BUSINFO 705

Group Assignment

Superannuation Fund Analysis

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Executive Summary

The purpose of this report is to evaluate Emily's superannuation strategy to ensure it meets her long-term retirement goals. Emily's current investment allocations in the Harbour Safe Bonds Fund, Balanced Horizon Mix Fund, and Sky High Equity Growth Fund yield an average return of 6.525% with a volatility of 7.26%.

Her portfolio's Sharpe Ratio of 0.62 indicates a balanced risk-return profile. However, projections using Monte Carlo show that her savings will reach $1,280,764 by age 65, falling short of her $1.5 million target, which is essential for maintaining her lifestyle, including travel, leisure activities, and medical costs. There is only a 13% probability of exceeding this target with her current strategy.

To address this shortfall, the report recommends increasing her contribution rate from 3% to 10% and optimizing her fund allocations to enhance returns and reduce risks. These strategic adjustments could boost the probability of surpassing $1.5 million to 81%. The recommendations are based on a comprehensive framework that includes salary growth projections, fund allocation optimization, and sensitivity analysis, ensuring a secure and comfortable retirement aligned with her financial goals.

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- *I acknowledge that I have adhered to the course rules surrounding the use of permitted software and 3rd party assistance.*

- *I declare that I have generated the calculations and data and/or composed the writing/translations in this assessment independently, using the tools and resources defined for use in this assessment.*
- *I understand the University expects all students to complete coursework with integrity and honesty.*
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1. Introduction

This report provides a comprehensive analysis of Emily's superannuation strategy, focusing on ensuring her financial security upon retirement. Emily, a 30-year-old software engineer based in Auckland, New Zealand, earns an annual salary of NZD 70,000 with an expected average annual raise of 3.5%. She currently contributes 3% of her salary to her superannuation scheme, which is fully matched by her employer. Her investment portfolio is diversified across three funds: Harbour Safe Bonds Fund, Balanced Horizon Mix Fund, and Sky High Equity Growth Fund.

The primary issue addressed in this report is whether Emily's current investment and contribution strategy is sufficient to meet her target of $1.5 million by age 65. Achieving this target is crucial for maintaining her desired lifestyle, which includes regular travel, leisure activities, and covering unforeseen expenses.

The study is structured into three primary areas: evaluating her current investment allocations, projecting the future value of her superannuation fund, and outlining an analysis framework to support these projections. By employing advanced financial modelling techniques, this report aims to provide actionable recommendations to optimize Emily's superannuation strategy, ensuring her long-term financial security and helping her achieve her retirement goals.

2. Superannuation strategy review

This section reviews Emily's current superannuation strategy while assessing its ability to meet her long-term needs. Additionally, we have included some recommendations to help her reach her financial goals.

To evaluate Emily's present investment allocations and portfolio performance, we used key financial metrics: the **expected return**, which shows the measure of return, an investment is projected to generate over a specific period (Chen, 2024), and **volatility**, which represents how much the price of assets changes from the mean price (Hayes, 2024). The weighted average returns of the three funds she invested in Harbour Safe Bonds Fund (HarbourSafe), Balanced Horizon Mixed Fund (Horizon), and Sky High Equity Growth Fund (SkyHigh), were used to determine the predicted return of her portfolio, calculated to be 6.525% (Appendix B.1) which

means that on average she can anticipate earning a 6.525% return on her investment. The standard deviations of the return of each fund were used to calculate the portfolio's volatility of 7.26%. In addition to this, we used **Sharpe's ratio** to explain how much excess return is received for each additional unit of risk assumed (Lioudis, 2024). With a risk-free rate of 2%, Sharpe's ratio of her portfolio is 0.62, indicating that the portfolio produces a respectable return for each unit of risk. Given her age and retirement goals, this suggests that Emily's portfolio is moderately effective in compensating for the risks taken, providing a reasonable balance between achieving growth and stability.

To assess the sufficiency of her portfolio, we considered Emily's current salary of $70,000, an anticipated 3.5% annual salary growth, and a total contribution rate of 6%. By projecting her yearly contributions and their growth over time, along with the anticipated 6.525% return and 7.26% volatility, we created a comprehensive model that breaks down her salary, contributions, and fund allocations year over year until age 65. Based on this model, she is expected to have an average of $1,280,764 in retirement savings by the time she is 65 years old. However, this falls short of her goal of $1.5 Mn calculated based on her future needs (Appendix B.7 & B.8), which is necessary to maintain her current standard of living, travel frequently, partake in leisure activities, and cover unforeseen medical costs (Le & Richardson, 2023). With the current and projected contributions, there is only a 13% probability that Emily will achieve a return exceeding 1.5 million.

To better align Emily's superannuation strategy with her long-term financial goals and ensure she reaches her target of $1.5 million by age 65, we recommend the following adjustments:

a. **Increase Contribution Rate:** Increasing her contribution rate beyond 3% will significantly enhance her retirement savings. This can be attained by allocating a higher percentage of her salary to her retirement fund. We recommend that Emily contribute 10% to her retirement fund, bringing the total contribution to 13%. This increased contribution will help grow her funds more effectively within her retirement timeline.

b. **Change Fund Allocation:** Optimizing her investment strategy by changing her funds' allocation can offer higher returns. Emily should consider diversifying the allocation of her funds to align with her risk tolerance and investment horizon. Using optimization

models to maximize the returns and minimize the risks of the funds, she can reallocate her current investments to achieve a more balanced and potentially higher-yielding portfolio.

By implementing these recommendations, the probability that Emily can earn a return exceeding $1.5 Mn will increase to 81%, thereby positioning her better to achieve a comfortable and financially secure retirement.

3. Projection Methodology for Superannuation Fund

This section describes the methods for projecting the future value of the superannuation fund at retirement age. It considers the unpredictability of wage increases and fund performance and describes the methodologies for ensuring robust analysis under various scenarios.

To accommodate income fluctuation, we assume compensation increases follow a normal distribution. This approach assumes annual salary rises are distributed around an average (mean) value, with some variation (standard deviation). Salary increases do not occur annually. Numerous factors can influence company performance, individual performance, economic conditions, inflation, and more. Assuming a normal distribution, we can better capture this fluctuation.

After projecting her salary growth, annual contributions to the funds were calculated. Emily's contributions, combined with her employer's matching contributions, comprised 6% of her contribution. Secondly, by dividing her contributions across three funds: 40% in the Harbour Safe Bonds Fund, 30% in the Balanced Horizon Mix Fund, and 30% in the Sky-High Equity Growth Fund, the growth of her superannuation fund was calculated. It is possible to determine the annual growth by applying the corresponding historical average growth rates of 3.75%, 6.5%, and 10.25%. By incorporating random variations based on the funds' volatility measurements (standard deviations of 5.00%, 10.50%, and 20.75%, respectively), the model was expanded to account for variability in fund performance using Monte Carlo simulation. This would include producing random returns for each fund each year, taken from a normal distribution specified by the fund's average growth rate and standard deviation, resulting in various possible future outcomes for Emily's superannuation balance. Using Monte Carlo simulation accounted for the uncertainty in our projected outcomes.

A few approaches ensured that Emily's superannuation fund analysis covered various probable situations and remained robust under varying conditions. Using the Monte Carlo technique and running thousands of simulations of Emily's superannuation fund growth by randomly varying the returns based on historical averages and volatilities for each fund, we can generate a distribution of potential outcomes, providing insight into the range of possible future balances and the likelihood of different scenarios occurring. Emily's investments are less vulnerable to huge swings in value since optimization techniques (Excel Solver) were used to reduce the overall volatility of her portfolio. This is especially crucial as Emily nears retirement, and capital preservation will likely become more critical. The same techniques can be used to estimate the appropriate allocation across the Harbour Safe, Horizon, and Sky-high funds, balancing risk (volatility) and reward (anticipated return). This allocation can be dynamic, shifting when Emily's circumstances or market conditions shift. Overall, this gives an organized asset allocation approach that considers risk and return, allowing Emily to meet her retirement goals while effectively managing uncertainties.

4. Analysis Framework: Implementation and Analysis of the Model

a. Implementation of the framework:

Emily's retirement strategy was developed using a comprehensive methodology, including sophisticated financial modelling tools. The methodology consists of two main components: salary projections using Monte Carlo simulations and fund allocation optimization using Excel Solver. The following actions were performed to implement the model:

i. Salary Growth Projection:

Monte Carlo simulations were used to forecast Emily's future earnings. This technique corrects for the inherent uncertainty in salary growth rates by producing multiple scenarios based on past trends and variability. Thousands of simulations of potential salaries were run, beginning with Emily's present pay of NZD 70,000 and a projected average yearly raise of 3.5% (with a standard variation of 0.7%). This method generates a distribution of future salary outcomes, providing a probabilistic picture of her income trajectory until retirement at age 65. This simulation determined the probability of her receiving a superannuation return of more than 1.5 million.

ii. Fund Allocation Optimization:

Emily's superannuation contributions are split between three funds: Harbour Safe Bonds Fund (conservative), Balanced Horizon Mix Fund (moderate), and Sky-high Equity Growth Fund (aggressive). Each fund has unique historical growth rates and volatility, influencing portfolio performance. Excel Solver was used to maximize Emily's fund allocation. This program maximizes predicted returns while minimizing portfolio volatility, considering Emily's risk tolerance and past performance indicators. By determining the minimum value that the volatility can take and using this as the minimum value, along with the current volatility (7.26%) as the maximum value that the volatility can take as constraints, along with the constraint that the total allocation should be 100%, the maximum value that the expected return was optimized by varying the allocation percentages across the three funds as decision variables, Solver determines the optimal mix that balances growth potential with risk management. Constraining the overall portfolio volatility ensures that Emily's investments are spread across different assets and risk levels, reducing the overall risk of her portfolio. Using Excel's scenario manager, sensitivity analysis of the funds under different scenarios was done.

b. Analysis of the framework:

The strategic financial predictions and optimization methodology for Emily's superannuation fund use advanced modelling tools and conservative risk management approaches. Using Monte Carlo simulations for wage growth and Excel Solver to allocate funds, a customized strategy was created that balances growth potential with risk avoidance. To assess the impact of different asset allocation strategies on Emily's superannuation fund, sensitivity analysis using Excel's Scenario Manager was conducted. This allowed for the creation and comparison of multiple scenarios (Base, Max, Min) by adjusting key input variables and noting their effects on the outcome. The results from the analysis highlight the trade-offs between risk and return in different allocation strategies, providing valuable insights into how varying her investments could impact the overall performance and risk profile of Emily's retirement savings. This understanding aids in informed decision-making for Emily's retirement planning.

This research's findings give Emily a clear path to reaching her retirement goals, allowing her to navigate uncertainty and capitalize on opportunities in the financial landscape. This meticulous

approach ensures that Emily's financial plan is comprehensive and flexible, ready to endure volatility in the financial markets while working to reach her long-term financial goals.

5. Conclusion

This report provides a comprehensive analysis of Emily's superannuation strategy, aiming to secure her financial stability upon retirement. By meticulously evaluating her current investment allocations, we assessed the balance between risk and return, considering her age and retirement goals. Our review of her contributions, salary, expected increases, and employer matches revealed the need for strategic adjustments to align with her long-term financial objectives.

Monte Carlo simulations provided a robust method for projecting the future value of Emily's superannuation fund, effectively accounting for salary variability and fund performance. To enhance her retirement savings, we recommend increasing her contribution rate from 6% to 13%, including a 10% personal contribution. This adjustment will significantly enhance her retirement savings.

Additionally, optimizing her investment strategy is crucial. We recommend diversifying her fund allocations to better align with her risk tolerance and investment horizon. Using optimization models, she should reallocate her current investments among the Harbour Safe Bonds Fund, Balanced Horizon Mix Fund, and Sky High Equity Growth Fund to maximize returns while minimizing risks.

The detailed analysis framework outlines steps to implement simulations and optimization models, providing a clear roadmap for enhancing Emily's superannuation strategy. This framework facilitates a comprehensive understanding of her financial preparedness and provides actionable insights to ensure that her envisioned retirement lifestyle is attainable.

This structured approach guarantees a thoroughly reviewed, accurately projected, and robustly analyzed superannuation strategy. Implementing the outlined recommendations will help Emily achieve her retirement goals, providing confidence and financial security for the future. Through strategic adjustments and continuous evaluation, Emily can be well-prepared to enjoy a comfortable and financially secure retirement.

References

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Appendix A- Use of ChatGPT (OpenAI, 2022)

The use of ChatGPT in the preparation of this paper has been carefully limited to specific linguistic and editorial tasks. Specifically, ChatGPT was utilized to edit and enhance the clarity and coherence of the language used in the document. It played a crucial role in improving the draft by suggesting more precise wording and refining sentence structures to ensure the information was presented effectively. Additionally, ChatGPT assisted in the drafting process by helping to organize and articulate complex ideas more clearly.

Furthermore, ChatGPT was employed to proofread the final version of the paper, ensuring that the language was accurate, grammatically correct, and free of typographical errors. This step was essential in maintaining the professionalism and readability of the document. However, it is important to note that all substantive content, analysis, and conclusions presented in the paper were developed independently by the authors without reliance on ChatGPT's input or suggestions.

Appendix B- Workings from Excel

1. Evaluation of current investment allocation using Expected return and Volatility

Funds	Mean	SD	Square of SD	Weights	Square of Weights
HSB	3.75%	5.00%	0.0025	0.4	0.16
HMF	6.50%	10.50%	0.011025	0.3	0.09
SKY	10.25%	20.75%	0.04305625	0.3	0.09

Expected Return	6.525%
Portfolio Variance	0.01
Portfolio Volatility	7.26%
Risk-free rate	2.00%
Sharpe's Ratio	62.35%

2. Current Return

Analysis

Return at 65	1280764.46	
Average Return	1032434.98	
Average Salary	233321.63	
Maximum Return	9789408.17	
Minimum Return	379071.03	
Probablity of getting atleast 1.5M	0.126	13%

3. Return when contribution changed to 13%

Analysis

Return at 65	1476953.29	
Average Return	2238731.92	
Average Salary	234167.26	
Maximum Return	9180095.45	
Minimum Return	792825.08	
Probablity of getting atleast 1.5M	0.811	81%

4. Return when allocation changed as per optimization model

Analysis

Return at 65	1015656.44	
Average Return	2317533.02	
Average Salary	233914.27	
Maximum Return	16125774.99	
Minimum Return	838050.45	
Probablity of getting atleast 1.5M	0.805	81%

5. Constraints used while minimizing portfolio volatility

Constraints for min return		
HSB + HMF + SkyHigh	=	1
Portfolio Volatility	<=	0.0726
Weight of HMF	>=	0.1
Weight of Sky	>=	0.1

6. Constraints used while maximizing return

Constraints for max return		
HSB + HMF + SkyHigh	=	1
Portfolio Volatility	<=	0.0726
Portfolio Volatility	>=	0.0441

7. Future Needs of Emily as a single person

Single Lifestyle		$ 1,200,000.00
Expenditure	**Amount $**	**% Contributed**
Fuel	24000	2%
Miscellaneous	60000	5%
Shopping	96000	8%
Leisure Activity	120000	10%
Emergency	120000	10%
Bills	144000	12%
Travel	180000	15%
Healthcare	216000	18%
Recreation Activities	240000	20%
Total	1200000	100%

8. Future Needs of Emily as a couple

Couple Lifestyle		$ 1,500,000.00
Expenditure	**Amount $**	**% Contributed**
Fuel	30000	2%
Miscellaneous	75000	5%
Leisure Activity	75000	5%
Shopping	135000	9%
Travel	135000	9%
Bills	150000	10%
Emergency	150000	10%
Healthcare	300000	20%
Recreation Activities	450000	30%
Total	1500000	100%

9. Scenario Analysis

	Weights		
Contributions	**Base**	**Max**	**Low**
HSB	0.4	0.29	0.8
HMF	0.3	0.46	0.1
Sky	0.3	0.25	0.1

Fund	Mean
HSB	0.0375
HMF	0.065
Sky	0.1025

Expected Return	0.06525

10. Scenario Summary

Scenario Summary	Current Values:	Base	MAx	Min
Changing Cells:				
HarbourSafe	0.4	0.4	0.29	0.8
Horizon Mix Fund	0.3	0.3	0.46	0.1
SkyHigh Equity Growth	0.3	0.3	0.25	0.1
Result Cells:				
Expected Return	0.06525	0.06525	0.0664	0.04675

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.