A case study on how prepared Canadians are for retirement

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- ▶ We consider retirement goals such as the importance of being able to afford expenses after retirement as well as to ensure quality of life after retirement.
- ▶ Our goal is to propose a safe withdrawal rate for post-retirement via:
  - ▶ Studying the spending habits of our retired clients;
  - ▶ Using a ruin-theory approach to model deposits and withdrawals considering clients' initial wealth.

The data at a glance:

- ▶ Data available through Canada's Financial Wellness Lab at Western University from a registered investment provider;
- ▶ Consider only retired clients;
- ▶ Four tables including:
    1. Personal information;
    2. Information on trades;
    3. Information on transactions;
    4. Initial wealth.

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.

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

Initial wealth:

- ▶ Most of male and female retirees belong to Group 3 of risk tolerance;
- ▶ Clients within the highest risk tolerance groups are younger and wealthier compared with other clients.

Gender	Group	Average age	Average initial wealth
Male	1	78	$288,646
	2	77	$293,678
	3	75	$353,021
	4	**74**	**$424,103**
Female	1	78	$372,890
	2	76	$364,195
	3	74	$342,971
	4	**73**	**$481,644**

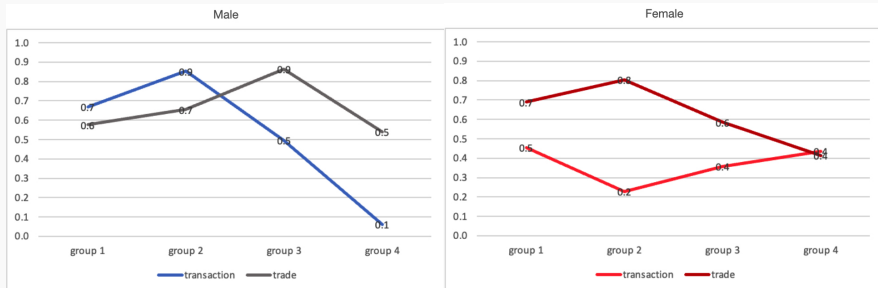Average number of deposits and withdrawals per year:
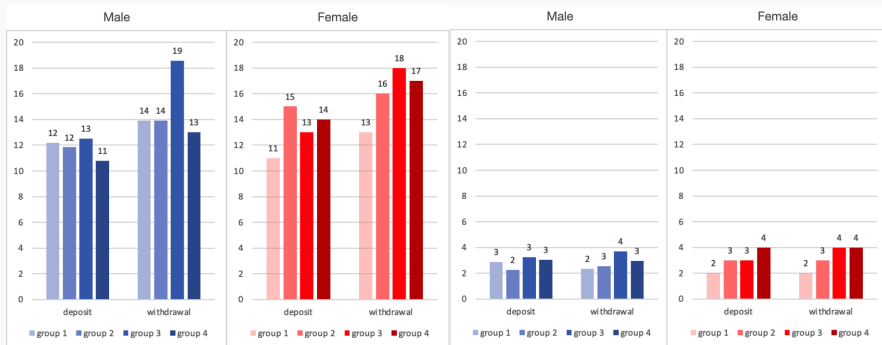
Correlation between annual number of deposits and withdrawals:
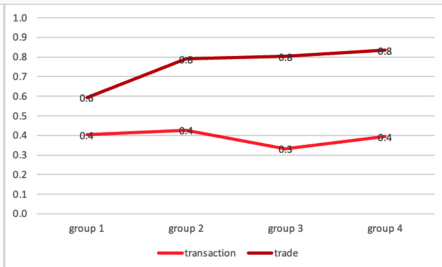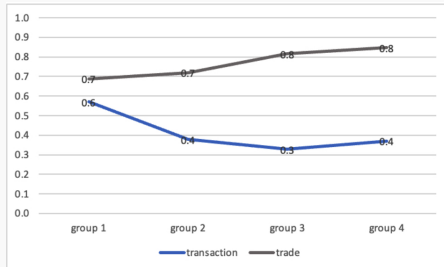
Average amounts of deposits and withdrawals per year:
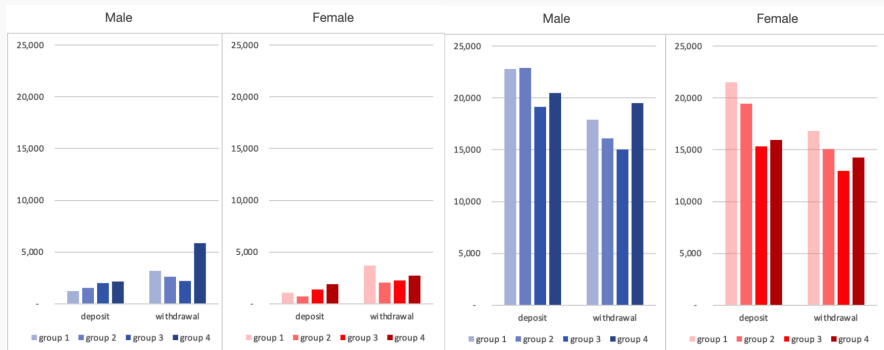
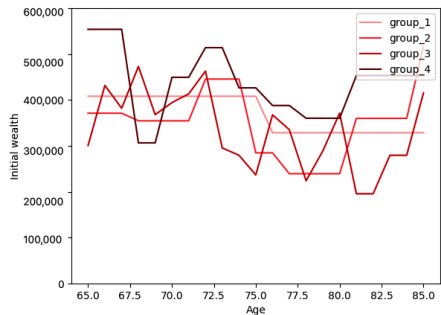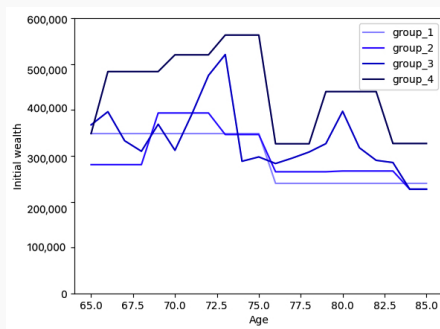Correlation between annual amounts of deposits and withdrawals:

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

$$U(t) = u + \underbrace{\sum_{i=1}^{N_1(t)} X_{1i} - \sum_{j=1}^{M_1(t)} Y_{1j}}_{\text{Trades: less frequent but larger amounts}} + \underbrace{\sum_{k=1}^{N_2(t)} X_{2k} - \sum_{l=1}^{M_2(t)} Y_{2l}}_{\text{Transactions: more frequent but smaller amounts}}$$
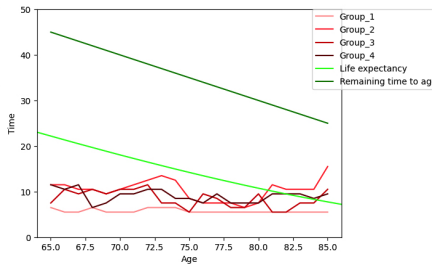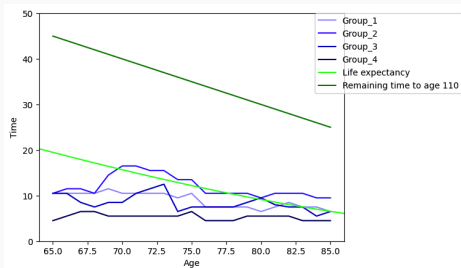
Initial wealth for male and female clients between ages 65 and 85:
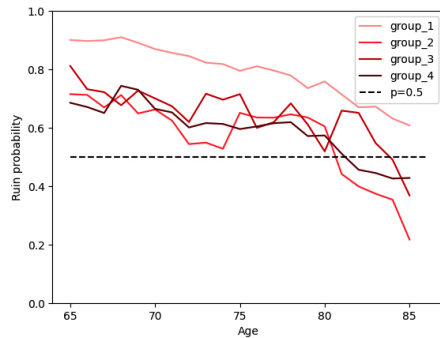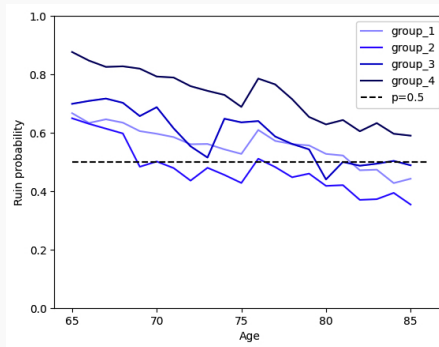
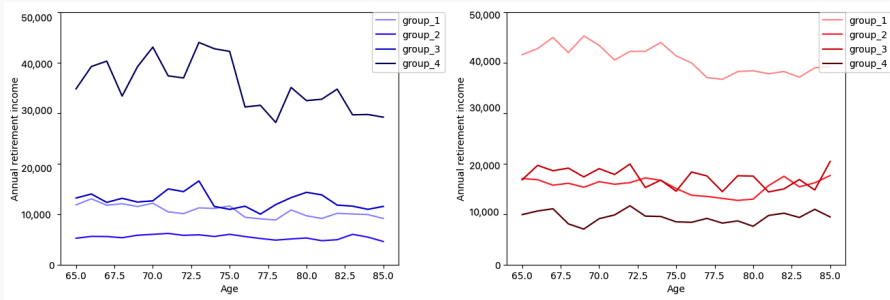Mean time to exhaustion of funds (age 65 to 85):
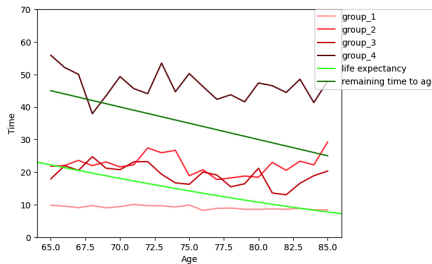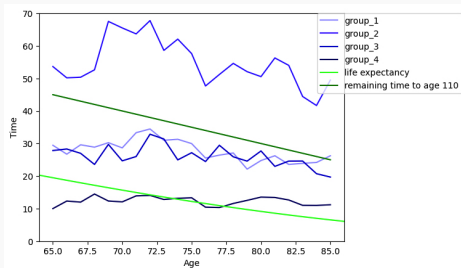
Median time to exhaustion of funds (age 65 to 85):

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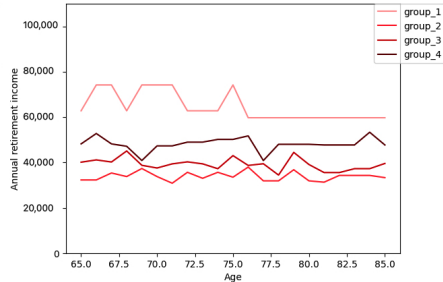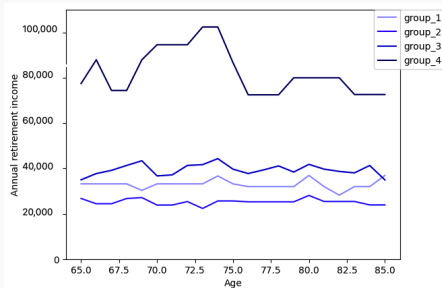
What percentage of their wealth do our clients spend annually? (based on median time to exhaustion of funds)

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.
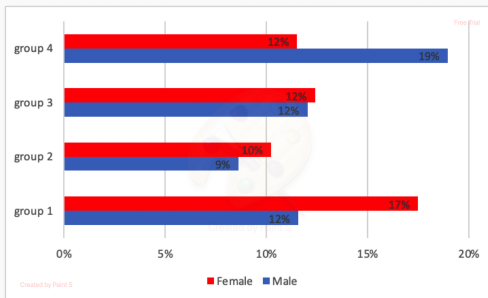
- ▶ Female clients in Group 1 (lowest risk tolerance level) and male clients in Group 4 (highest risk tolerance level) have the shortest time to exhaustion of funds at all ages as well as the highest annual retirement income.

- 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
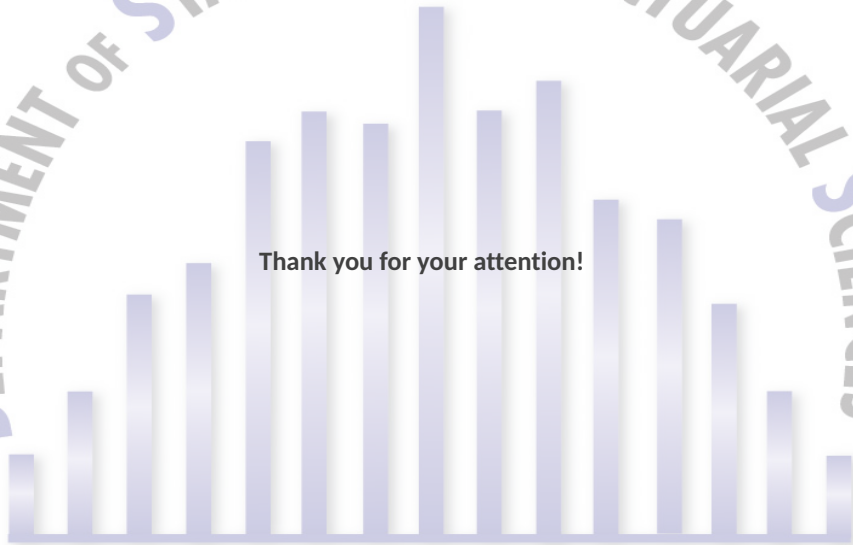
Conclusions

Ruin probability less than 0.5:

		Age							
		Withdrawal rate / Ruin probability							
	Group	[69, 73]	[74, 75]	[77, 80]	81	82	83	84	85
Male	1	-	-	-	-	12% / 0.47	13% / 0.47	13% / 0.43	15% / 0.44
	2	6% / 0.47	10% / 0.43	10% / 0.43	10% / 0.42	10% / 0.37	10% / 0.37	11%/ 0.39	11%/ 0.35
	3	-	-	-	-	13% / 0.48	13% / 0.48	-	15% / 0.48
	4	-	-	-	-	-	-	-	-
Female	1	-	-	-	-	-	-	-	-
	2	-	-	-	9% / 0.44	10% / 0.39	10% / 0.37	10% / 0.35	6% / 0.21
	3	-	-	-	-	-	-	10% / 0.49	13% / 0.36
	4	-	-	-	-	11% / 0.45	11% / 0.44	11% / 0.42	11% / 0.42

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!