} - \sum_{l=1}^{M_2(t)} Y_{2l}}_{\text{Transactions: more frequent but smaller amounts}}$$

Initial wealth for male and female clients between ages 65 and 85:





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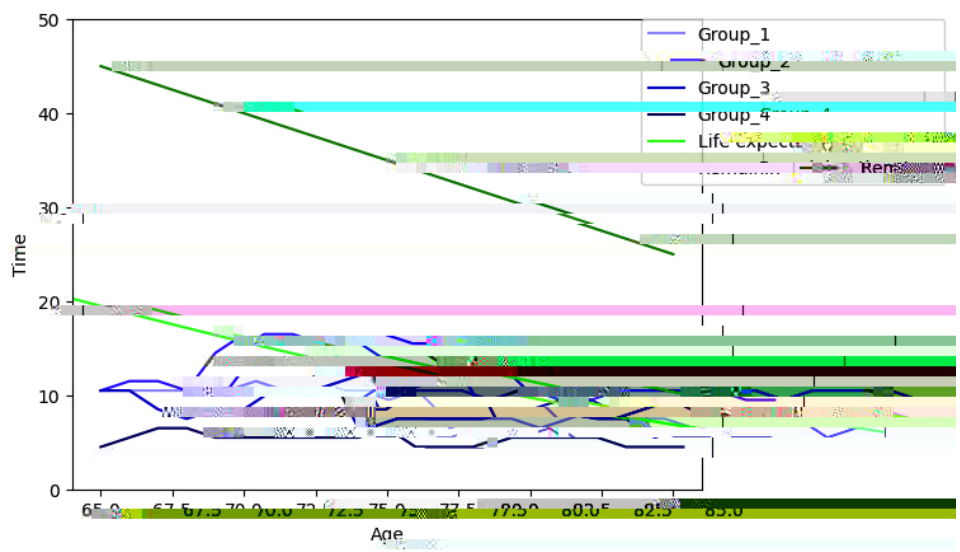
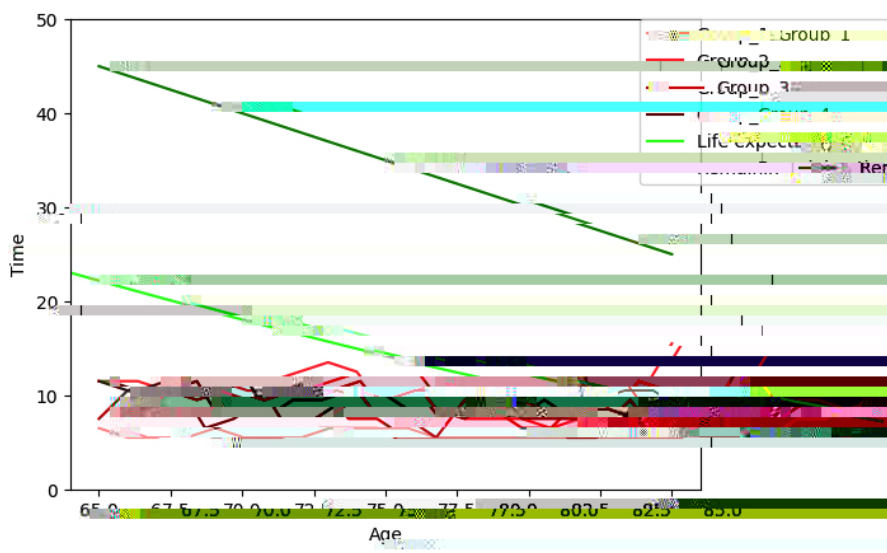
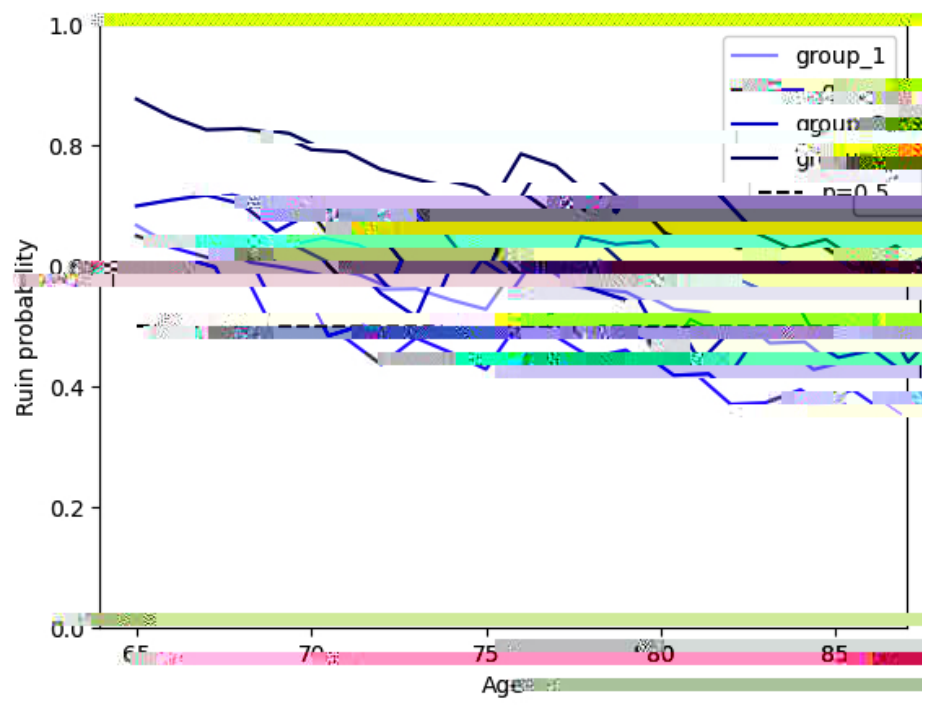
Implementation

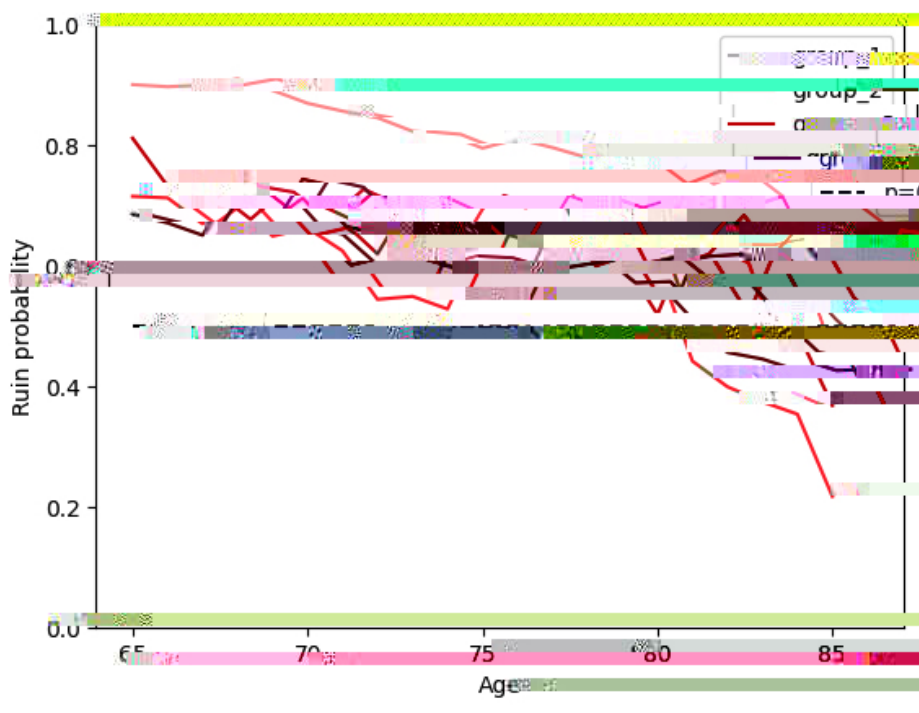
Median time to exhaustion of funds (age 65 to 85):





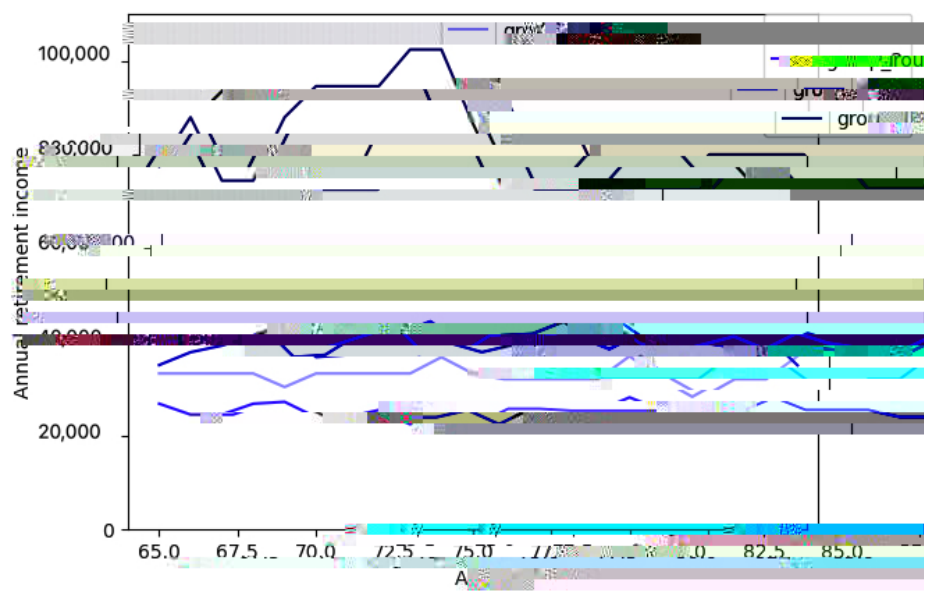
Ruin probability and life expectancy (ages 65 to 85):

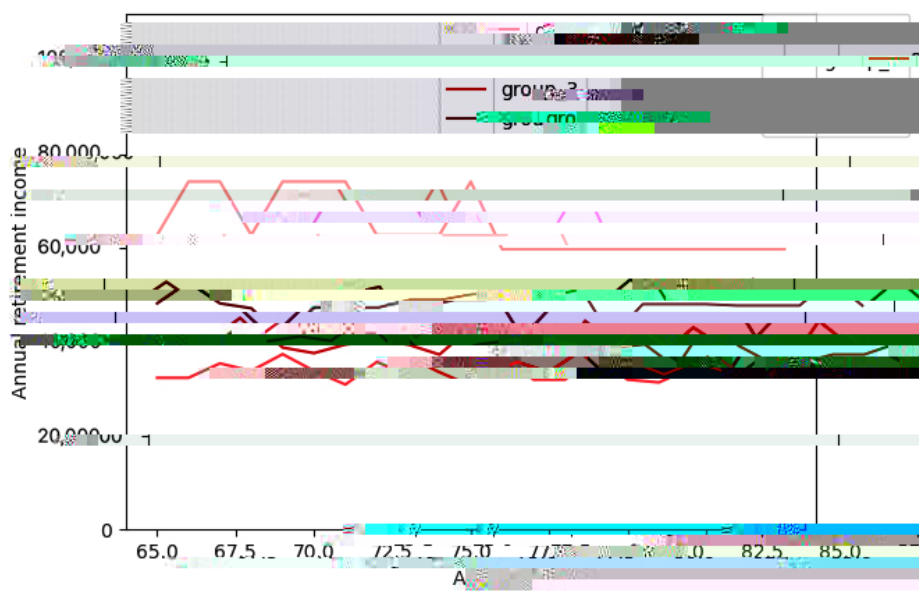




Annual income based on mean time (age 65 to 85):

Annual income based on median time (age 65 to 85):





Model
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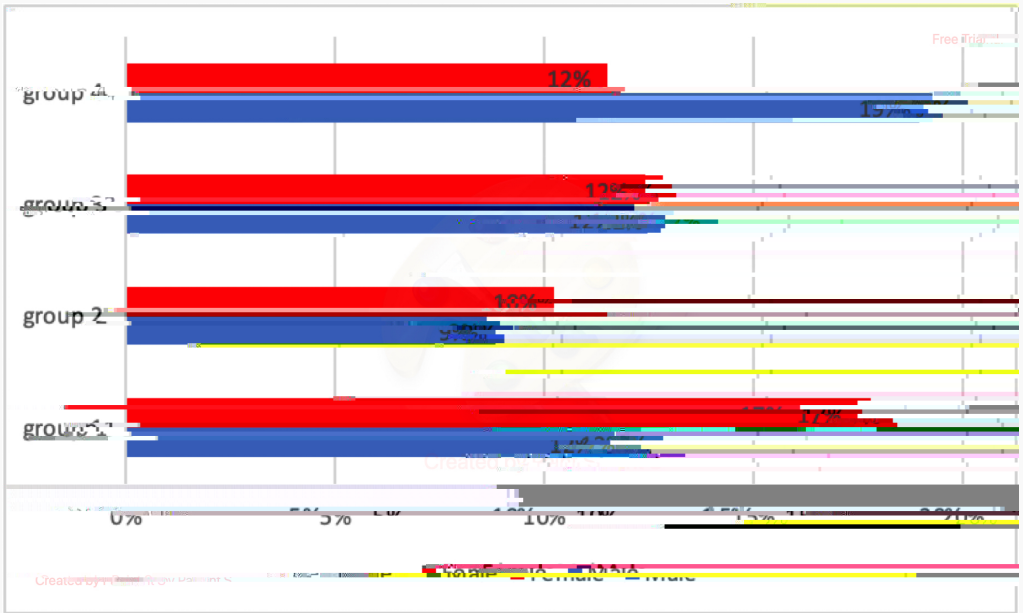
What percentage of their wealth do our clients spend annually? (based on median time to exhaustion of funds)

Gender	Group 1	Group 2	Group 3	Group 4
Male	12%	9%	12%	19%
Female	17%	10%	12%	12%



Conclusions

- Calculations of time to exhaustion of funds and of annual retirement income based on median are more reliable compared to the calculations based on the mean due to the obtained ruin probabilities.
- Female clients in Group 1 (lowest risk tolerance level) and male clients in Group 4 (highest risk tolerance level) have the shortest time to exhaustion of funds at all ages as well as the highest annual retirement income.

Conclusions

- In total, only for 27% of male clients (9% of Group 1, 82% of Group 2, 22% of Group 3) the ruin probability within their lifetime is less than 0.5, which is still a high probability.
- In total, only for 17.5% of female clients (29% of Group 2, 16% of Group 3, 16% of Group 4), the ruin probability within their lifetime is less than 0.5

0.5

Conclusions

- However, the well-known 4% rule is considered risky by some authors and low by others. Our data suggests that 4% of the initial wealth corresponds to an yearly income of less than $7,508 and $8,378 for half of our male and female clients, respectively, which are obviously inadequate amounts to meet living expenses.
- Since the ruin probability for our clients is very high, they should rely on other financial sources in addition to the data that we have.
- Finally, there are two governmental plans:
  - Old Age Security and Canada Pension Plan that provide total maximum annual payments of $23,970.84 for ages 65 to 74 and $24,798.84 for 75 and over for those who retired at age 65.

Thank you for your attention!