

EXECUTIVE SUMMARY

Emily, a 30-year-old Data analyst, seeks GSM Bank's financial advice to plan her superannuation funds for retirement. Currently earning NZD 80,000 with an average annual raise of 3.5%, she currently benefits from an employer-matched contribution of 3% to her superannuation. Her current investments span into three funds: Stable, Balanced, and SkyHigh. This report offers tailored strategies to optimize risk management that would give her financial stability at retirement.

The investment suggestions for Emily are:

- Gradually increase the percentage of superannuation fund contributions to a maximum of 10% over the years.
- Adjust the investment allocation across the three funds as the contribution percentage rises.
- Ensure that, by retirement age, most of the investment is allocated to both a stable bond fund and a balanced hybrid fund.

The recommendation considers the average life expectancy of women in New Zealand along with parameters like inflation, the cost of living and future expenses until and after her retirement. The projected investment returns are designed to sustain Emily's current lifestyle, travel regularly, leisure activities, and will have sufficient funds for healthcare and unforeseen expenses after retirement.

INTRODUCTION

Retirement planning is essential for ensuring a financially secure and comfortable future, particularly for individuals like Emily, who are planning an eventful post-retirement life. Emily, a 30-year-old data analyst based in New Zealand, working from the age of 24 and plans to retire at the age of 65. Considering the average life expectancy of women in New Zealand, the post-retirement cost of living has been calculated to ensure the optimal fund allocation, providing financial stability. She envisions her retirement life to match her current standard of living, travelling regularly and engaging in leisure activities while having sufficient funds to cover healthcare and unforeseen expenses.

With a minimum superannuation contribution scheme, it would be hard to plan a post-retirement life as inflation can significantly impact her future living cost. Her current superannuation contributions matched with her employers contribution, are invested across stable, balanced, and growth-oriented funds. While this diversified approach provides stability, its ability to meet her long-term financial need accounting for rising costs, salary growth, and market performance requires further analysis.

This report evaluates Emily's current superannuation strategy and projects the future value of her retirement savings based on her salary progression, expected contributions, fund performance, and inflation. It also estimates her post-retirement expenses and compares them with her projected retirement corpus. Based on these findings, we will provide a tailored superannuation strategy aligned with her goals and risk tolerance, ensuring a secure and fulfilling retirement.

SUPERANNUATION STRATEGY REVIEW

Evaluation of Current Superannuation Investment Allocation

The current allocation strategy of the superannuation fund divides her contribution into three funds: 40% in Stable bonds fund, 40% into Balanced fund and 20% into SkyHigh.

Types	Fund	Risk	Annual growth	Volatility
Stable Bonds Fund	Stable	Low risk	3.5%	4%
Balanced Hybrid Fund	Balanced	Medium risk	6.5%	8.50%
SkyHigh Equity Growth Fund	Growth	High risk	10.50%	20.50%

Table 1: Invested Funds

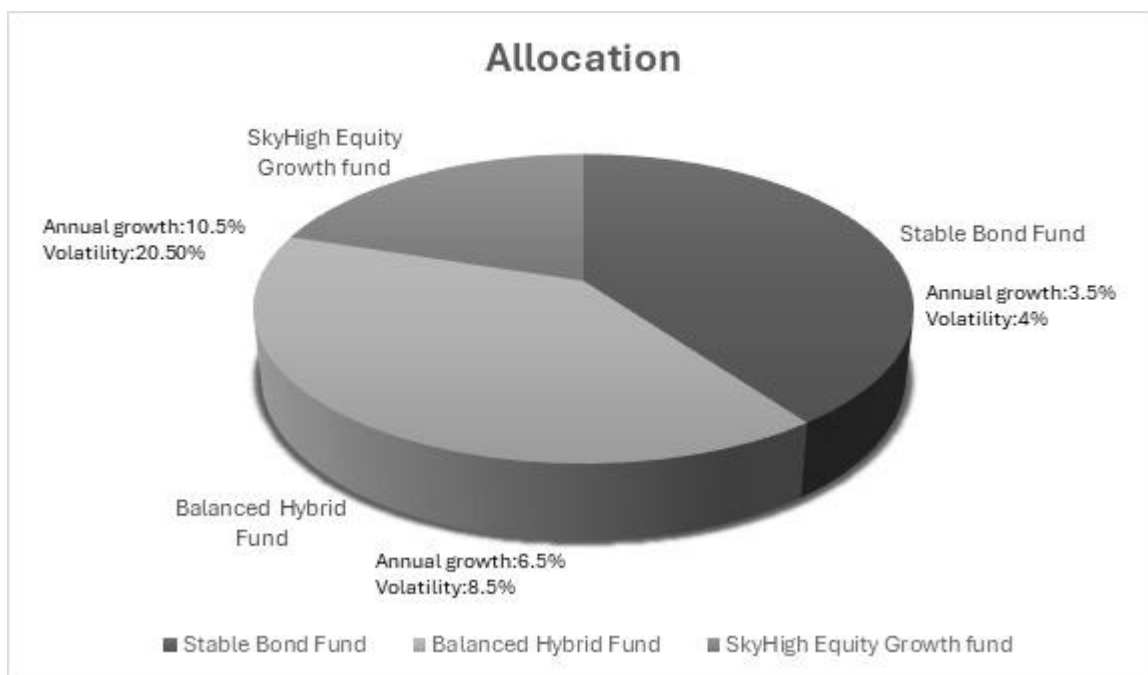


Fig 1: Current Fund Allocation

The low growth rate of the stable fund may not align with Emily's long-term need for higher returns to meet her retirement goals. While a slightly higher allocation to SkyHigh could enhance her returns while maintaining acceptable risk, the balanced fund aligns well with her short-term goals.

Assessment of Contribution

Currently, she contributes 3% of the salary, matched by her employer. This results in an annual contribution of NZD 4601.43. Assuming an average salary growth of 3.5% with 0.7 as standard deviation, and her contributions scale proportionately:

- The current contributions may not suffice to achieve her retirement lifestyle envisioned since other factors like inflation, increase in taxes, healthcare cost can affect the spending and saving rates.
- To match her goals, increasing the contribution from the 3% threshold is advisable, since the employer would also match her contribution up to 10%.

Based on the volatility of each fund, we can calculate the risk score for Emily's investment portfolio. The calculation is attached in the appendix (refer Appendix A.1) for the same:

- Stable Bonds Fund has a volatility of 4%, so the weight for risk score is 1.
- Balanced Hybrid Fund has a volatility of 8.5%, so the weight for risk score is 2.12.
- SkyHigh Equity Growth Fund has a volatility of 20.5%, so the weight for risk score is 5.12.

Using these figures, we calculate the overall portfolio risk score:

- The current Risk Score for Emily's superannuation investments is 44.
- This risk score of 44 places Emily's portfolio in the medium to high-risk category, reflecting a significant exposure to market volatility, especially due to the 20% steady allocation in the high-risk SkyHigh Fund.

To maintain her current lifestyle, including travel and leisure activities, Emily will need an average of NZD 130,000 per year post-retirement life. To reach this goal, she should gradually increase her superannuation contributions in a way that balances growth and stability. This will help her build a solid retirement fund while minimizing risks over time.

Recommendations for Adjustments

Emily is currently contributing 3% of her salary to her superannuation fund. Based on this contribution and her current investment choices, we estimate that her superannuation balance when she reaches 65 will likely fall between \$1.21 million and \$1.29 million, considering the past performance of her chosen funds.

However, this amount will not be enough to support Emily's desired retirement lifestyle, which includes maintaining her current standard of living and her travel and leisure activities. As per our calculation, she should have an average of NZD 130000 per year post-retirement, which means she needs to increase her current contribution and investment strategy.

1. **Reallocation of Equity:** Adjust allocation in Stable, Balanced, and SkyHigh to balance risk and maximize growth , optimization technique was used to obtain maximum return with respect to risk constraints (refer Appendix A.2).
2. **Increase Contributions:** Raise contributions from 3-10% of her salary to build a larger retirement corpus.

3. **Rebalance Periodically:** Review the portfolio every 5 years to adjust risk as retirement approaches.

Age	Superannuation	Stable	Balanced	SkyHigh	Risk Profile
30-35	4%	20%	60%	20%	48.5
36-40	6%	20%	70%	10%	42.8
41-45	8%	40%	50%	10%	38.4
46+	10%	60%	40%	-	28.2
				Overall Risk	39.4 (Approx. 39)

Table 2: Proposed Slab wise Fund Allocation and Risk score

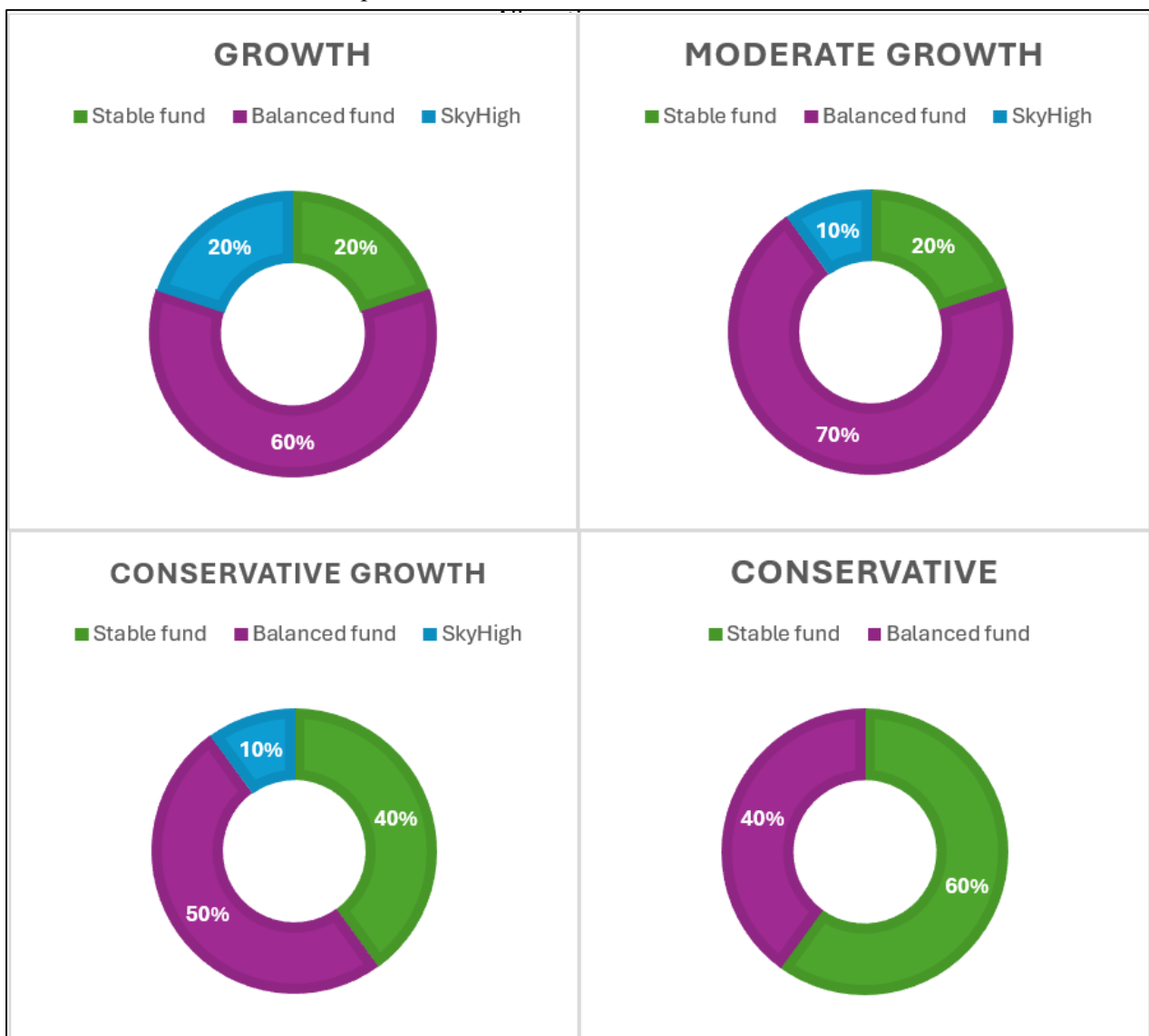


Fig 2: Proposed Fund Allocation

PROJECTION METHODOLOGY

To project the future value of Emily's superannuation fund, considering the variability in salary increases and fund performance, we use a Monte Carlo simulation approach. This method captures the impact of uncertainties and generates a range of potential outcomes.

Salary Growth: Grows annually based on a random normal distribution with a mean growth rate of 3.5% ($\pm 0.7\%$).

Contributions: Emily contributes 3% of her gross salary, with a matching contribution from her employer (up to 3%) and annual government contributions of NZD 521.43.

Investment Allocation: The annual growth of each fund is modelled using random sampling from their respective distributions, reflecting market uncertainty.

Fund Balances: The balance of each fund grows based on its rate of return, and contributions are added proportionally.

Inflation: According to the statistics, the NZ inflation rate is between 2-3% and now it is at 2.2%. All the future expenses were calculated using the inflation, since the expenses are bound to increase with the change.

Monte Carlo Approach: Multiple simulations were performed to estimate the range of possible outcomes for Superannuation fund by calculating the expected value of fund at retirement and confidence interval, providing a range for the likely final balance.

To achieve Emily's financial goals, we recommend a **slab-wise increase in superannuation contributions** and adjustments to her fund allocation.

1. Contribution Increase Strategy:

- Gradual contribution increases from 3% to 10% over the next 25 years, incrementing by **1-2% every 5 years**.
- With employer matching, contributions effectively double, enhancing savings while ensuring returns, significantly.
- Utilizes approximately **22% of unused salary balance**, while reducing taxable income.

2. Portfolio Reallocation for Stability: Fund allocation adjustments as contributions increase:

- Slab 1 (4% Contribution): Stable (20%), Balanced (60%), SkyHigh (20%) — Risk Score: **49 (medium-high risk)**.
- Slab 2 (6% Contribution): Stable (20%), Balanced (70%), SkyHigh (10%) — Risk Score: **43 (medium risk)**.
- Slab 3 (8% Contribution): Stable (40%), Balanced (50%), SkyHigh (10%) — Risk Score: **38 (low-medium risk)**.

- Slab 4 (10% Contribution): Stable (60%), Balanced (40%), SkyHigh (0%) — Risk Score: **28 (low risk)**.

Overall Risk Score became **39 (Medium-low)**



Fig 3: Risk score of proposed investment strategy

Increased superannuation contributions can lead to tax savings, enhancing the net retirement savings.

3. Projected Outcome:

- By aligning contributions and allocations with her salary growth and risk tolerance, Emily's superannuation fund can grow to **NZD 2.35 Million** (refer Appendix C.3) **by retirement**.
- This corpus will adequately cover her retirement goals, factoring in inflation (2–3%) and life expectancy projections.
- She can withdraw the required amount annually for her post-retirement life expenses, thereby continuously getting returns of the balance amount.
- Based on our analysis, Emily will need approximately NZD 98,000 annually at the beginning of her retirement, with expenses expected to rise in line with inflation. Considering projected investment returns, she can withdraw up to a maximum of NZD 180,000 per year (refer Appendix C.4), with the surplus serving as a contingency fund for unforeseen circumstances.

ANALYSIS FRAMEWORK

Data Collection

- **Demographic Details:**
 - Collected information on the data analyst's age (30 years), profession, and income (NZD 80,000). The expected salary growth-rate is 3.5% ($\pm 0.7\%$).
- **Lifestyle and Economic Factors:**
 - Examined annual inflation rates (2–3%) to estimate future cost-of-living adjustments.
 - Researched the average life expectancy of women is 90 years, (refer Appendix B.3) and potential future shifts due to advancements in healthcare.
- **Superannuation Scheme Details:**
 - Evaluated the current employer-matched contribution plan and employee allocation (Stable Bonds, Balanced Hybrid, and SkyHigh Growth funds).
- **Financial Patterns:**
 - Assessed the starting age of employment and financial patterns, including expected expenses, savings trends, and superannuation balances.

Model Simulation

Using a Monte Carlo model, we analysed Emily's superannuation growth by age 65, assessing best- and worst-case scenarios. The analysis revealed she could withdraw up to NZD 180,000 annually, exceeding her estimated need of NZD 130,000, with the surplus serving as a risk fund for unforeseen expenses.

With the average life expectancy for women in New Zealand in mind, we suggested a few changes to her investment strategy. The plan is to gradually increase her superannuation contributions every five years, eventually reaching 10%. Plus, she'll benefit from her employer matching those contributions along the way. These adjustments are designed to give Emily confidence and flexibility in her financial future, making sure she can enjoy the lifestyle she's planning for in retirement.

We also took inflation into account, estimating a 2-3% increase in expenses each year. Since Emily doesn't desire a luxurious lifestyle and simply wants to maintain her current standard of living with the addition of travel and leisure activities, it is recommended that she focus her investments on stable and balanced funds. This approach will provide her with the necessary stability and growth to achieve her goals while managing risk effectively.

An optimization model was created with a minimum allocation of 20% in the Stable bonds fund and at most 20% in skyhigh equity growth fund. Since the funds were allocated to minimize risk, the allocation to the SkyHigh fund was kept lower. This approach ensures that even in unforeseen circumstances, Emily will have sufficient savings by the time she nears

retirement. By the time Emily retires, the remaining balance after covering her expenses will be nearly 40% of her salary, providing a solid financial stability to handle any unexpected emergencies that may arise in her life. She can also rely on these savings to cover unexpected expenses while keeping her lifestyle modest. Meanwhile, the superannuation funds can continue to generate returns, enabling her to maintain a comfortable and sustainable lifestyle post-retirement.

CONCLUSION

Emily is well-positioned for a financially secure and fulfilling retirement. Her solid salary and the combined superannuation contributions from both her and her employer provide a strong foundation. To fully realize her dream retirement—travelling, enjoying leisure activities, and maintaining a safety net for unforeseen circumstances—Emily could make some strategic adjustments to her superannuation.

Currently, her fund allocation leans more conservatively than necessary for someone of her age and financial standing. Shifting her contributions to moderate-risk funds would allow for higher potential returns without exposing her to excessive risk. From our simulations, this approach would enable Emily to save nearly 40% more by the time she approaches retirement. This cushion ensures she can sustain herself comfortably through any unforeseen challenges, including emergencies.

Increasing her superannuation contribution rate is another impactful step Emily can take. By gradually raising her contributions to 10% over the next 20 years, she can maximize the power of compounding interest. This strategy significantly enhances her financial stability, paving the way for a more comfortable retirement.

Regularly reviewing her superannuation strategy is equally essential. By periodically evaluating her investments, Emily can adjust her portfolio to include more stable and balanced funds as she nears retirement. This shift helps protect her accumulated savings while still allowing for growth. Additionally, using Monte Carlo simulations to model various scenarios will prepare her for market fluctuations and ensure she remains on track.

With these focused adjustments—reallocating funds to moderate risk, increasing contributions, and staying proactive in her reviews—Emily is set to achieve her retirement dreams.

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APPENDIX

APPENDIX A

A.1: Risk score calculation

Investment Allocation and Risk Analysis

Fund Details:

Type	Fund	Risk	Annual Growth	Volatility
Stable Bonds Fund	Stable	Low risk	3.5%	4%
Balanced Hybrid Fund	Balanced	Medium risk	6.5%	8.5%
SkyHigh Equity Growth Fund	Growth	High risk	10.5%	20.5%

Coefficients Based on Annual Growth:

The coefficients are calculated with a base of 4% annual growth.

- Stable Fund: Coefficient = 1
- Balanced Fund: Coefficient = $\frac{8.5}{4} = 2.12$
- SkyHigh Fund: Coefficient = $\frac{20.5}{4} = 5.12$

Emily’s Current Allocation:

- Allocation:
Stable: 40%, Balanced: 40%, SkyHigh: 20%
- Risk Score Calculation:

$$\text{Risk Score} = (0.4 \times 1) + (0.4 \times 2.12) + (0.2 \times 5.12) = 2.272$$

- Risk Score (Scaled to 100):

$$\text{Scaled Risk Score} = \left(\frac{100}{5.12}\right) \times 2.272 \approx 44.375 \text{ (Approx.: 44)}$$

Proposed Allocations and Risk Analysis:

Slab 1:

- Allocation: Stable: 20%, Balanced: 60%, SkyHigh: 20%
- Risk Score Calculation:

$$(0.2 \times 1) + (0.6 \times 2.12) + (0.2 \times 5.12) = 2.496$$

- Risk Score (Scaled to 100):

$$\text{Scaled Risk Score} = 2.496 \times 19.5 = 48.672 \text{ (Approx.: 49)}$$

Slab 2:

- Allocation: Stable: 20%, Balanced: 70%, SkyHigh: 10%
- Risk Score Calculation:

$$(0.2 \times 1) + (0.7 \times 2.12) + (0.1 \times 5.12) = 2.196$$

- Risk Score (Scaled to 100):

$$\text{Scaled Risk Score} = 2.196 \times 19.5 = 42.822 \text{ (Approx.: 43)}$$

Slab 3:

- Allocation: Stable: 40%, Balanced: 50%, SkyHigh: 10%
- Risk Score Calculation:

$$(0.4 \times 1) + (0.5 \times 2.12) + (0.1 \times 5.12) = 1.972$$

- Risk Score (Scaled to 100):

$$\text{Scaled Risk Score} = 1.972 \times 19.5 = 38.454 \text{ (Approx.: 38)}$$

Slab 4:

- Allocation: Stable: 60%, Balanced: 40%, SkyHigh: 0%
- Risk Score Calculation:

$$(0.6 \times 1) + (0.4 \times 2.12) + (0 \times 5.12) = 1.448$$

- Risk Score (Scaled to 100):

$$\text{Scaled Risk Score} = 1.448 \times 19.5 = 28.236 \text{ (Approx.: 28)}$$

A.2: Formulation for optimization of fund Allocation

Objective Function: Maximize the total investment value:

$$\text{Maximize } Z = 0.04S + 0.085B + 0.205H$$

Where:

- S is the funds allocated to Stable funds
- B is the funds allocated to Balanced fund
- H is the funds allocated to Skyhigh fund

Subject to the following constraints:

1. Funds allocated to Stable must be at least 20:

$$S \geq 20$$

2. Funds allocated to Skyhigh must not exceed 20:

$$H \leq 20$$

3. The total allocation to all three funds must equal 100:

$$S + B + H = 100$$

Here, the goal is to maximize investment returns while minimizing risk by setting constraints on the amounts allocated to each fund type.

APPENDIX B

B.1: Model Parameters for Current Strategy

Field	Value
Current Age	30
Retirement Age	65
Current Salary	80000
Salary Growth Rate (Mean)	0.035
Salary Growth Rate (Std Dev)	0.007
Employee Contribution (%)	0.03
Employer Match (%)	0.03
Inflation Rate	0.02
Stable Growth (Mean)	0.035
Stable Volatility	0.04
Balanced Growth (Mean)	0.065
Balanced Volatility	0.085
SkyHigh Growth (Mean)	0.105
SkyHigh Volatility	0.205
Stable Allocation	0.4
Balanced Allocation	0.4
SkyHigh Allocation	0.2

B.2: Emily's Future Expenses

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Age	Year	Salary	Total Expenses (NZD)	Housing	Food	Transportation	Healthcare	Clothing and Personal Care	Entertainment and Leisure	Miscellaneous	Savings	% Savings
2	30	1	61072.00	47064	24480	7344	4896	3000	3672	2448	1224	14008.00	22.94
3	31	2	62791.38	48012.78	24969.6	7490.88	4993.92	3067.5	3745.44	2496.96	1248.48	14778.60	23.54
4	32	3	64169.96	48980.70435	25468.99	7640.6976	5093.7984	3136.51875	3820.3488	2546.8992	1273.4496	15189.25	23.67
5	33	4	66424.93	49968.15973	25978.37	7793.511552	5195.674368	3207.090422	3896.755776	2597.837184	1298.918592	16456.77	24.77
6	34	5	68077.48	50975.54065	26497.94	7949.381783	5299.587855	3279.249956	3974.690892	2649.793928	1324.896964	17101.94	25.12
7	35	6	70150.12	52003.24959	27027.9	8108.369419	5405.579612	3353.03308	4054.184709	2702.789806	1351.394903	18146.87	25.87
8	36	7	72849.60	53051.69717	27568.46	8270.536807	5513.691205	3428.476325	4135.268404	2756.845602	1378.422801	19797.90	27.18
9	37	8	75104.67	54121.3023	28119.83	8435.947543	5623.965029	3505.617042	4217.973772	2811.982514	1405.991257	20983.37	27.94
10	38	9	77540.82	55212.49239	28682.22	8604.666494	5736.444329	3584.493425	4302.333247	2868.222165	1434.111082	22328.33	28.80
11	39	10	79561.83	56325.70347	29255.87	8776.759824	5851.173216	3665.144528	4388.379912	2925.586608	1462.793304	23236.13	29.21
12	40	11	82111.70	57461.3804	29840.98	8952.29502	5968.19668	3747.610279	4476.14751	2984.09834	1492.04917	24650.32	30.02
13	41	12	84659.08	58619.97704	30437.8	9131.340921	6087.560614	3831.931511	4565.67046	3043.780307	1521.890153	26039.10	30.76
14	42	13	87858.58	59801.95641	31046.56	9313.967739	6209.311826	3918.14997	4656.98387	3104.655913	1552.327957	28056.62	31.93
15	43	14	89985.38	61007.79091	31667.49	9500.247094	6333.498063	4006.308344	4750.123547	3166.749031	1583.374516	28977.59	32.20
16	44	15	92570.44	62373.9625	32300.84	9690.252036	6460.168024	4096.450282	4845.126018	3230.084012	1615.042006	30332.48	32.77
17	45	16	94737.75	63492.96287	32946.86	9884.057077	6589.371384	4188.620413	4942.028538	3294.685692	1647.342846	31244.79	32.98
18	46	17	98115.81	64773.29368	33605.79	10081.73822	6721.158812	4282.864372	5040.869109	3360.579406	1680.289703	33342.52	33.98
19	47	18	100402.68	66079.46672	34277.91	10283.37298	6855.581988	4379.228821	5141.686491	3427.790994	1713.895497	34323.21	34.19
20	48	19	103372.35	67412.00412	34963.47	10489.04044	6992.693628	4477.761469	5244.520221	3496.346814	1748.173407	35960.35	34.79
21	49	20	106403.30	68771.43861	35662.74	10698.82125	7132.547501	4578.511102	5349.410626	3566.27375	1783.136875	37631.87	35.37
22	50	21	109238.68	70158.31366	36375.99	10912.79768	7275.198451	4681.527602	5456.398838	3637.599225	1818.799613	39080.36	35.78
23	51	22	112051.13	71573.18375	37103.51	11131.05363	7420.70242	4786.861973	5565.526815	3710.35121	1855.175605	40477.95	36.12
24	52	23	115628.51	73016.61458	37845.58	11353.6747	7569.116468	4894.566367	5676.837351	3784.558234	1892.279117	42611.90	36.85
25	53	24	119311.92	74489.18329	38602.49	11580.7482	7720.498797	5004.694111	5790.374098	3860.249399	1930.124699	44822.74	37.57
26	54	25	124263.91	75991.47869	39374.54	11812.36316	7874.908773	5117.299728	5906.18158	3937.454387	1968.727193	48272.43	38.85
27	55	26	127394.60	77524.10151	40162.03	12048.61042	8032.406949	5232.438972	6024.305212	4016.203474	2008.101737	49870.50	39.15

B.3: Life Expectancy Calculation

	A	B	C	D	E	F	G	H	I	J
1	How long will I live?									
2										
3	To find out how long you'll live, enter your:									
4										
5	Year you were born in:		1994							
6	Age (nearest birthday):		30							
7	Sex:		Female							
8										
9	You can expect to live to:									
10			91.9	years (assuming low death rates)						
11			89.5	years (assuming medium death rates)						
12			87.3	years (assuming high death rates)						
13	Average life expectancy of a female									89.6
14	Note:									
15	1. Life expectancy indicates the average length of life. It does not indicate how long a specific individual will live. An									
16	individual's life expectancy can be affected by events such as accidents, epidemics, and wars, as well as experiences									
17	during their life (eg smoking, diet, environment). Life expectancy will also vary by ethnicity and socioeconomic status.									
18	2. For the calculation to work please click 'enable content' at the top of the page.									
19										
20	Source:									
21	Stats NZ, complete cohort life tables 1876–2021 (updated March 2023)									
22	and national population projections 2022(base)–2073, mortality assumptions (published July 2022).									
23										

B.4: Current Superannuation Strategy

	A	B	C	D	E	F	G	H	I	J	K
1	Year	Age	Salary	Employee Contribution	Employee Contribution After	Employer Contribution	Total Contribution	Stable Balance	Balanced Balance	SkyHigh Balance	Total Balance
2	1	30	80000	2400	1680	1680	29475.42	11790.168	11790.168	5895.084	29475.42
3	2	31	82327.4	2470	1728.875375	1728.875375	4720.127338	14424.05968	14703.34758	7010.58895	36137.9962
4	3	32	85055.1	2552	1709.607814	1709.607814	4782.691268	17198.89504	16981.54339	9867.025241	44047.46366
5	4	33	86558.9	2597	1739.832999	1739.832999	4858.028669	20441.90814	21497.62798	14045.89781	55985.43394
6	5	34	90435.5	2713	1817.752926	1817.752926	5052.246994	22280.16094	26241.67455	16992.12169	65513.95719
7	6	35	92484.3	2775	1858.934657	1858.934657	5154.893997	25745.43047	27106.1413	26552.20393	79403.7757
8	7	36	95938.9	2878	1928.37216	1928.37216	5327.969564	29379.5554	29896.45231	35651.93126	94927.93897
9	8	37	100177	3005	2013.557171	2013.557171	5540.29638	31931.18802	33387.92486	38664.46398	103983.5769
10	9	38	103679	3110	2083.943843	2083.943843	5715.737788	35287.39665	38602.55365	46389.52677	120279.4771
11	10	39	106988	3210	2150.454302	2150.454302	5881.517588	37016.74225	43888.37309	57533.16239	138438.2777
12	11	40	111529	3346	2241.730556	2241.730556	6109.027059	42874.66782	47386.30649	76541.05768	166802.032
13	12	41	113868	3416	2288.747179	2288.747179	6226.217744	46691.24961	48361.10522	75893.33702	170945.6919
14	13	42	117794	3534	2367.660784	2367.660784	6422.912849	49135.97226	53612.13406	83863.61057	186611.7169
15	14	43	122950	3688	2471.287173	2471.287173	6681.20549	55990.62472	61310.93992	116471.3193	233772.8839
16	15	44	128152	3845	2575.84621	2575.84621	6941.022793	60922.25161	65787.70813	112517.0703	239227.027
17	16	45	133606	4008	2685.488664	2685.488664	7215.1107	63950.94509	68767.05893	119823.4657	252541.4697
18	17	46	137893	4137	2771.641533	2771.641533	7429.849941	69536.95502	81985.94323	103771.1019	255294.0001
19	18	47	143124	4294	2876.788769	2876.788769	7691.933349	73596.6432	100008.6336	134462.8046	308068.0814
20	19	48	148791	4464	2990.700136	2990.700136	7975.861683	76723.90452	116559.6044	92585.29036	285868.7993
21	20	49	151900	4557	3053.190469	3053.190469	8131.621168	80184.49144	130806.3083	122544.0346	333534.8343
22	21	50	159148	4774	3198.874984	3198.874984	8494.74526	86552.26921	146380.5382	136227.5392	369160.3466
23	22	51	163852	4916	3293.430316	3293.430316	8730.427953	97352.20772	169798.1821	144897.6026	412047.9924
24	23	52	168542	5056	3387.703735	3387.703735	8965.407966	99600.60088	184245.5634	132345.2704	416191.4347
25	24	53	173767	5213	3492.720741	3492.720741	9227.166772	107348.6785	193571.3447	109103.4809	410023.504
26	25	54	179877	5396	3615.523882	3615.523882	9533.258182	117337.8219	229278.8375	145305.6004	491922.2598
27	26	55	186420	5593	3747.051719	3747.051719	9861.096224	117911.896	264469.6727	159175.0294	541556.5981
28	27	56	193700	5814	3885.188800	3885.188800	10200.188800	128912.0848	305566.7888	175703.8888	620563.8888
29											
30											

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Proposed Superannuation Strategy

Savings After Current Ctnb

Current Superannuation Strategy

Emily's | + - < >

B.5: Monte Carlo Results (Statistics) for current strategy

Original Allocation	
Mean	1281792.065
SD	610824.1736
SE	19315.95638
LB	1243932.79
UB	1319651.339

B.6: Annual Withdrawal based on current strategy

Annual Withdrawal after Retirement	
Initial Amount	1278538.691
Annual Return	0.059
Number of Years	25
Final Value	0
Annual withdrawal	NZD 99,067.51

B.7: Past superannuation balance

A	B	C	D	E	F	G	H	I	J
Age	Salary (NZD)	Net Income (NZD)	Expenses (NZD)	Savings (NZD)	Bank Balance (NZD)	Personal Contribution (NZD)	Employer Contribution (NZD)	Total Contribution (NZD)	Superannuation Balance (NZD)
24	65504.44	63539.3068	39302.66	20424.2884	13100.89	1906.179204	1906.179204	3812.358408	3812.358408
25	67725.38	65693.6186	40635.23	21116.7715	26645.96	1970.808558	1970.808558	3941.617116	7753.975524
26	70430.94	68318.0118	42258.56	21960.3711	40732.15	2049.540354	2049.540354	4099.080708	11853.05623
27	72746.04	70563.6588	43647.62	22682.2193	55281.36	2116.909764	2116.909764	4233.819528	16086.87576
28	74602.37	72364.2989	44761.42	23261.021	70201.83	2170.928967	2170.928967	4341.857934	20428.73369
29	76379.04	74087.6688	45827.42	23814.9887	85477.64	2222.630064	2222.630064	4445.260128	24873.99382

APPENDIX C: Model Parameters for Modelling Proposed Assessment

C.1: Model Parameters for Proposed Strategy

Field	Value	Slab 1	Slab 2	Slab 3	Slab 4
Current Age	30				
Retirement Age	65				
Current Salary	80000				
Salary Growth Rate (Mean)	0.035				
Salary Growth Rate (Std Dev)	0.007				
Employee Contribution (%)	0.03				
Employer Match (%)	0.03				
Inflation Rate	0.02				
Stable Growth (Mean)	0.035				
Stable Volatility	0.04				
Balanced Growth (Mean)	0.065				
Balanced Volatility	0.085				
SkyHigh Growth (Mean)	0.105				
SkyHigh Volatility	0.205				
Stable Allocation	0.4	0.2	0.2	0.4	0.6
Balanced Allocation	0.4	0.6	0.7	0.5	0.4
SkyHigh Allocation	0.2	0.2	0.1	0.1	
Government Contribution	521.43				

C2: Proposed Superannuation Strategy

	A	B	C	D	E	F	G	H	I	J	K
1	Year	Age	Salary	Employee Contribution	Employee Contribution After	Employer Contribution	Total Contribution	Stable Balance	Balanced Balance	SkyHigh Balance	Total Balance
2	1	30	80000	3200	2240	2240	30835.429	6167.0858	18501.2574	6167.0858	30835.429
3	2	31	82128.64	3285	2299.60198	2299.60198	6106.177666	7581.830422	23898.54982	7405.932781	38886.31303
4	3	32	85159.99	3406	2282.287643	2282.287643	6210.117111	9351.150901	29059.07878	6441.494348	44851.72403
5	4	33	89057.76	3562	2386.748073	2386.748073	6470.488629	11206.2687	34819.4396	6180.312566	52206.02086
6	5	34	92273.24	3691	2472.922787	2472.922787	6685.28232	13507.40606	36625.92275	7819.839978	57953.16879
7	6	35	94574.28	3783	2534.590829	2534.590829	6838.992216	15755.89261	43322.15698	9335.66274	68413.71233
8	7	36	98291.54	5897	3951.319807	3951.319807	10370.24206	17629.5697	50458.12167	10517.03485	78604.72621
9	8	37	99849.56	5991	4013.952189	4013.952189	10526.35561	19867.18635	61982.67997	13145.51874	94995.38506
10	9	38	104064.7	6244	4183.399195	4183.399195	10948.70859	23450.12853	67524.13502	17100.6033	108074.8669
11	10	39	107434.5	6446	4318.865039	4318.865039	11286.36226	27862.95309	90889.37574	25936.12933	144688.4581
12	11	40	110807.7	6648	4454.467598	4454.467598	11624.3567	30021.13548	96309.7022	21012.11586	147342.9535
13	12	41	113417.3	9073	6079.166497	6079.166497	15673.97933	37648.11063	118339.004	32213.95149	188201.0662
14	13	42	117509.9	9401	6298.52807	6298.52807	16220.74623	45471.99159	106568.6646	34982.47183	187023.128
15	14	43	123717.7	9897	6631.269047	6631.269047	17050.11553	52928.69662	115013.9862	46391.98268	214334.6655
16	15	44	128416.6	10273	6883.127864	6883.127864	17677.88304	60879.81301	117124.0272	60147.931	238151.7712
17	16	45	133360.7	10669	7148.131515	7148.131515	18338.41452	67186.37235	139107.1053	65667.90047	271961.3781
18	17	46	136578.3	13658	9150.745357	9150.745357	23330.00425	81404.6816	165308.7887	78400.90212	325114.3724
19	18	47	140208	14021	9393.938829	9393.938829	23936.17305	100627.2921	189145.0793	61364.86986	351137.2413
20	19	48	144276.8	14428	9666.543667	9666.543667	24615.65078	118675.2193	215547.2697	72114.10778	406336.5968
21	20	49	149336	14934	10005.51076	10005.51076	25460.53891	143009.786	228647.981	52625.73784	424283.5049
22	21	50	155234	15523	10400.67759	10400.67759	26445.50698	174768.1894	278687.6459	52982.90724	506438.7425
23	22	51	161957.1	16196	10851.12488	10851.12488	27568.26366	196721.5281	299055.8804	61363.47582	557140.8843
24	23	52	167670.2	16767	11233.90643	11233.90643	28522.36096	233107.6806	323015.024	61034.77901	617157.4836
25	24	53	173189.7	17319	11603.71319	11603.71319	29444.1181	242264.0052	355371.6275	73942.51583	671578.1485

C.3: Monte Carlo Results (Statistics) for the proposed strategy

Mean	2350783.161
SD	760488.5909
SE	24048.76082
LB	2303647.59
UB	2397918.732

C.4: Annual Withdrawal based on the proposed strategy

Annual Withdrawal after Retirement	
Initial Amount	2350783.161
Annual Return	0.059
Number of Years	25
Final Value	0
Annual withdrawal	NZD 1,82,150.33

APPENDIX D: Summary of the Use of Generative AI tools

Date	Time	Software or Tools	Why the tool was used or how the tool was used.
10-11-2024	10:25 am	OpenAI	For calculating annual withdrawal from superannuation post-retirement
10-11-2024	10:25 am	OpenAI	For calculating the age when she started her career

The following screenshots provide examples of the above processes:

D.1.1: Prompt for calculating annual withdrawal from superannuation post-retirement

Emily has \$2.3 million in her superannuation account at age 65 and plans to withdraw it evenly until age 90. Her investments are split into two funds: 60% earning 4% annually and 40% earning 8.5% annually. How to calculate the annual withdrawal amount to deplete the account by age 90? Provide Excel Formulae

D.1.2: Formulae for calculating annual withdrawal from superannuation post-retirement

The formula to calculate the annual withdrawal amount is based on the **Future Value of Annuities**:

$$FV = PV \times (1 + r)^t - \frac{W}{r} [(1 + r)^t - 1]$$

Where:

- $FV = 0$ (target balance at age 90)
- $PV = 2,300,000$ (initial balance)
- $r = 5.9\% = 0.059$ (average annual return)
- $t = 25$ years
- W = annual withdrawal amount (to be calculated)

Rearranging for W :

$$W = \frac{PV \times r \times (1 + r)^t}{(1 + r)^t - 1}$$

In Excel, you can use the **PMT** function to calculate the annual withdrawal amount. The formula would be:

excel

 Copy code

```
=PMT(5.9%, 25, -2300000, 0, 1)
```

Explanation of the formula:

- **5.9%**: The annual return rate as a decimal.
- **25**: The number of years (time horizon).
- **-2300000**: The initial balance (negative because it's a cash outflow for withdrawals).
- **0**: The target balance at the end of the period.
- **1**: Indicates payments are made at the beginning of each year (set to **0** if withdrawals occur at the end of each year).

D.2.1: Prompt for calculating the age when she started her career

Determine how many years it takes for a salary to grow from NZD 65,000 to NZD 80,000 with an annual increment rate of 3.5%. Provide the formula used for the calculation as part of the explanation

D.2.2: Formulae for calculating the age when she started her career

To find the number of years (n) given the past salary ($P = 65,000$) and the current salary ($F = 80,000$) with an annual increment rate ($r = 3.5\%$), we use the compound growth formula:

$$F = P \times (1 + r)^n$$

Rearranging for n :

$$n = \frac{\log(F/P)}{\log(1 + r)}$$

Substitute $F = 80,000$, $P = 65,000$, and $r = 0.035$ into the equation:

$$n = \frac{\log(80,000/65,000)}{\log(1.035)}$$

Let me calculate n for you.

The number of years is approximately **6.04 years**. This aligns closely with the 6-year assumption, confirming the calculation. [↗]