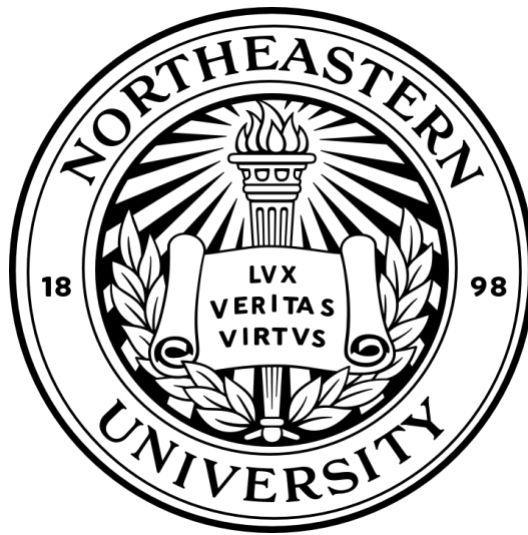# Financial Analysis of an Engineer Report

Team 8:

- Simran Bhatia
- Saksham Saxena
- Sachin Gahane
- Kaustubh Khedekar
- Rehan Ahmed
- Rahul Kotikalapudi

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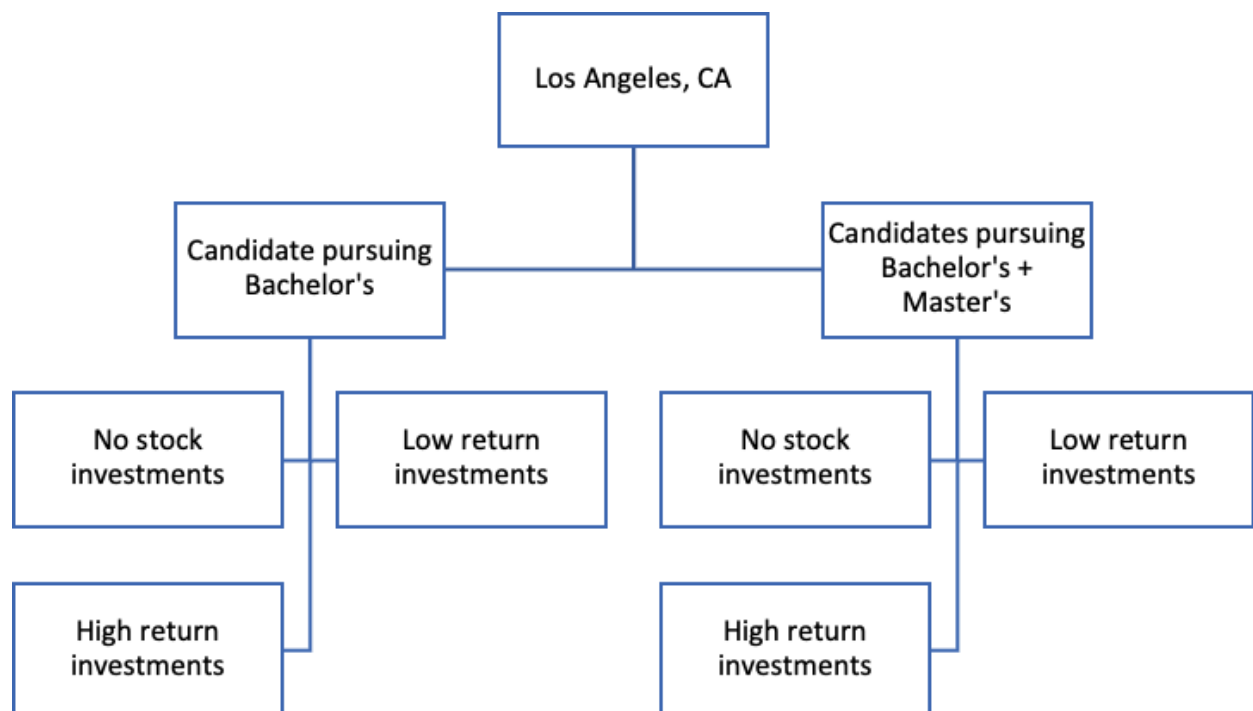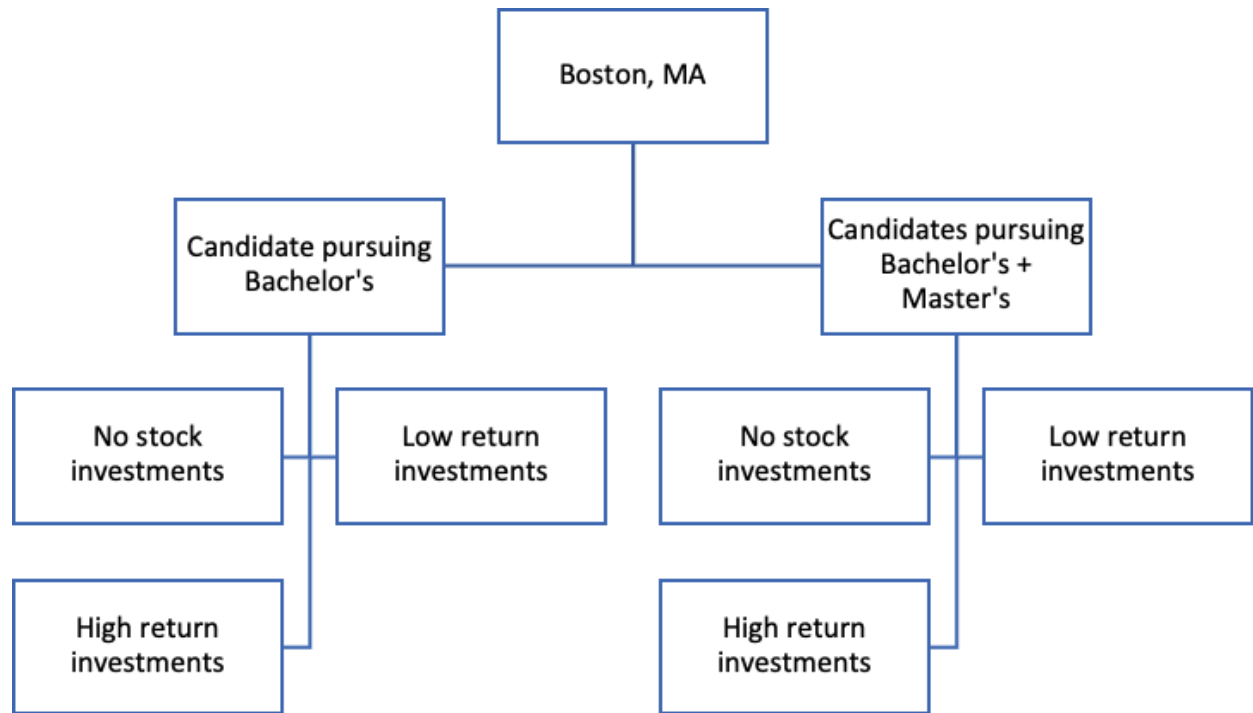
Project Description

Objective

New graduates often struggle to manage their finances without prior context and alongside commencing their professional careers. Making wise financial decisions can have a massive impact on one's life in the long run, so it's important to make informed choices starting from the early stages of their professional journey. This project team, consisting of six people, collaborated to put the theories they acquired in their Engineering Economic Decision-Making course into practice. The team computed how a basic engineer can manage their finances and build a nest egg with assets using sound economic ideas, thus exhibiting skills essential to becoming competent professional engineers.

Outline

Rehan, a recent college graduate with a passion for Software Engineering, is considering pursuing a Bachelor's or Master's qualification in the field. Fortunately, he gained valuable insights by taking an extra course in Engineering Decision-Making during the spring. With a desire to live in one of the IT hubs on either coast of USA, i.e. Boston MA in the east, or Los Angeles CA in the west. Rehan is keen on analyzing his options based on the potential financial outcomes. Given his strong numerical and statistical skills, Rehan is also evaluating various stock investment options, including "No stock Investments", "Low-Risk returns", and "High-Risk returns", to secure his financial future. He faces the challenge of weighing the costs and benefits of getting a Bachelor's versus a Bachelor's plus Master's degree while accounting for all major expenses that may arise during his educational journey. Ultimately, Rehan must make a decision based on these factors to determine his best course of action in order to achieve his career goals and secure a financially stable future.

Alternatives

After conducting a thorough analysis of bachelor's and master's degree programs, the team took into account critical variables such as cost of living, transportation expenses, and location up to retirement age. They conducted extensive research on several cities, focusing on Boston (MA) and Los Angeles (LA), both prominent IT hubs with varying living costs. The team then created a shortlist of 12 alternatives, consisting of a degree program, a city to consider, and an investment option amongst no stock investments, low risk returns, and high-risk returns. Each alternative could be weighed against the others to determine the optimal approach for achieving their educational and financial objectives.

Boston, MA

Boston, MA

- **Candidate pursuing Bachelor's**
  - No stock investments
  - Low return investments
  - High return investments

- **Candidates pursuing Bachelor's + Master's**
  - No stock investments
  - Low return investments
  - High return investments

Los Angeles, CA

Los Angeles, CA

- **Candidate pursuing Bachelor's**
  - No stock investments
  - Low return investments
  - High return investments

- **Candidates pursuing Bachelor's + Master's**
  - No stock investments
  - Low return investments
  - High return investments

Namely:

- Boston, MA – Candidate doing bachelor's not investing in stocks.
- Boston, MA – Candidate doing bachelor's investing in stocks with low return.
- Boston, MA – Candidate doing bachelor's investing in stocks with high return.
- Boston, MA – Candidate doing Bachelor's + master's not investing in stocks.
- Boston, MA – Candidate doing Bachelor's + master's investing in stocks with low return.
- Boston, MA – Candidate doing bachelor's + master's investing in stocks with high return.
- Los Angeles, CA – Candidate doing bachelor's not investing in stocks.
- Los Angeles, CA – Candidate doing bachelor's investing in stocks with low return.
- Los Angeles, CA – Candidate doing bachelor's investing in stocks with high return.
- Los Angeles, CA – Candidate doing Bachelor's + master's not investing in stocks.
- Los Angeles, CA – Candidate doing Bachelor's + master's investing in stocks with low return.
- Los Angeles, CA – Candidate doing Bachelor's + master's investing in stocks with high return.

The baseline decision criteria for the alternatives includes:

- Base Salary
- Signing bonus
- Educational Loan (Bachelor's and Master's)
- Transportation (Use of Public Transport, First Car, Second Car)
- Accommodation (First House)
- Stock investments (No Stock, Low Return Stocks, High Return Stocks)
- Retirement fund Contribution with Employers Match
- Retirement fund receipt
- Increase in salary rate
- Insurances (Car, House and Medical)
- Taxes
- Food + Leisure Expense

Research

For bachelor's degree average expenses in Boston MA

1. Base Salary
- Bachelor's: $90,000per annum
- Master's: $110,000 per annum

2. Background Information
- Signing Bonus for Bachelor's: $8100 (9% of Salary)
- Signing Bonus for Master's: $9450(9% of Salary)
- Retirement Fund Contribution: 3% of monthly Salary
- Retirement Fund Employer Match: 3%
- Retirement fund receipt: 8%
- Increase in salary rate for Bachelor's and Master's: 3.5% per annum

3. Loan

The interest rates for bachelor's and master's loans can vary depending on various factors such as state regulations, partnerships between academic institutions and state/federal banks, and individual financial circumstances. It's important to note that these interest rates can be affected by scholarships and other benefits that a student may or may not receive during their course of study.

Based on this team's analysis, the average interest rate for bachelor's and master's loans is currently at 4.45%. However, it's vital to understand that this rate is subject to change depending on the lender, loan type, and borrower's credit score. Therefore, it's crucial to thoroughly research and compare different loan options to find the best interest rate and terms that suit your individual needs and financial situation.

- Bachelor's loan: $125,000
- Bachelor's loan interest: 4.45%
- Nper(months): 180
- Master's loan: $60,000
- Master's loan interest: 4.45%
- Nper(months): 180

4. Accommodation and Transportation

Apartment renting
- Apartment: $1500/month with utilities
- Increment in rent = 6.1% annually

Buying a House at the age of 35
- Total Cost: $800,000
- Down Payment: $50,000
- Monthly loan payment: $3580.61 (Equal payments) at 4%/year
- Insurance: 125 per month
- House Appreciation: 6% per annum
- Resale Value after 30 years: $4,594,792.94

5. Transportation

Local Transportation and Cabs
- $200/monthly when student
- $400/monthly when working
- Increment: $3 monthly

Car 1 – 2027 Toyota Camry
- Initial cost: $30000
- Down payment: $5,000
- Monthly payment: $471.78
- Rate: 5%/year for 5 years (60 months)
- O&M cost: $66
- O&M increment monthly: $1
- Mileage: 36 mpg
- Insurance: 200

Car 2 – 2042 BMW X6
- Initial cost: $70000
- Down payment: $10,000
- Monthly payment: $1132.27
- Rate: 5%/year for 5 years (60 months)
- O&M cost: $100
- O&M increment monthly: $1.5
- Mileage: 30 mpg
- Insurance: 300

6. Stock investment options

MARR = X% From (0% to 20%)

1. No stock investment (0% of the salary invested in stocks)
2. Low return low risk stocks investment = 6% (4% of the salary invested in stocks)
3. High return high risk stocks investment = 12% (4% of the salary invested in stocks)

For bachelor's degree average expenses in Los Angeles CA

1. **Base Salary:**
- Bachelors: $105,000 per annum
- Masters: $125,000 per annum

2. Background Information

- Signing Bonus: 9% of salary = $9450 (Bachelor's)
- Signing Bonus: 9% of salary = $11250 (Master's)
- Retirement/401k (% match): 8%
- Increase in salary rate: Estimated to be 3.5% per year.

3. Loan

When it comes to bachelors' and master's loans, the interest rates vary based on state regulations and the partnerships between academic institutions and state/federal banks. In our scenario, we have calculated an average interest rate of 4.45%, which can be influenced by scholarships and other benefits that the student may receive during their course of study.

- Bachelor's loan: $150,000
- Bachelor's loan interest: 4.45%
- Nper(months): 180
- Master's loan: $75,000
- Master's loan interest: 4.45%
- Nper(months): 180

4. Accommodation and Transportation

Apartment renting
- Apartment: $2000/month with utilities
- Increment in rent = 6.1% annually

Buying a House at the age of 35
- Total Cost: $1000,000
- Down Payment: $60,000
- Monthly loan payment: $4487.70 (Equal payments) at 4%/year
- Insurance: 175 per month
- House Appreciation: 6% per annum
- Resale Value after 30 years: $5,743,491.17

5. Transportation

Local Transportation and Cabs
- $250/monthly when student
- $500/monthly when working
- Increment: $3 monthly

Car 1 – 2027 Lexus NX
- Initial cost: $40000
- Down payment: $6,000
- Monthly payment: $641.62
- Rate: 5%/year for 5 years (60 months)
- O&M cost: $80
- O&M increment monthly: $1
- Mileage: 36 mpg
- Insurance: 250

Car 2 – 2042 Tesla Z
- Initial cost: $90000
- Down payment: $12,000
- Monthly payment: $1471.96
- Rate: 5%/year for 5 years (60 months)
- O&M cost: $125
- O&M increment monthly: $1.5
- Mileage: 30 mpc
- Insurance: 400

6. Stock investment options

MARR = X% From (0% to 20%)

1. No stock investment (0% of the salary invested in stocks)
2. Low return low risk stocks investment = 6% (4% of the salary invested in stocks)
3. High return high risk stocks investment = 12% (4% of the salary invested in stocks)

Financing options

Loan Payments

For Rehan as a student analyzing the situations that are available to him, he considers following loans that he might require to perform the analysis.

a.   Undergraduate loan

- Boston area
    - Loan amount = $125,000
    - NPER = 180 months
    - Interest = 4.45%
    - PMT = $1,821.37
- Los Angeles area
    - Loan amount = $150,000
    - NPER = 180 months
    - Interest = 4.45%
    - PMT = $2,276.71

b.   Graduate loan if Rehan decides to pursue his Master's.

- Boston area
    - Loan amount = $60,000 + $125,000 during Bachelor's
    - NPER = 180 months
    - Interest = 4.45%
    - PMT = $499.96 for master's loan and $1,244.11 for Bachelor's loan
- Los Angeles area
    - Loan amount = $75,000 + $150,000 during Bachelor's
    - NPER = 180 months
    - Interest = 4.45%
    - PMT = $625 for master's loan and $1492.93 for bachelor's loan

c.   Loan for the 1st car purchase

- Boston area
    - Loan amount = $25,000
    - NPER = 60 months
    - Interest = 5%
    - PMT = $471.78
- Los Angeles area
    - Loan amount = $34,000
    - NPER = 60 months

- Interest = 5%
- PMT = $641.42

d.   Loan for the 2nd car purchase

- Boston area
  - Loan amount = $60,000
  - NPER = 60 months
  - Interest = 5%
  - PMT = $1,132.27
- Los Angeles area
  - Loan amount = $78,000
  - NPER = 60 months
  - Interest = 5%
  - PMT = $1,471.96

e.   Loan for the house he buys

- Boston area
  - Loan amount = $750,000
  - NPER = 360 months
  - Interest = 4%
  - PMT = $3,580.61
- Los Angeles area
  - Loan amount = $940,000
  - NPER = 360 months
  - Interest = 4%
  - PMT = $4487.70

Health Crisis

a.   Monthly medical insurance premium, Boston area = $150

b.   Monthly medical insurance premium, Los Angeles area = $200

Analysis

Our analysis considers two possible locations for Rehan, Boston, and Los Angeles. Once he chooses his preferred city, he can decide to pursue both a bachelor's and master's degree or only a bachelor's degree. He also has the option to invest in stocks with a potential return of either 6% or 12%, or not invest at all. These factors lead to a total of 12 different scenarios that we analyzed.

As the cost of living is generally higher in Los Angeles than in Boston, we aimed to determine whether the potential increase in income justifies moving to a city with a higher cost of living. We also assessed whether pursuing a master's degree is worth the investment.

To evaluate these factors, we assumed that Rehan would contribute 3% of his salary to a retirement account each month, and his employer would match this amount. We also assumed an 8% return on investment, based on historical S&P returns, and calculated the future worth of his retirement savings at the time of retirement. Additionally, we assumed that Rehan would invest 4% of his income in stocks and computed the future worth of his investments at the time of retirement, based on the potential return rates.

We also made some other assumptions, such as Rehan's car and housing expenses, based on his city of residence and career status, to facilitate our analysis.

Finally, we carried out a Minimum Acceptable Rate of Return (MARR) analysis for future worth for each of the 12 scenarios, using MARR values ranging from 0% to 20%. We observed certain trends in the results and determined the best-case scenario based on the maximum future worth for each MARR value. However, our analysis has some limitations, including assumptions that may not hold true in the future, unforeseen life events, and other factors that may impact Rehan's decisions.

Use of Engineering Economy

To create a comprehensive financing plan for our project, our team utilized a range of engineering economy tools and methods. We conducted thorough economic research and employed various analysis techniques, including future worth analysis, ranking approach, varying rates of return, loan payment plans, and tax analysis.

To ensure accuracy and efficiency, we utilized Microsoft Excel to perform calculations and automate our calculations using cross referencing with a main sheet, and other Excel tools. Additionally, we referred to class resources and materials to ensure that our methods were suitable for the project at hand.

Our analyses were based on reasonable assumptions and reliable data sources, which are cited below. However, we recognize that uncertainties and limitations are always present in any financial projection.

In summary, we believe that our approach provides a strong foundation for making informed decisions about financing our project and optimizing its potential return on investment.

Summary

Results and Recommendations

In our analysis of three different stock scenarios (no stock, low yield stock, and high yield stock), we used historical data to estimate the annual yields of low and high yielding stocks as 6% and 12%, respectively. We assumed that these yields were consistent across all cases and that the minimum acceptable rate of return (MARR) ranged from 0% to 20%. Based on these assumptions, we found that (Table 1), the order of FW for each scenario changed depending on the MARR. Specifically, for MARR from 0% to 6%, the order of FW was no stock < low stock < high stock. For MARR from 6% to 12%, the order was low stock < no stock < high stock. For MARR from 12% to 20%, the order was low stock < high stock < no stock. These findings are consistent with our assumptions and historical data.

Scenario	Notations	City	Degree	Stock	MARR Calculations										
					4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%
1	B-B-NS	Boston	Bachelor's	No Stock	1.09E+07	1.17E+07	1.28E+07	1.42E+07	1.60E+07	1.85E+07	2.20E+07	2.66E+07	3.31E+07	4.22E+07	5.49E+07
2	B-B-LS	Boston	Bachelor's	Low Return Stock	1.13E+07	1.19E+07	1.26E+07	1.38E+07	1.53E+07	1.72E+07	1.98E+07	2.33E+07	2.82E+07	3.50E+07	4.45E+07
3	B-B-HS	Boston	Bachelor's	High Return Stock	1.62E+07	1.68E+07	1.77E+07	1.87E+07	2.02E+07	2.21E+07	2.47E+07	2.82E+07	3.31E+07	3.99E+07	4.94E+07
4	B-M-NS	Boston	Bachelor's + Master's	No Stock	1.20E+07	1.29E+07	1.41E+07	1.57E+07	1.77E+07	2.04E+07	2.40E+07	2.87E+07	3.52E+07	4.39E+07	5.59E+07
5	B-M-LS	Boston	Bachelor's + Master's	Low Return Stock	1.24E+07	1.31E+07	1.41E+07	1.54E+07	1.70E+07	1.91E+07	2.18E+07	2.55E+07	3.05E+07	3.73E+07	4.65E+07
6	B-M-HS	Boston	Bachelor's + Master's	High Return Stock	1.70E+07	1.77E+07	1.87E+07	1.99E+07	2.15E+07	2.36E+07	2.64E+07	3.01E+07	3.51E+07	4.19E+07	5.11E+07
7	LA-B-NS	Los Angeles	Bachelor's	No Stock	1.19E+07	1.25E+07	1.33E+07	1.43E+07	1.57E+07	1.74E+07	1.98E+07	2.29E+07	2.73E+07	3.33E+07	4.16E+07
8	LA-B-LS	Los Angeles	Bachelor's	Low Return Stock	1.24E+07	1.28E+07	1.33E+07	1.39E+07	1.48E+07	1.58E+07	1.72E+07	1.90E+07	2.15E+07	2.48E+07	2.95E+07
9	LA-B-HS	Los Angeles	Bachelor's	High Return Stock	1.81E+07	1.85E+07	1.90E+07	1.97E+07	2.05E+07	2.15E+07	2.29E+07	2.47E+07	2.72E+07	3.06E+07	3.52E+07
10	LA-M-NS	Los Angeles	Bachelor's + Master's	No Stock	1.37E+07	1.44E+07	1.53E+07	1.64E+07	1.78E+07	1.97E+07	2.20E+07	2.51E+07	2.92E+07	3.47E+07	4.22E+07
11	LA-M-LS	Los Angeles	Bachelor's + Master's	Low Return Stock	1.42E+07	1.47E+07	1.53E+07	1.61E+07	1.70E+07	1.81E+07	1.96E+07	2.15E+07	2.39E+07	2.72E+07	3.15E+07
12	LA-M-HS	Los Angeles	Bachelor's + Master's	High Return Stock	1.94E+07	1.99E+07	2.05E+07	2.13E+07	2.22E+07	2.33E+07	2.48E+07	2.67E+07	2.91E+07	3.24E+07	3.67E+07

Table 1: The MARR at which future worth switch over happens from Low yield to no stocks and high yield to no stocks.

When comparing similar scenarios between Los Angeles (LA) and Boston in terms of pursuing a master's degree and investing in stocks (example comparing the cases of pursuing masters and expecting high stock return for Boston and LA), we used data from the Bureau of Labor Statistics to estimate the median weekly earnings for workers with a master's degree in each city. We also used historical data to estimate the average annual returns for the stock market in each city. Based on these estimates, we found that (Table 2) the net future worth for LA was consistently higher for every case up until 7% MARR, the switch over to Boston being preferred option in terms of net future worth occurs at either 8% or 9% MARR, after which Boston is consistently the better option. This could be a consequence of LA having higher cost of living, which is not proportional to the salary increase Rehan gets; due to which he is left with more money in the bank on most months in case of Boston, hence at higher MARR, Boston is better option. However, due to his increased salary when living in LA, he invests a higher amount of money in stocks, retirement, house, whose returns matter at lower MARR. However, the cost of living in each city may affect the overall return on investment.

Scenario	Notations	City	Degree	MARR Calculations								
				4%	5%	6%	7%	8%	9%	10%	11%	12%
1	B-B-NS	Boston	Bachelor's	1.09E+07	1.17E+07	1.28E+07	1.42E+07	1.61E+07	1.86E+07	2.20E+07	2.68E+07	3.33E+07
2	B-B-LS	Boston	Bachelor's	1.13E+07	1.20E+07	1.28E+07	1.39E+07	1.53E+07	1.72E+07	1.98E+07	2.34E+07	2.83E+07
3	B-B-HS	Boston	Bachelor's	1.62E+07	1.69E+07	1.77E+07	1.88E+07	2.02E+07	2.22E+07	2.48E+07	2.83E+07	3.32E+07
4	B-M-NS	Boston	Bachelor's + Master's	1.21E+07	1.30E+07	1.43E+07	1.59E+07	1.80E+07	2.07E+07	2.44E+07	2.93E+07	3.59E+07
5	B-M-LS	Boston	Bachelor's + Master's	1.25E+07	1.33E+07	1.43E+07	1.56E+07	17208869.89	1.94E+07	2.22E+07	2.61E+07	3.12E+07
6	B-M-HS	Boston	Bachelor's + Master's	1.71E+07	1.79E+07	1.89E+07	2.02E+07	2.18E+07	2.40E+07	2.69E+07	3.07E+07	3.58E+07
7	LA-B-NS	Los Angeles	Bachelor's	1.20E+07	1.26E+07	1.35E+07	1.46E+07	1.59E+07	1.78E+07	2.03E+07	2.36E+07	2.81E+07
8	LA-B-LS	Los Angeles	Bachelor's	1.25E+07	1.29E+07	1.35E+07	1.42E+07	1.50E+07	1.62E+07	1.77E+07	1.96E+07	2.23E+07
9	LA-B-HS	Los Angeles	Bachelor's	1.82E+07	1.87E+07	1.92E+07	1.99E+07	2.08E+07	2.19E+07	2.34E+07	2.54E+07	2.81E+07
10	LA-M-NS	Los Angeles	Bachelor's + Master's	1.38E+07	1.46E+07	1.55E+07	1.66E+07	1.81E+07	1.99E+07	2.24E+07	2.56E+07	2.98E+07
11	LA-M-LS	Los Angeles	Bachelor's + Master's	1.43E+07	1.48E+07	1.55E+07	1.62E+07	17213086.49	1.84E+07	2.00E+07	2.19E+07	2.45E+07
12	LA-M-HS	Los Angeles	Bachelor's + Master's	1.96E+07	2.01E+07	2.07E+07	2.15E+07	2.25E+07	2.37E+07	2.52E+07	2.72E+07	2.97E+07

Table 2: The MARR at which the future worth switch occurs between Boston and LA.

In terms of comparing bachelor's and master's degree scenarios within the same city (Table 3) and stock profile, we assumed that the earnings potential for someone with a master's degree would be higher than that of someone with a bachelor's degree in the same field. We also assumed that the loan taken out to finance education would have an interest rate of 4.45%. Based on these assumptions, we found that pursuing a master's degree was a better option for maximizing future worth for lower MARRs, but it switches over to pursuing only a bachelor's being better option to maximize future worth at higher MARR. This switchover occurs at either 15%, 16% or 17%. A possible reason for this could be that Rehan has higher savings in bank earlier on as he starts his job 2 years (Fig 1) earlier compared to master's case; because of which the future worth will be higher at higher MARR. However, there are several complications to consider, such as the fact that the earnings potential for someone with a master's degree may vary depending on the field and that the cost of obtaining a master's degree can vary widely depending on the institution and program.

Scenario	Notations	City	Degree	Stock	MARR Calculations										
					10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	B-B-NS	Boston	Bachelor's	No Stock	2.20E+07	2.66E+07	3.31E+07	4.22E+07	5.49E+07	7.28E+07	9.82E+07	1.34E+08	1.86E+08	2.61E+08	3.68E+08
2	B-B-LS	Boston	Bachelor's	Low Return Stock	1.98E+07	2.33E+07	2.82E+07	3.50E+07	4.45E+07	5.79E+07	7.70E+07	1.04E+08	1.43E+08	1.99E+08	2.81E+08
3	B-B-HS	Boston	Bachelor's	High Return Stock	2.47E+07	2.82E+07	3.31E+07	3.99E+07	4.94E+07	6.28E+07	8.19E+07	1.09E+08	1.48E+08	2.04E+08	2.85E+08
4	B-M-NS	Boston	Bachelor's + Master's	No Stock	2.40E+07	2.87E+07	3.52E+07	4.39E+07	5.59E+07	7.25E+07	9.55E+07	1.27E+08	1.72E+08	2.35E+08	3.24E+08
5	B-M-LS	Boston	Bachelor's + Master's	Low Return Stock	2.18E+07	2.55E+07	3.05E+07	3.73E+07	4.65E+07	5.92E+07	7.68E+07	1.01E+08	1.36E+08	1.84E+08	2.52E+08
6	B-M-HS	Boston	Bachelor's + Master's	High Return Stock	2.64E+07	3.01E+07	3.51E+07	4.19E+07	5.11E+07	6.38E+07	8.14E+07	1.06E+08	1.40E+08	1.88E+08	2.57E+08
7	LA-B-NS	Los Angeles	Bachelor's	No Stock	1.98E+07	2.29E+07	2.73E+07	3.33E+07	4.16E+07	5.33E+07	6.98E+07	9.33E+07	1.27E+08	1.75E+08	2.45E+08
8	LA-B-LS	Los Angeles	Bachelor's	Low Return Stock	1.72E+07	1.90E+07	2.15E+07	2.48E+07	2.95E+07	3.59E+07	4.51E+07	5.80E+07	7.66E+07	1.03E+08	1.42E+08
9	LA-B-HS	Los Angeles	Bachelor's	High Return Stock	2.29E+07	2.47E+07	2.72E+07	3.06E+07	3.52E+07	4.17E+07	5.08E+07	6.37E+07	8.23E+07	1.09E+08	1.48E+08
10	LA-M-NS	Los Angeles	Bachelor's + Master's	No Stock	2.20E+07	2.51E+07	2.92E+07	3.47E+07	4.22E+07	5.24E+07	6.55E+07	8.60E+07	1.13E+08	1.52E+08	2.06E+08
11	LA-M-LS	Los Angeles	Bachelor's + Master's	Low Return Stock	1.96E+07	2.15E+07	2.39E+07	2.72E+07	3.15E+07	3.73E+07	4.53E+07	5.63E+07	7.17E+07	9.34E+07	1.24E+08
12	LA-M-HS	Los Angeles	Bachelor's + Master's	High Return Stock	2.48E+07	2.67E+07	2.91E+07	3.24E+07	3.67E+07	4.25E+07	5.05E+07	6.15E+07	7.69E+07	9.86E+07	1.29E+08

Table 3: Heat map depicting switching from master's to bachelor's being the better option for future worth.
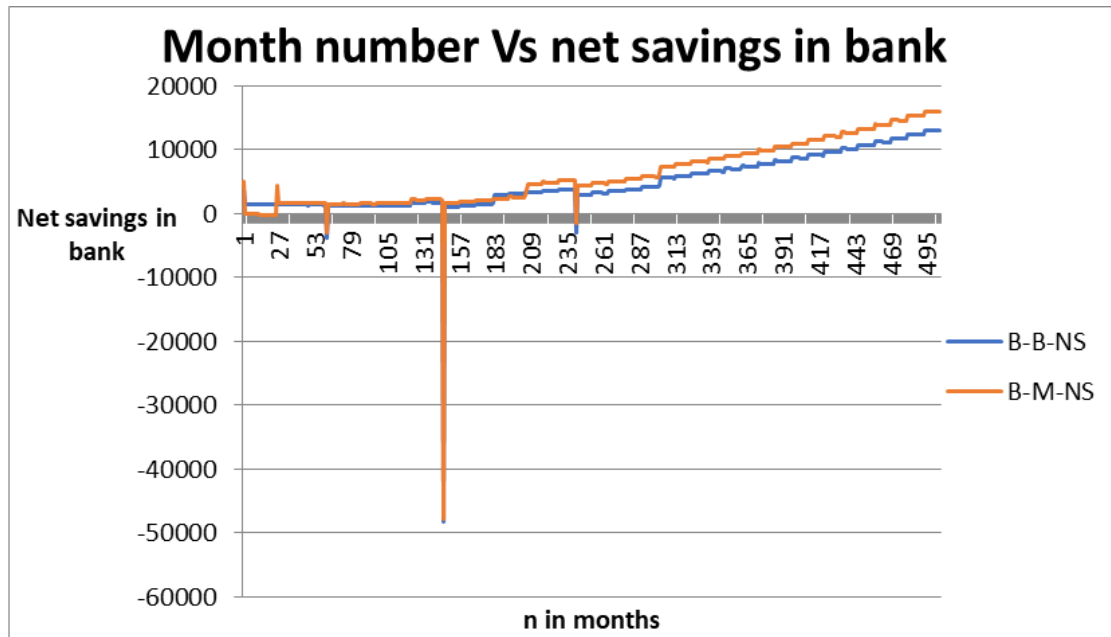

Fig 1: Month (n) vs savings in bank for that month, B-B-NS and B-M-NS represent Boston, Bachelor's, and no stock, Boston, Master's, and no stock scenarios respectively.

After conducting a thorough analysis, we have found that the best option for maximizing future worth (Table 4) depends on the MARR and investment strategies. Specifically, we found that living in Los Angeles, pursuing a master's degree, and investing in high-yield stocks was the best option for MARRs up to 8%. However, from 9% to 11% MARR, the best option was living in Boston, pursuing a master's degree, and investing in high yield stocks, the switch over could be due to higher savings in bank in Boston but higher return on investments in LA. from 12% to 14% MARR, the switchover makes sense because high yield stocks have a 12% per annum return. Beyond 14% MARR, living in Boston, pursuing only bachelor's and not investing in stocks is the best option. This could be because of the higher cash flow earlier on as discussed above and as can be seen from fig () This finding was based on our assumption that high-yield stocks would yield a return of 12% per annum. We arrived at these results through several analyses, including comparisons between different cities, educational levels, and investment strategies. We used data from reliable sources, such as the Bureau of Labor Statistics and historical stock market data, to make our estimates and assumptions. However, there are several limitations to our analysis, such as

the fact that stock market returns can be volatile and unpredictable, and that the cost of living and education can vary widely depending on location and other factors.

City	Degree	Stock	MARR Calculations											
			6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%
Boston	Bachelor's	No Stock	$1,27,73,632.35	$1,41,73,571.15	$1,60,38,315.91	$1,85,49,059.83	$2,19,63,520.80	$2,66,49,700.87	$3,31,34,920.78	$4,21,77,148.89	$5,48,68,901.39	$7,27,88,770.15	$9,82,22,649.51	$13,44,87,033.89
Boston	Bachelor's	Low Return Stock	$1,27,68,019.79	$1,38,44,997.68	$1,52,70,223.24	$1,71,78,633.30	$1,97,62,353.74	$2,32,96,110.08	$2,81,74,228.36	$3,49,64,594.40	$4,44,87,448.30	$5,79,30,580.02	$7,70,17,916.75	$10,42,56,474.00
Boston	Bachelor's	High Return Stock	$1,76,68,482.48	$1,87,45,460.36	$2,01,70,685.93	$2,20,79,095.98	$2,46,62,816.42	$2,81,96,572.76	$3,30,74,691.04	$3,98,65,057.08	$4,93,87,910.98	$6,28,31,042.70	$8,19,18,379.43	$10,91,56,936.68
Boston	Bachelor's + Master's	No Stock	$1,41,12,903.76	$1,56,76,282.29	$1,77,13,569.81	$2,03,94,444.30	$2,39,55,029.17	$2,87,25,299.76	$3,51,68,158.43	$4,39,35,248.06	$5,59,46,806.91	$7,25,06,093.70	$9,54,63,575.18	$12,74,52,814.21
Boston	Bachelor's + Master's	Low Return Stock	$1,41,06,984.05	$1,53,50,813.83	$1,69,60,114.58	$1,90,64,070.39	$2,18,42,378.08	$2,55,46,177.43	$3,05,27,959.03	$3,72,84,384.55	$4,65,17,702.36	$5,92,23,974.78	$7,68,20,005.26	$10,13,26,179.64
Boston	Bachelor's + Master's	High Return Stock	$1,86,89,518.68	$1,99,33,348.46	$2,15,42,649.21	$2,36,46,605.02	$2,64,24,912.72	$3,01,28,712.06	$3,51,10,493.66	$4,18,66,919.18	$5,11,00,236.99	$6,38,06,509.41	$8,14,02,539.89	$10,59,08,714.27
Los Angeles	Bachelor's	No Stock	$1,32,98,175.47	$1,43,22,989.32	$1,56,57,393.30	$1,74,17,406.88	$1,97,67,674.86	$2,29,43,080.75	$2,72,80,273.04	$3,32,63,729.53	$4,15,93,163.14	$5,32,82,283.16	$6,98,03,657.42	$9,33,01,398.15
Los Angeles	Bachelor's	Low Return Stock	$1,32,91,627.49	$1,39,39,653.60	$1,47,61,285.19	$1,58,18,575.93	$1,71,99,646.62	$1,90,30,558.16	$2,14,92,798.55	$2,48,49,082.62	$2,94,81,467.88	$3,59,47,728.01	$4,50,64,802.53	$5,80,32,411.60
Los Angeles	Bachelor's	High Return Stock	$1,90,08,833.95	$1,96,56,860.06	$2,04,78,491.66	$2,15,35,782.39	$2,29,16,853.09	$2,47,47,764.62	$2,72,10,005.01	$3,05,66,289.08	$3,51,98,674.34	$4,16,64,934.47	$5,07,82,008.99	$6,37,49,618.07
Los Angeles	Bachelor's + Master's	No Stock	$1,53,19,066.31	$1,64,29,079.42	$1,78,39,182.94	$1,96,50,935.78	$2,20,05,149.14	$2,50,98,286.57	$2,92,06,032.62	$3,47,17,247.74	$4,21,82,993.47	$5,23,87,454.70	$6,64,50,716.07	$8,59,77,926.96
Los Angeles	Bachelor's + Master's	Low Return Stock	$1,53,12,339.36	$1,60,59,228.89	$1,69,82,983.83	$1,81,39,147.25	$1,96,04,409.28	$2,14,85,647.56	$2,39,33,078.76	$2,71,59,448.30	$3,14,68,101.93	$3,72,94,137.75	$4,52,64,841.17	$5,62,88,569.50
Los Angeles	Bachelor's + Master's	High Return Stock	$2,05,19,765.08	$2,12,66,654.61	$2,21,90,409.54	$2,33,46,572.97	$2,48,11,834.99	$2,66,93,073.27	$2,91,40,504.48	$3,23,66,874.02	$3,66,75,527.65	$4,25,01,563.47	$5,04,72,266.88	$6,14,95,995.22

Table 4: Best case scenario for each MARR.

Overall, our findings suggest that pursuing a master's degree and living in Los Angeles and investing in stocks can lead to higher future earnings potential, at lower MARR, but it tends towards living in Boston, pursuing only bachelor's and not investing in stocks as the MARR increases. However, individual circumstances and preferences may vary, and it is important to consider all factors carefully when making decisions about financial planning and investment strategies.

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Appendix

Scenario	Notations	City	Degree	Stock	0%	1%	2%	3%	4%	5%	6%
1	B-B-NS	Boston	Bachelor's	No Stock	$90,34,068.16	$93,57,067.29	$97,56,825.57	$1,02,57,781.83	$1,08,93,524.92	$1,17,10,548.74	$1,27,73,632
2	B-B-LS	Boston	Bachelor's	Low Return Stock	$98,22,220.79	$1,00,84,292.98	$1,04,05,541.03	$1,08,04,266.19	$1,13,05,553.84	$1,19,44,061.31	$1,27,68,019
3	B-B-HS	Boston	Bachelor's	High Return Stock	$1,47,22,683.47	$1,49,84,755.66	$1,53,06,003.72	$1,57,04,728.87	$1,62,06,016.53	$1,68,44,523.99	$1,76,68,482
4	B-M-NS	Boston	Bachelor's + Master's	No Stock	$97,13,857.08	$1,01,11,593.70	$1,05,98,199.94	$1,11,99,796.08	$1,19,51,516.83	$1,29,00,940.54	$1,41,12,903
5	B-M-LS	Boston	Bachelor's + Master's	Low Return Stock	$1,05,24,693.21	$1,08,57,155.01	$1,12,60,563.52	$1,17,55,112.29	$1,23,67,849.74	$1,31,35,274.82	$1,41,06,984
6	B-M-HS	Boston	Bachelor's + Master's	High Return Stock	$1,51,07,227.84	$1,54,39,689.64	$1,58,43,098.15	$1,63,37,646.92	$1,69,50,384.37	$1,77,17,809.45	$1,86,89,518
7	LA-B-NS	Los Angeles	Bachelor's	No Stock	$1,03,54,730.14	$1,06,30,416.99	$1,09,63,215.70	$1,13,69,602.50	$1,18,71,913.67	$1,25,00,711.21	$1,32,98,175
8	LA-B-LS	Los Angeles	Bachelor's	Low Return Stock	$1,12,74,241.53	$1,14,78,846.96	$1,17,20,050.41	$1,20,07,167.58	$1,23,52,614.08	$1,27,73,142.54	$1,32,91,627
9	LA-B-HS	Los Angeles	Bachelor's	High Return Stock	$1,69,91,448.00	$1,71,96,053.42	$1,74,37,256.88	$1,77,24,374.05	$1,80,69,820.55	$1,84,90,349.01	$1,90,08,833
10	LA-M-NS	Los Angeles	Bachelor's + Master's	No Stock	$1,19,44,357.11	$1,22,75,038.32	$1,26,69,806.29	$1,31,45,438.53	$1,37,24,110.31	$1,44,35,393.59	$1,53,19,066
11	LA-M-LS	Los Angeles	Bachelor's + Master's	Low Return Stock	$1,28,65,761.80	$1,31,22,267.08	$1,34,22,492.17	$1,37,76,479.67	$1,41,97,215.89	$1,47,01,682.55	$1,53,12,339
12	LA-M-HS	Los Angeles	Bachelor's + Master's	High Return Stock	$1,80,73,187.52	$1,83,29,692.79	$1,86,29,917.89	$1,89,83,905.39	$1,94,04,641.61	$1,99,09,108.27	$2,05,19,765

Table 5: Best case scenario from 0% to 6% MARR.

Scenario	Notations	City	Degree	Stock	MARR Calculations					
					7%	8%	9%	10%	11%	12%
1	B-B-NS	Boston	Bachelor's	No Stock	$1,41,73,571.15	$1,60,38,315.91	$1,85,49,059.83	$2,19,63,520.80	$2,66,49,700.87	$3,31,34,920.78
2	B-B-LS	Boston	Bachelor's	Low Return Stock	$1,38,44,997.68	$1,52,70,223.24	$1,71,78,633.30	$1,97,62,353.74	$2,32,96,110.08	$2,81,74,228.36
3	B-B-HS	Boston	Bachelor's	High Return Stock	$1,87,45,460.36	$2,01,70,685.93	$2,20,79,095.98	$2,46,62,816.42	$2,81,96,572.76	$3,30,74,691.04
4	B-M-NS	Boston	Bachelor's + Master's	No Stock	$1,56,76,282.29		$2,03,94,444.30	$2,39,55,029.17	$2,87,25,299.76	$3,51,68,158.43
5	B-M-LS	Boston	Bachelor's + Master's	Low Return Stock	$1,53,50,813.83	$1,69,60,114.58	$1,90,64,070.39	$2,18,42,378.08	$2,55,46,177.43	$3,05,27,959.03
6	B-M-HS	Boston	Bachelor's + Master's	High Return Stock	$1,99,33,348.46	$2,15,42,649.21	$2,36,46,605.02	$2,64,24,912.72	$3,01,28,712.06	$3,51,10,493.66
7	LA-B-NS	Los Angeles	Bachelor's	No Stock	$1,43,22,989.32	$1,56,57,393.30	$1,74,17,406.88	$1,97,67,674.86	$2,29,43,080.75	$2,72,80,273.04
8	LA-B-LS	Los Angeles	Bachelor's	Low Return Stock	$1,39,39,653.60	$1,47,61,285.19	$1,58,18,575.93	$1,71,99,646.62	$1,90,30,558.16	$2,14,92,798.55
9	LA-B-HS	Los Angeles	Bachelor's	High Return Stock	$1,96,56,860.06	$2,04,78,491.66	$2,15,35,782.39	$2,29,16,853.09	$2,47,47,764.62	$2,72,10,005.01
10	LA-M-NS	Los Angeles	Bachelor's + Master's	No Stock	$1,64,29,079.42	$1,78,39,182.94	$1,96,50,935.78	$2,20,05,149.14	$2,50,98,286.57	$2,92,06,032.62
11	LA-M-LS	Los Angeles	Bachelor's + Master's	Low Return Stock	$1,60,59,228.89	$1,69,82,983.83	$1,81,39,147.25	$1,96,04,409.28	$2,14,85,647.56	$2,39,33,078.76
12	LA-M-HS	Los Angeles	Bachelor's + Master's	High Return Stock	$2,12,66,654.61	$2,21,90,409.54	$2,33,46,572.97	$2,48,11,834.99	$2,66,93,073.27	$2,91,40,504.48

Table 6: Best case scenario from 7% to 12% MARR

Scenario	Notations	City	Degree	Stock	13%	14%	15%	16%	17%	18%
1	B-B-NS	Boston	Bachelor's	No Stock	$4,21,77,148.89	$5,48,68,901.39	$7,27,88,770.15	$9,82,22,649.51	$13,44,87,033.89	$18,64,01,888.62
2	B-B-LS	Boston	Bachelor's	Low Return Stock	$3,49,64,594.40	$4,44,87,448.30	$5,79,30,580.02	$7,70,17,916.75	$10,42,56,474.00	$14,32,98,387.43
3	B-B-HS	Boston	Bachelor's	High Return Stock	$3,98,65,057.08	$4,93,87,910.98	$6,28,31,042.70	$8,19,18,379.43	$10,91,56,936.68	$14,81,98,850.12
4	B-M-NS	Boston	Bachelor's + Master's	No Stock	$4,39,35,248.06	$5,59,46,806.91	$7,25,06,093.70	$9,54,63,575.18	$12,74,52,814.21	$17,22,29,759.38
5	B-M-LS	Boston	Bachelor's + Master's	Low Return Stock	$3,72,84,384.55	$4,65,17,702.36	$5,92,23,974.78	$7,68,20,005.26	$10,13,26,179.64	$13,56,30,165.44
6	B-M-HS	Boston	Bachelor's + Master's	High Return Stock	$4,18,66,919.18	$5,11,00,236.99	$6,38,06,509.41	$8,14,02,539.89	$10,59,08,714.27	$14,02,12,700.07
7	LA-B-NS	Los Angeles	Bachelor's	No Stock	$3,32,63,729.53	$4,15,93,163.14	$5,32,82,283.16	$6,98,03,657.42	$9,33,01,398.15	$12,69,03,683.02
8	LA-B-LS	Los Angeles	Bachelor's	Low Return Stock	$2,48,49,082.62	$2,94,81,467.88	$3,59,47,728.01	$4,50,64,802.53	$5,80,32,411.60	$7,66,16,264.97
9	LA-B-HS	Los Angeles	Bachelor's	High Return Stock	$3,05,66,289.08	$3,51,98,674.34	$4,16,64,934.47	$5,07,82,008.99	$6,37,49,618.07	$8,23,33,471.43
10	LA-M-NS	Los Angeles	Bachelor's + Master's	No Stock	$3,47,17,247.74	$4,21,82,993.47	$5,23,87,454.70	$6,64,50,716.07	$8,59,77,926.96	$11,32,76,085.94
11	LA-M-LS	Los Angeles	Bachelor's + Master's	Low Return Stock	$2,71,59,448.30	$3,14,68,101.93	$3,72,94,137.75	$4,52,64,841.17	$5,62,88,569.50	$7,16,85,638.27
12	LA-M-HS	Los Angeles	Bachelor's + Master's	High Return Stock	$3,23,66,874.02	$3,66,75,527.65	$4,25,01,563.47	$5,04,72,266.88	$6,14,95,995.22	$7,68,93,063.99

Table 7: Best case scenario from 13% to 18% MARR

Scenario	Notations	City	Degree	Stock	15%	16%	17%	18%	19%	20%
1	B-B-NS	Boston	Bachelor's	No Stock	$7,27,88,770.15	$9,82,22,649.51	$13,44,87,033.89	$18,64,01,888.62	$26,09,82,828.32	$36,84,55,013.58
2	B-B-LS	Boston	Bachelor's	Low Return Stock	$5,79,30,580.02	$7,70,17,916.75	$10,42,56,474.00	$14,32,98,387.43	$19,94,72,031.26	$28,05,61,683.68
3	B-B-HS	Boston	Bachelor's	High Return Stock	$6,28,31,042.70	$8,19,18,379.43	$10,91,56,936.68	$14,81,98,850.12	$20,43,72,493.94	$28,54,62,146.36
4	B-M-NS	Boston	Bachelor's + Master's	No Stock	$7,25,06,093.70	$9,54,63,575.18	$12,74,52,814.21	$17,22,29,759.38	$23,51,61,275.01	$32,39,29,232.88
5	B-M-LS	Boston	Bachelor's + Master's	Low Return Stock	$5,92,23,974.78	$7,68,20,005.26	$10,13,26,179.64	$13,56,30,165.44	$18,38,67,636.72	$25,19,72,496.76
6	B-M-HS	Boston	Bachelor's + Master's	High Return Stock	$6,38,06,509.41	$8,14,02,539.89	$10,59,08,714.27	$14,02,12,700.07	$18,84,50,171.35	$25,65,55,031.39
7	LA-B-NS	Los Angeles	Bachelor's	No Stock	$5,32,82,283.16	$6,98,03,657.42	$9,33,01,398.15	$12,69,03,683.02	$17,51,82,299.89	$24,48,28,793.07
8	LA-B-LS	Los Angeles	Bachelor's	Low Return Stock	$3,59,47,728.01	$4,50,64,802.53	$5,80,32,411.60	$7,66,16,264.97	$10,34,19,703.32	$14,22,86,574.85
9	LA-B-HS	Los Angeles	Bachelor's	High Return Stock	$4,16,64,934.47	$5,07,82,008.99	$6,37,49,618.07	$8,23,33,471.43	$10,91,36,909.78	$14,80,03,781.31
10	LA-M-NS	Los Angeles	Bachelor's + Master's	No Stock	$5,23,87,454.70	$6,64,50,716.07	$8,59,77,926.96	$11,32,76,085.94	$15,16,69,475.20	$20,59,59,124.92
11	LA-M-LS	Los Angeles	Bachelor's + Master's	Low Return Stock	$3,72,94,137.75	$4,52,64,841.17	$5,62,88,569.50	$7,16,85,638.27	$9,33,81,249.87	$12,41,90,106.61
12	LA-M-HS	Los Angeles	Bachelor's + Master's	High Return Stock	$4,25,01,563.47	$5,04,72,266.88	$6,14,95,995.22	$7,68,93,063.99	$9,85,88,675.59	$12,93,97,532.33

Table 8: Best case scenario from 15% till 20% MARR

NOTE: Look at the table for reference to determine the scenario (for example, BBNS refers to Boston, Bachelor's, No stock scenario).
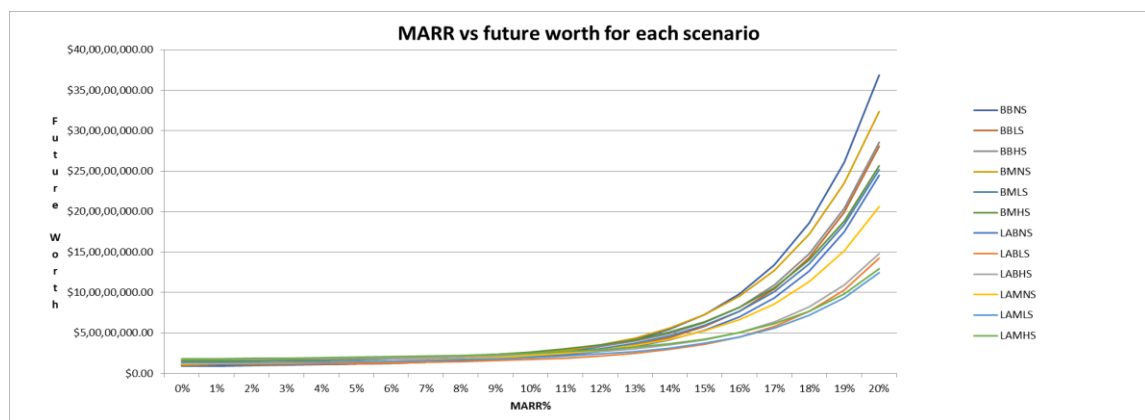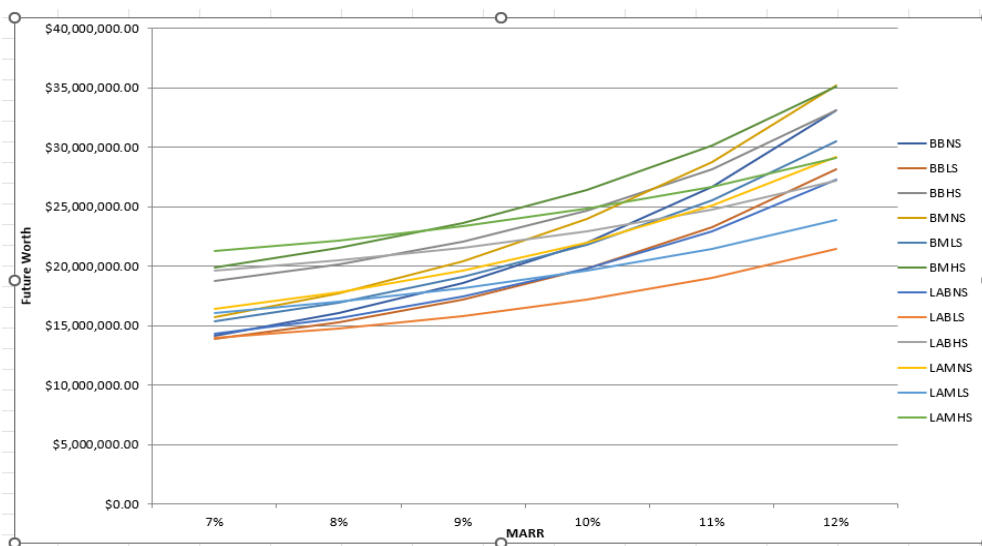

Fig 2: MARR vs Future Worth

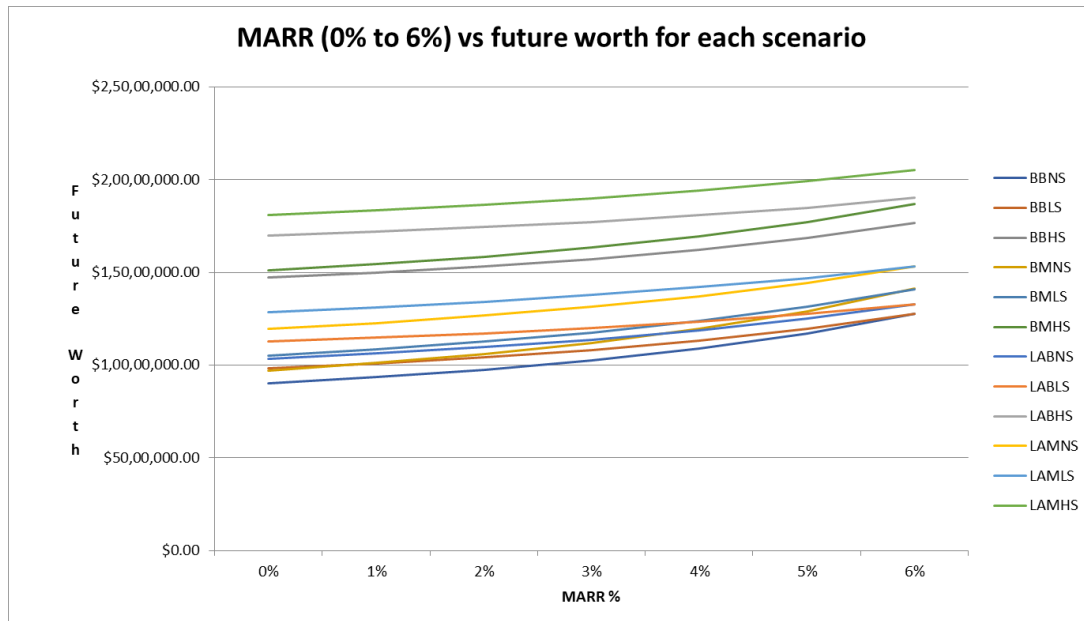Fig 3: MARR vs Future worth from 7% to 12% MARR.

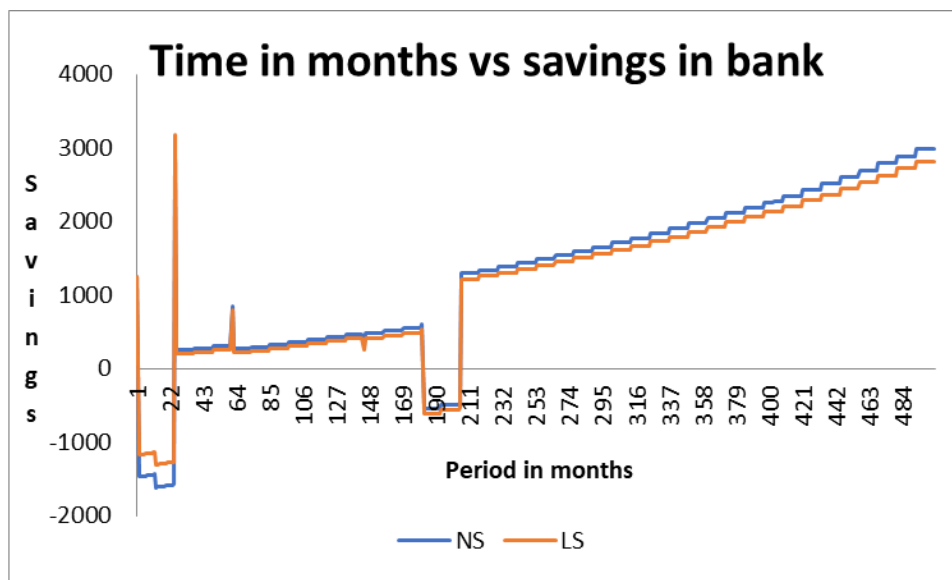Fig 3: MARR vs Future Worth for each scenario from 0% to 6% MARR

Fig 4: Period in months vs Savings in bank

In fig 4, Red represents total savings in bank for month n as a difference of B-B-NS – B-M-NS cases. Blue represents total savings for the month n as a difference of B-B-LS – B-M-NS scenarios.