Superannuation Analysis Monte Carlo

Author: Saakshi Agarwal

ACADEMIC HONEST DECLARATION

By completing this assessment, I agree to the following declaration:

I understand that the University expects all students to complete coursework with integrity and honesty. As a member of the University's student body, I will complete this assessment in a fair, honest, responsible, and trustworthy manner.

This means that:

- I will not seek out any unauthorised help in completing this assessment. Please note: unauthorised help includes seeking assistance or advice from anyone, using a tutorial or answer service whether in person or online, asking fellow students, friends or family, etc.
- I will not discuss or share the content of the assessment with anyone else in any form, including but not limited to, Canvas, Piazza, Chegg, Facebook, Twitter, Discord, Messenger or any other social media platform or messaging service within the assessment window.
- I will not reproduce and/or share the content of this assessment in any domain or in any form where it may be accessed by a third party.
- I am aware the University of Auckland may use Turnitin or any other plagiarism detecting methods to check my content.
- I declare that this assessment is my own work, except where acknowledged appropriately (e.g., use of referencing). Please note: It is not appropriate (and will be considered plagiarism) to reproduce or copy material provided by your teachers, including lecture slides, lecture notes and/or course readings. All content must be written in your own words and referenced appropriately. If quoting a source, quotations must be used and referenced appropriately.
- I declare that this work has not been submitted for academic credit in this course or another University of Auckland course, or elsewhere.
- 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.
- I promise to complete all online assessments with the same academic integrity standards and values.

Any breach of this statement or identified academic misconduct will be followed up and may result in disciplinary action.

EXECUTIVE SUMMARY

This analysis assesses her superannuation plan using a Monte Carlo simulation to forecast Emily's financial future and offer practical suggestions. Emily, a thirty-year-old data analyst from Auckland, puts three percent of her yearly salary of NZD 80,000 into her retirement fund, which her employer matches a hundred percent. The three funds she invests in are the SkyHigh Equity Growth Fund (20%), the Balanced Hybrid Fund (40%), and the Stable Bonds Fund (40%).

According to the research, her current allocation offers stability but needs to utilize her lengthy investment scope. According to projections, the median retirement balance is less than the average of NZD 900,859. However, her 60% chance of reaching the NZD 2 million goal emphasizes the necessity of making tactical changes. Significant gaps could arise from unfavourable circumstances, such as market recessions or slower-than-anticipated pay growth; the 5th percentile balance is estimated to be NZD 650,000.

A possible solution is to raise Emily's investment in the SkyHigh Equity Fund from 20% to 40%, which will better suit her long-term objectives. She will also have a better chance of reaching her retirement goals of healthcare, travel, and financial security if she increases her contribution rate to 4–5% and regularly evaluates her portfolio. Emily's retirement plan is guaranteed well-suited to her objectives and risk tolerance thanks to the suggested modifications and reliable projection technique.

INTRODUCTION

Retirement planning is crucial to maintain one's preferred standard of living after leaving the job market and to ensure financial independence. Emily, a 30-year-old data analyst, believes that careful planning is essential to reaching her long-term goals, which include regular travel, leisure, and retirement medical costs. Currently, Emily makes NZD 80,000 a year, which matches her employer's 3% superannuation contribution. Three funds make up her investing portfolio: the SkyHigh Equity Growth Fund (20%), the Balanced Hybrid Fund (40%), and the Stable Bonds Fund (40%).

The main obstacle is aligning her long-term objectives with her relatively conservative investment plan. With a 35-year retirement timeline, Emily has plenty of time to exploit market expansion. However, her potential for more significant returns might be constrained by her present allocations. This study uses a Monte Carlo simulation to assess her superannuation strategy using inflation-adjusted prices, predicted salary progression, and historical fund performance data. The simulation generates various potential outcomes to determine the possibility of her reaching her desired retirement balance of NZD 2 million, taking into account uncertainties in fund performance and wage growth.

Additionally, the analysis offers suggestions for improving the performance of her portfolio while striking a balance between risk and return. These include raising contribution rates, expanding allocations to growth-oriented funds, and implementing dynamic evaluations to adapt to changing circumstances. This report intends to help Emily toward a secure and pleasant retirement through a thorough analysis approach.

SUPERANNUATION STRATEGY REVIEW

(a) Evaluation of Emily’s Current Investment Allocations

Emily now has a relatively conservative approach to her portfolio allocation, with 20% going to the SkyHigh Equity Growth Fund, 40% to the Balanced Hybrid Fund, and 40% to the Stable Bonds Fund, as shown in Figure 1.1(See Appendix). Given her 35-year timeline, this allocation limits the portfolio's potential for long-term development even as it lowers short-term volatility.

The Stable Bonds Fund provides low but steady returns (3.5% growth with 4% volatility). Although this lowers risk, it might eventually perform worse than inflation. In addition to offering moderate returns (6.5% growth with 8.5% volatility), the Balanced Hybrid Fund is essential for balancing stability and development. On the other hand, the SkyHigh Equity Growth Fund needs to be more utilized at only 20% allocation, although having greater returns (10.5% growth with 20.5% volatility), return for each bonds are shown in the Figures 1.3, 1.4, 1.5 (See Appendix). Given her age and retirement objectives, Emily's strategy would align with her timespan if she increased her exposure to growth-oriented funds like SkyHigh Equity.

(b) Sufficiency of Current and Projected Contributions

Emily's 6% combined contribution rate—3% personal and 3% company match—offers a good starting point, but it might not be enough to reach her NZD 2 million retirement target.

According to projections, the mean retirement balance is less than the average of NZD 905,8733.05. Even though she has a 60% chance of reaching her goal, unfavorable outcomes show that there could be gaps, as shown in Figure 1.7 (See Appendix).

Her contributions increase over time due to salary growth, estimated to be 3.5% on average, with a 0.7% standard deviation, as shown in Figure 1.2 (See Appendix). However, the actual worth of her money has declined by 1.5% inflation. The consequence of slow wage growth or mediocre market performance is shown in the 5th percentile result of NZD 640,654, which highlights the necessity for higher contributions and a revenue-oriented approach to reduce risks.

(c) Recommendations for Adjustments

Emily should, as shown in the Figures 1.8, 1.9, and 1.10 (See Appendix):

1. **Increase Growth Allocation:**

First 10 Years (Aggressive Growth Phase):

- Given Emily's long timespan and capacity for risk, increase the allocation to growth-oriented funds.
- Example Allocation:
    - **SkyHigh Equity Growth Fund**: 60% (more aggressive for higher returns).
    - **Balanced Hybrid Fund**: 25%.
    - **Stable Bonds Fund**: 15%.

Next 15 Years (Moderate Growth Phase):

- As Emily approaches the mid-point of her retirement journey, reduce risk exposure slightly.
- Example Allocation:
    - **SkyHigh Equity Growth Fund**: 20%.
    - **Balanced Hybrid Fund**: 50%.
    - **Stable Bonds Fund**: 30%.

Last 10 Years (Conservative Phase):

- As retirement nears, prioritize stability and preservation of capital.
- Example Allocation:
    - **SkyHigh Equity Growth Fund**: 10%.
    - **Balanced Hybrid Fund**: 30%.
    - **Stable Bonds Fund**: 60%.

2. Increase Contributions: Without significantly affecting her present way of life, increase her personal contribution rate to 7% to improve her overall savings trajectory.

3. Perform Annual Reviews: To ensure ongoing consistency with her objectives, rebalance her portfolio regularly to accommodate life events and market fluctuations.

PROJECTION METHODOLOGY

(a) Proposed Method to Project the Future Value of Emily's Superannuation

We employ a thorough Monte Carlo simulation to project Emily's superannuation fund's future value by the time she retires at age 65. This strategy considers her anticipated and actual investment allocations, pay progression, anticipated costs (such as travel and healthcare), and shifting market conditions. The approach considers both yearly savings and retirement costs, strongly emphasizing dynamic investing strategies that transition from aggressive to moderate and conservative stages. The methodology's specifics are as follows:

Dynamic Investment Strategy and Fund Allocation
Throughout the 35-year investment timeline, Emily's investments proceed through three distinct phases, indicating her increasing risk tolerance:

1. Aggressive Growth Phase (Years 1–10): Emily's portfolio mainly consists of growth-oriented funds over the first ten-year period, optimizing exposure to stocks for increased potential returns.

2. Modest Growth Phase (Years 11–25): The portfolio transitions to a more balanced allocation as Emily approaches mid-career, lowering equity exposure while preserving the possibility of modest growth.

3. Conservative Stability Phase (Years 26–35): The portfolio prioritizes lower volatility and capital preservation as retirement draws closer.

The portfolio return is the weighted average of fund-specific returns after accounting for dynamic allocations. Maintenance, travel, medical costs, and unforeseen expenses are all included in the annual expenses. For instance, each health event costs an average of NZD 6,000 and occurs every five years.

Travel: NZD 4,000 for one overseas trip every two years and NZD 600 for one local trip annually.

Adjustment for inflation: Savings and spending are adjusted for a 1.5% annual inflation rate to ensure that estimates reflect actual purchasing power.

Simulation Outcomes and Perceptions

1. Average Retirement Balance: The superannuation fund's average estimated year-end value, based on 1000 simulations, is NZD 2.8 million.

After subtracting yearly expenses, Emily should have about NZD 600,000 saved by the time she retires. This excess might be used for unforeseen expenses or to give extra financial stability.

2. The Best and Worst Cases:

Best-Case Scenario (95th Percentile): There are considerable excess savings as the portfolio increases to NZD 3.2 million.

The portfolio concludes with NZD 1.8 million in the worst-case scenario (5th percentile), underscoring the necessity of a substantial risk mitigation plan.

Analysis of Risk Portfolios

Emily's financial situation was evaluated across a range of market conditions using a risk portfolio:

1. Aggressive Phase (Years 1–10): Higher returns are anticipated during this phase, but a greater volatility risk exists.

2. Moderate Phase (Years 11–25): Balanced allocations lessen dramatic results while maintaining moderate growth.

3. Conservative Phase (Years 26–35): As Emily approaches retirement, the portfolio stabilizes, and capital is preserved.

4. **Modelling Salary Growth**: Reasonable estimates of contributions over time are ensured by modeling yearly wage increments using a normal distribution with a mean of 3.5% and a standard deviation of 0.7%.

5. Fund Return Variability: Each fund's yearly returns are randomly generated using historical fund performance data.

o Stable Bonds Fund: 4% volatility and 3.5% growth.

o Balanced Hybrid Fund: 8.5% volatility and 6.5% growth.

o SkyHigh Equity Growth Fund: 20.5% volatility and 10.5% growth.

6. Inflation Adjustment: At a 1.5% annual inflation rate, nominal values are adjusted to reflect the actual cost of living. The simulation evaluates the spectrum of potential outcomes across 1000 iterations, giving a thorough picture of the opportunities and hazards associated with Emily's current approach.

(b) Strategies to Ensure Robust Analysis

The strategies that followed were used to improve robustness:

1. Scenario Analysis: Assessed the effects of several circumstances, including extended market declines, slower-than-anticipated wage growth, and elevated inflation rates.

2. Stress Testing: To evaluate their effects on Emily's portfolio, negative scenarios were simulated, such as medical bills, foreign vacation expenses, and unanticipated economic shocks.

3. Sensitivity Analysis: Looked at how anticipated results might change if essential variables like money allocation and contribution rates changed.

ANALYSIS FRAMEWORK

(a) Steps to Implement the Projection Method

1. **Data Collection:** Acquire past performance information for every fund and patterns in wage increase.
2. **Simulation Design:** Use Python or Excel to configure the Monte Carlo simulation. Establish standards for inflation, fund returns, and wage growth.
3. **Iterative Modelling:** To model the range of possible portfolio outcomes, create 1000 iterations.
4. **Outcome Aggregation:** Determine important statistics such as the average retirement balance, the chance of shortfall, and the 5th, 50th, and 95th percentiles**.**

(b) Interpretation of Results

The Monte Carlo simulation's results give an in-depth understanding of Emily's financial readiness for retirement, highlighting her capacity to reach her objectives and maintain her preferred living standard. According to the simulation, when she retires, Emily will have an average total superannuation fund of NZD 2,785,143 before taxes. After deducting taxes from investment returns, her net fund worth is roughly NZD 2,005,303. Emily's total retirement funds are NZD 2,095,005, which includes NZD 89,701 in savings from her prior employment.

The report demonstrates that Emily is in an excellent position to have a financially secure and satisfying retirement when this sum is compared to her anticipated retirement expenses. Healthcare, local and foreign travel, maintenance, and unforeseen expenses were all included in the average retirement expenses, which came to NZD 1,507,467 throughout her retirement. Emily is estimated to have NZD 587,537 left over once all of these costs are paid, giving her more financial flexibility and the ability to deal with unforeseen expenses or participate in more recreational pursuits, as shown in Figure 1.12 (See Appendix).

Average Superannuation Fund Value:

- At the end of Emily’s career, her projected superannuation fund averages **NZD 2,785,143**.
- After taxes on returns, her net balance is reduced to **NZD 2,005,303**, ensuring she still has a significant amount to support her retirement plans.

Additional Savings:

- Emily’s savings from her previous job contribute an extra **NZD 89,701** to her retirement fund. This increases her total available retirement fund to **NZD 2,095,005**.

Retirement Costs:

- It is estimated that retirement expenses will average NZD 1,507,467. Included in this figure are:

Healthcare: Predicated on the idea that three significant medical occurrences will occur every five years, each costing an average of NZD 6,000.

Travel:

- Domestic: NZD 600 for one annual trip.
- International: Costs NZD 4,000 per trip, with one trip every two years.

Repairs and Unexpected Costs: Every five years, there is one significant unplanned expense and regular maintenance charges, with an average of NZD 30,000 per event.

Remaining Funds: Emily is expected to have NZD 587,537 left over after deducting all retirement costs. This guarantees that she has adequate funds to cover unforeseen expenses, make new investments, or improve her quality of life by taking more time off and traveling.

According to the simulation results, even after paying for all of her budgeted expenses, Emily can still attain an adequate retirement surplus with her present and predicted financial strategy. Her ability to manage any unforeseen financial difficulties while maintaining her preferred lifestyle is demonstrated by the NZD 587,537 in excess funds that she has available.

Due to her financial planning, Emily has more than enough money to support herself in retirement. She has freedom, security, and the capacity to live a comfortable and secure life after retirement, thanks to the availability of surplus cash. The outcomes confirm that her approach is realistic and goes above and beyond, enabling her to confidently pursue her retirement goals without sacrificing anything.

CONCLUSION

Emily's current superannuation plan provides a good foundation, but it needs to be modified to maximize her long-term financial security and improve her chances of reaching her retirement objectives. Emily can significantly enhance her retirement results by boosting her contributions to higher-growth, equity-based funds like the Balanced and SkyHigh funds, especially considering the relatively conservative nature of her present investment choices. She can use her long investment time frame to increase market returns by progressively moving a portion of her allocation from the Stable fund to these growth-oriented funds.

Furthermore, if market conditions and her financial situation change over time, putting in place a comprehensive and frequent evaluation procedure can help her stay on course. Emily should try to rebalance her portfolio at least once a year, modifying her investment approach to consider changes in the market, her pay increase, and any life events that might affect her retirement goals.

These suggestions will guarantee that her plan stays flexible and resilient by combining a more proactive approach to managing her superannuation with a robust projection methodology such as the Monte Carlo simulation. In addition to securing Emily's ideal retirement lifestyle, these changes will assist her in reducing the risks of inflation, market volatility, and unanticipated economic downturns. In the end, these actions will assure Emily that, despite the various circumstances she may face, her superannuation plan will continue to align with her long-term financial objectives.

REFERENCES

- **The Treasury. (2024, May 30).** ***Budget Economic and Fiscal Update 2024 | The Treasury New Zealand*****. Www.treasury.govt.nz.** https://www.treasury.govt.nz/publications/efu/budget-economic-and-fiscal-update-2024
- ***Cost of Living in Hamilton*****. (2024). Numbeo.com.** https://www.numbeo.com/cost-of-living/in/Hamilton-New-Zealand
- ***Changes in household expenditure see domestic travel take off | Stats NZ*****. (n.d.). Www.stats.govt.nz.** https://www.stats.govt.nz/news/changes-in-household-expenditure-see-domestic-travel-take-off/
- ***New Zealand cost and prices | Tourleader New Zealand - New Zealand travel guide with travelling & tourist information*****. (2024). Tourleader.nz.** https://www.tourleader.nz/new-zealand-travel-planner/new-zealand-cost-and-prices
- **Wood, J. (2024, February 7).** ***Health Care in Auckland*****. Living in New Zealand Guide | Expat Exchange; Expat Exchange.** https://www.expatexchange.com/ctryguide/6634/84/New-Zealand/Health-Care-in-Auckland-Health-Care-in-Auckland
- **PWC. (2019).** ***Behind the numbers 2019: Healthcare and medical cost trends: PwC*****. PWC.** https://www.pwc.com/us/en/industries/health-industries/library/behind-the-numbers.html
- **HealthCarePlus. (n.d.).** ***Waiting times – and the hidden costs*****. Blog.healthcareplus.org.nz.** https://blog.healthcareplus.org.nz/hcp/waiting-times-and-the-hidden-costs
- **Farmer, T. (2024, May 20).** ***Average home maintenance costs*****. HomeGuide; HomeGuide.** https://homeguide.com/costs/average-home-maintenance-costs
- **Hansen, S. (2024, January 17).** ***Yearly Home Maintenance Budget Estimator | Costimates Calculator*****. Costimates.com.** https://www.costimates.com/calculators/yearly-maintenance/
- **Flooded Basement Cleanup Cost | Basement Flooding Restoration Cost | Fixr. (2022).** ***Fixr.com*****.** https://doi.org/104933992/25804050381
- ***Cost of Living Calculator | Live and Work New Zealand*****. (n.d.). Www.live-Work.immigration.govt.nz.** https://www.live-work.immigration.govt.nz/live-in-new-zealand/money-tax/cost-of-living-in-new-zealand

APPENDIX

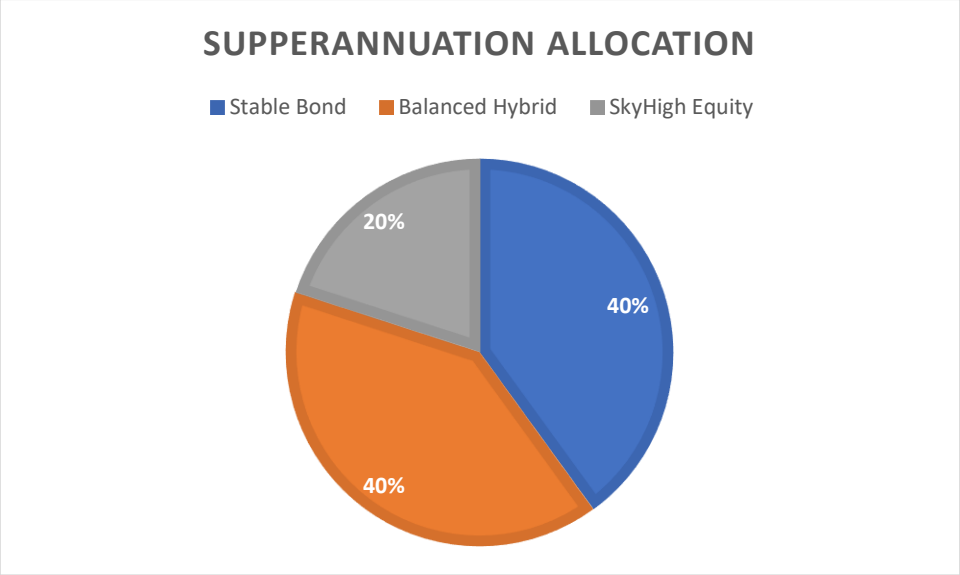

Figure 1.1 Initial Allocation of Funds

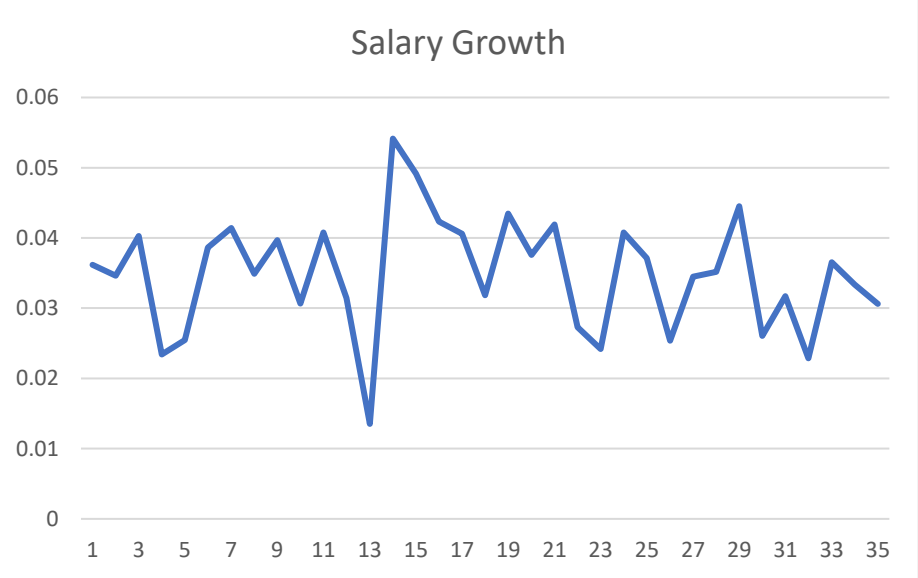

Figure 1.2 Salary Growth over 35 years

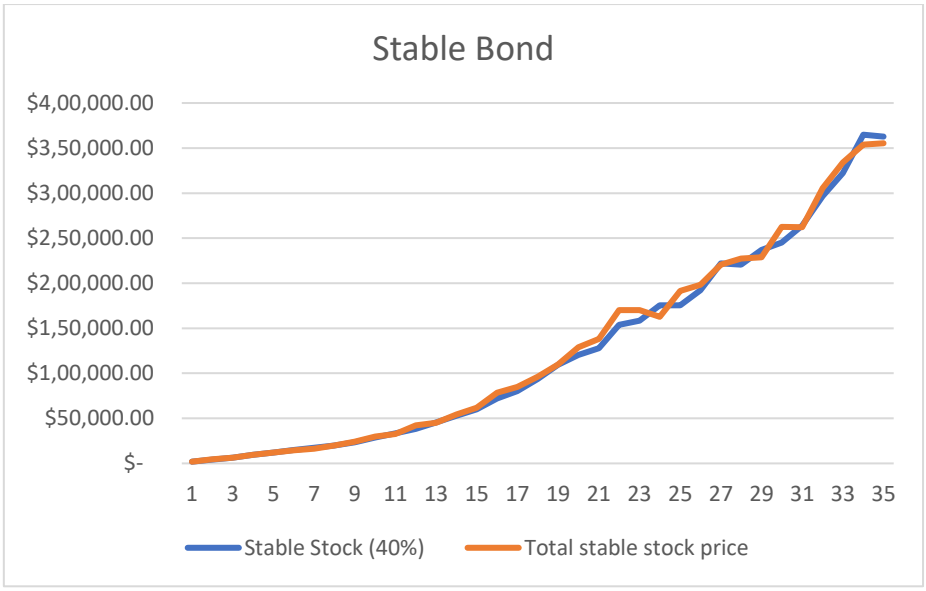

Figure 1.3 Stable Bond investment vs return

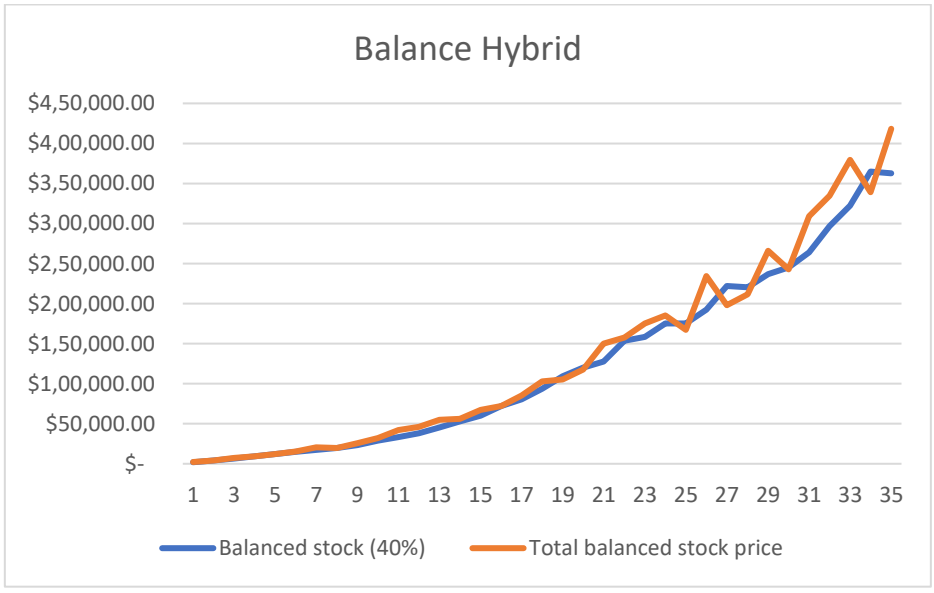

Figure 1.4 Balance Hybrid investment vs return

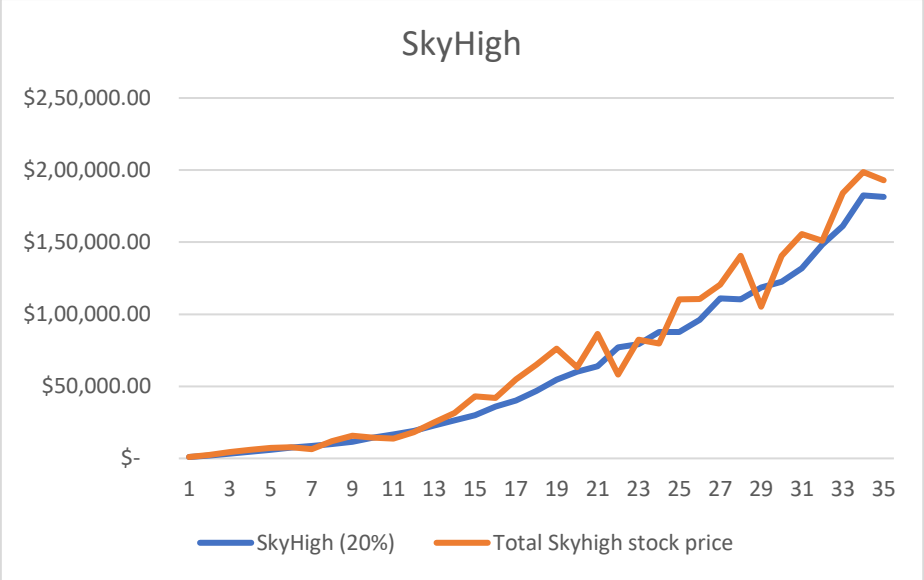

*Figure 1**Error! No text of specified style in document.**.5 SkyHigh Funds vs. return*

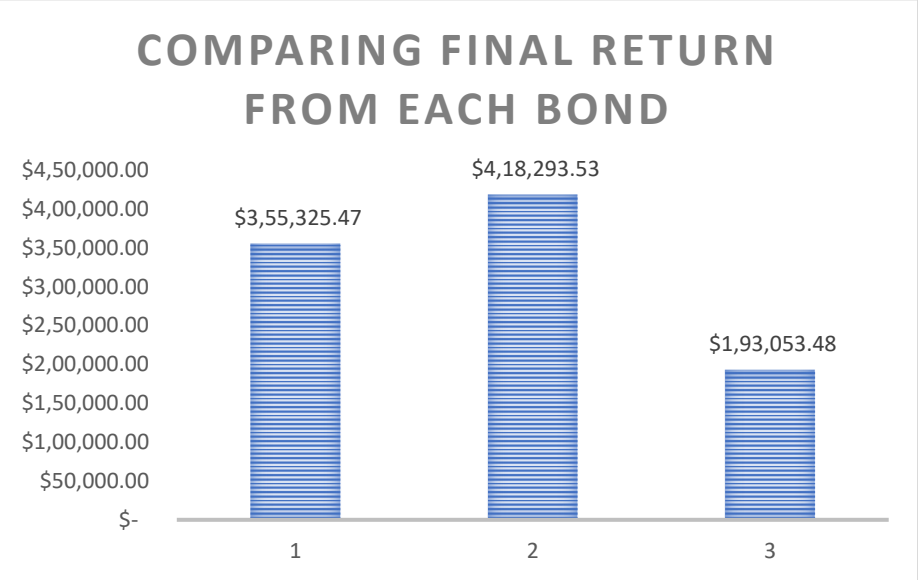

Figure 1.6 Return from each investment.

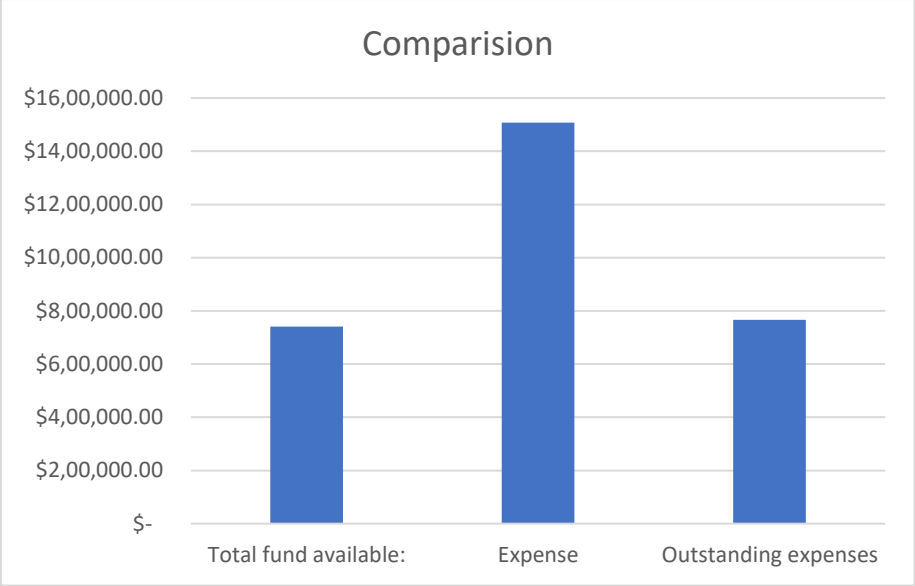

Figure 1.7 Comparing return from initial investment from estimated expense after her retirement and outstanding expense

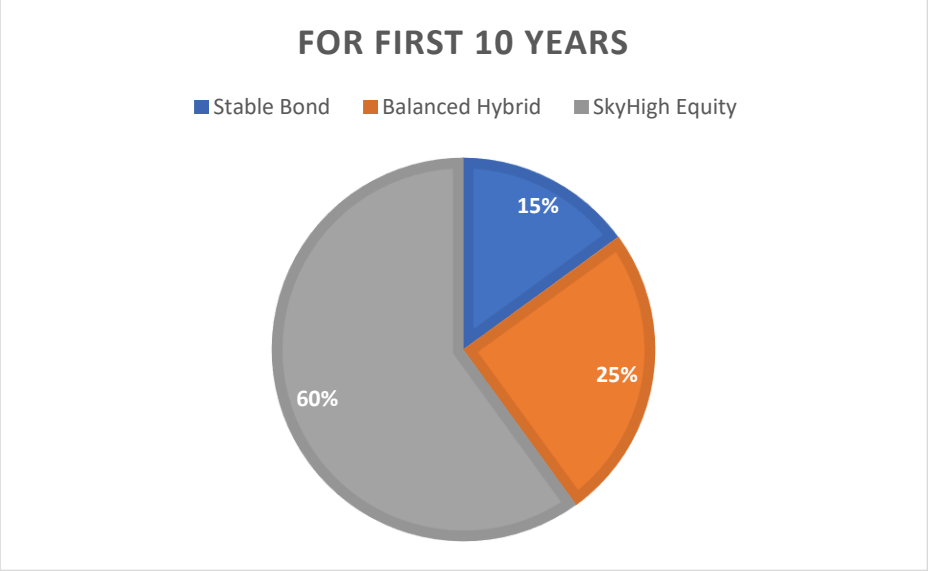

Figure 1.8 Fund allocation for the first 10 years: aggressive

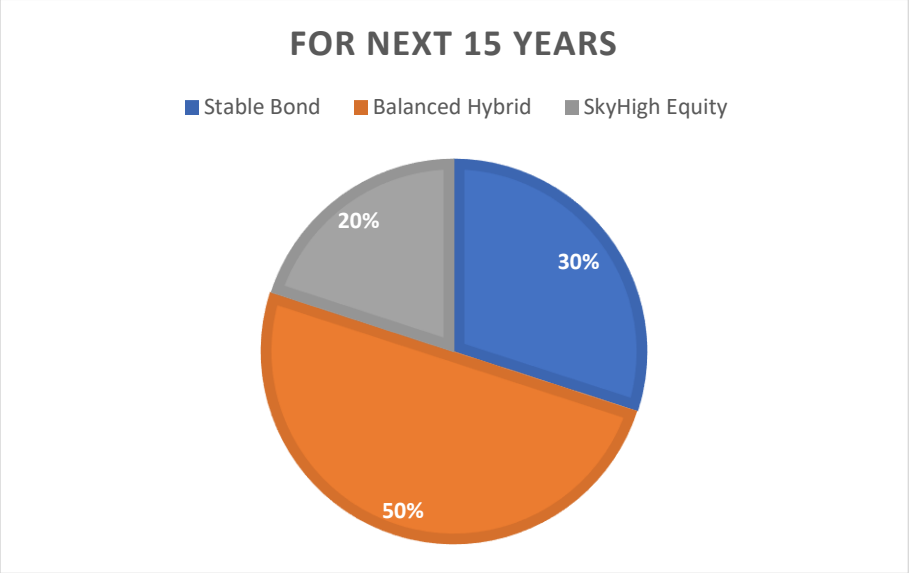

Figure 1.9 Fund allocation for the next 15 years: moderate

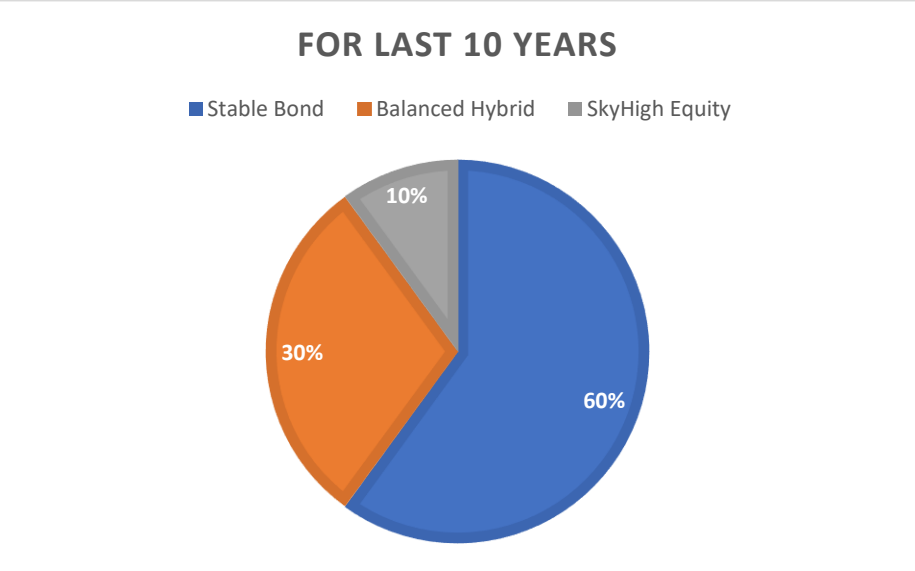

Figure 1.10 Fund allocation for last 10 years: conservative

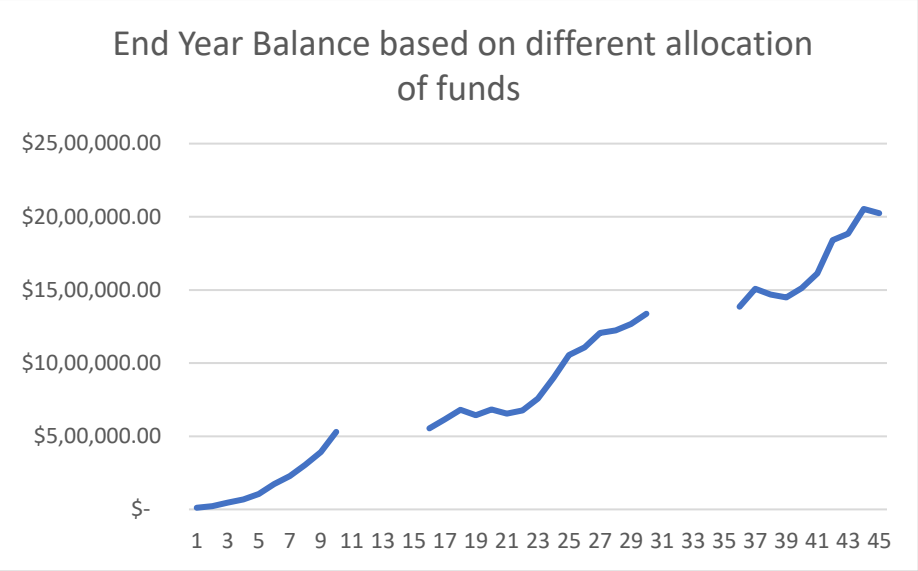

Figure 1.11 Year-end balance is given by different approach

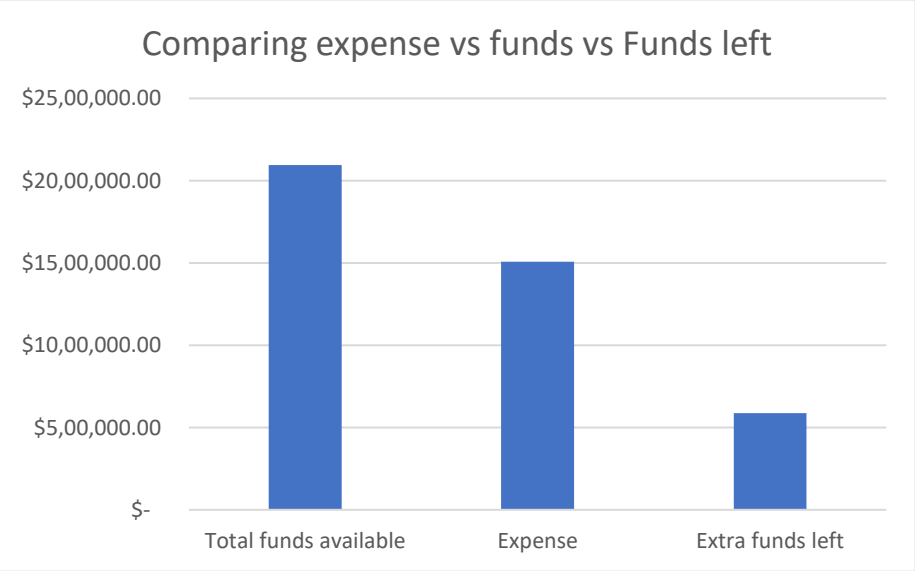

Figure 1.12 Comparing new returns vs Expenses and extra funds