

## **Retirement Planning Project**

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FIN5823: Financial Modeling

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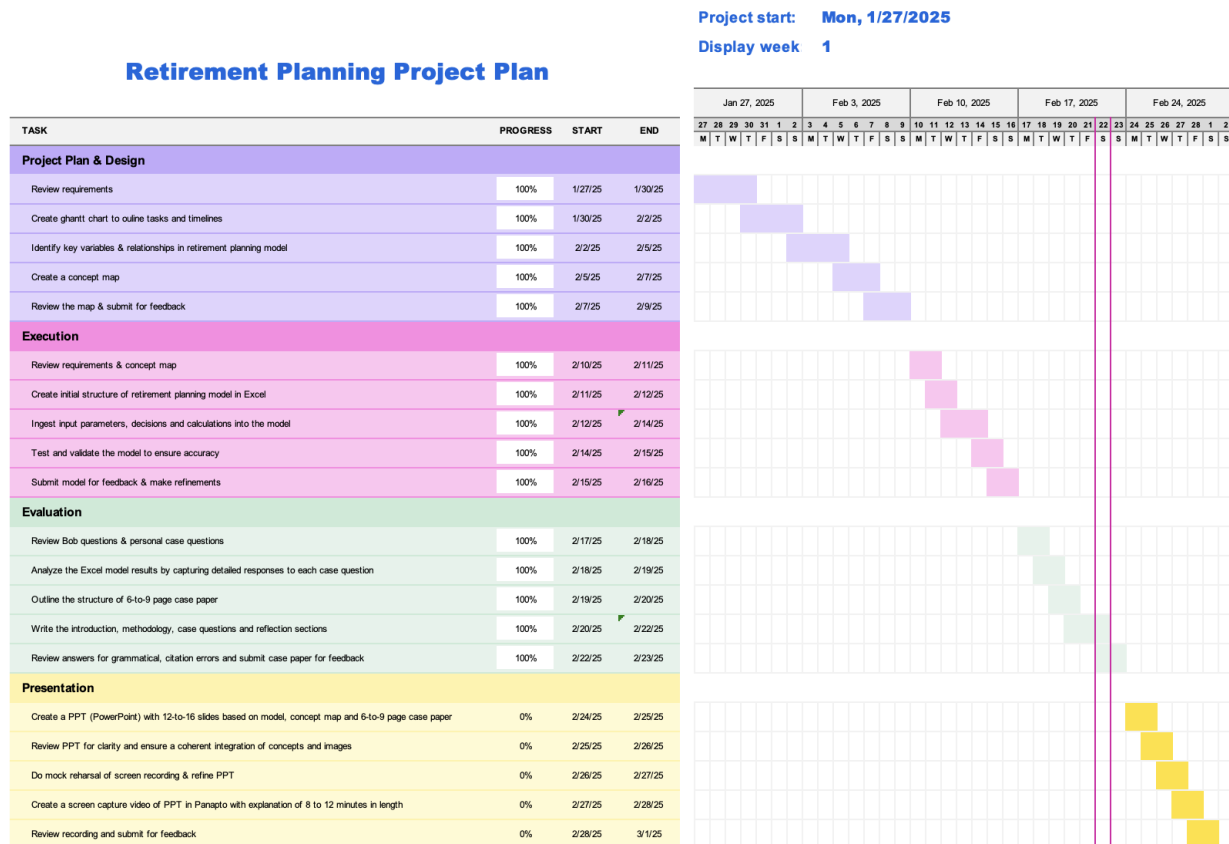
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## Introduction

Bob Davidson, a 46-year-old professor, wants to retire comfortably at age 60–65, fund his daughter’s education, and maintain his desired lifestyle, post-retirement (including travel). He needs to determine if his current savings rate is sufficient, how much he should save annually, how to manage risks like inflation and further such questions. The aim of this project is to help Bob get clarity by building a financial model in Excel, analyzing the model, creating a structured approach to answer Bob’s questions, evaluating personal retirement plan strategies and finally reflecting on lessons learned. The detailed project plan is as shown in Figure 1 (Vertex42, 2019).

Figure 1.

*Ghantt chart*



## Process to Create the Model

The process to create the retirement plan model in Excel as shown in Figure 2 involved four steps (J S, 2016c). The model aims to project retirement savings, estimate retirement income, assess future expenses, and analyze potential risks.

Figure 2

### Retirement Plan Model

Retirement Plan Model												
Note: All colored cells are input parameters. Gold colored cells are defaults (adjustable values). Cell values in grey are automatically generated based on input parameters & formulas.												
Input Parameters			Defaults			Calculations						
Annual retirement savings			137,000.00	Return on Investment (ROI) on savings		7.15%	ROI % Calculation		137,000.00	ROI % Calculation		137,000.00
Annual salary			90,000.00	Personal Contribution (TC) 15% max		7,000.00	Personal Contribution		90,000.00	Personal Contribution		90,000.00
Current age			45	Retirement Age		65	ROI % Retirement		45	ROI % Retirement		45
Retirement funds withdrawal rate			4.50%	Vest. Longevity Withdrawal Rate		0.20%	Vest. Longevity Withdrawal Rate		4.50%	Vest. Longevity Withdrawal Rate		4.50%
Asset 1 - Home equity			400,000.00	Global Equity Fund (US, equities)		0.32%	Global Equity Fund (US, equities)		400,000.00	Global Equity Fund (US, equities)		400,000.00
Asset 2 - College fund (529)			200,000.00	Global Bond Fund (US, bonds)		0.32%	Global Bond Fund (US, bonds)		200,000.00	Global Bond Fund (US, bonds)		200,000.00
Asset 3 - Life Insurance			1,000,000.00	Global Dividend Fund (US, equities)		0.32%	Global Dividend Fund (US, equities)		1,000,000.00	Global Dividend Fund (US, equities)		1,000,000.00
Asset 4 - Life Insurance			500,000.00	Global Dividend Fund (US, equities)		0.32%	Global Dividend Fund (US, equities)		500,000.00	Global Dividend Fund (US, equities)		500,000.00
Total Income (Retirement only)			211,111.11	Total Income (Retirement only)		211,111.11	Total Income (Retirement only)		211,111.11	Total Income (Retirement only)		211,111.11
Asset 5 - Other funds			50,000.00	Total Income (Retirement only)		211,111.11	Total Income (Retirement only)		211,111.11	Total Income (Retirement only)		211,111.11
Year	Age	Annual Retirement Savings	Personal Contribution	Return on Investment	Total Income	Total Income (Retirement only)	Total Income (Retirement only)	Total Income (Retirement only)	Total Income (Retirement only)	Total Income (Retirement only)	Total Income (Retirement only)	Total Income (Retirement only)
2023	45	95,000.00	7,000.00	8,000.00	17,000.00	48,111.11	137,000.00	137,000.00	137,000.00	137,000.00	137,000.00	137,000.00
2024	46	96,800.00	7,000.00	8,000.00	17,800.00	49,451.11	8,754.40	145,844.40	145,844.40	145,844.40	145,844.40	145,844.40
2025	47	98,600.00	7,000.00	8,000.00	18,600.00	50,791.11	8,754.40	154,688.80	154,688.80	154,688.80	154,688.80	154,688.80
2026	48	100,400.00	7,000.00	8,000.00	19,400.00	52,131.11	8,754.40	163,533.20	163,533.20	163,533.20	163,533.20	163,533.20
2027	49	102,200.00	7,000.00	8,000.00	20,200.00	53,471.11	8,754.40	172,377.60	172,377.60	172,377.60	172,377.60	172,377.60
2028	50	104,000.00	7,000.00	8,000.00	21,000.00	54,811.11	8,754.40	181,222.00	181,222.00	181,222.00	181,222.00	181,222.00
2029	51	105,800.00	7,000.00	8,000.00	21,800.00	56,151.11	8,754.40	190,066.40	190,066.40	190,066.40	190,066.40	190,066.40
2030	52	107,600.00	7,000.00	8,000.00	22,600.00	57,491.11	8,754.40	198,910.80	198,910.80	198,910.80	198,910.80	198,910.80
2031	53	109,400.00	7,000.00	8,000.00	23,400.00	58,831.11	8,754.40	207,755.20	207,755.20	207,755.20	207,755.20	207,755.20
2032	54	111,200.00	7,000.00	8,000.00	24,200.00	60,171.11	8,754.40	216,599.60	216,599.60	216,599.60	216,599.60	216,599.60
2033	55	113,000.00	7,000.00	8,000.00	25,000.00	61,511.11	8,754.40	225,444.00	225,444.00	225,444.00	225,444.00	225,444.00
2034	56	114,800.00	7,000.00	8,000.00	25,800.00	62,851.11	8,754.40	234,288.40	234,288.40	234,288.40	234,288.40	234,288.40
2035	57	116,600.00	7,000.00	8,000.00	26,600.00	64,191.11	8,754.40	243,132.80	243,132.80	243,132.80	243,132.80	243,132.80
2036	58	118,400.00	7,000.00	8,000.00	27,400.00	65,531.11	8,754.40	251,977.20	251,977.20	251,977.20	251,977.20	251,977.20
2037	59	120,200.00	7,000.00	8,000.00	28,200.00	66,871.11	8,754.40	260,821.60	260,821.60	260,821.60	260,821.60	260,821.60
2038	60	122,000.00	7,000.00	8,000.00	29,000.00	68,211.11	8,754.40	269,666.00	269,666.00	269,666.00	269,666.00	269,666.00
2039	61	123,800.00	7,000.00	8,000.00	29,800.00	69,551.11	8,754.40	278,510.40	278,510.40	278,510.40	278,510.40	278,510.40
2040	62	125,600.00	7,000.00	8,000.00	30,600.00	70,891.11	8,754.40	287,354.80	287,354.80	287,354.80	287,354.80	287,354.80
2041	63	127,400.00	7,000.00	8,000.00	31,400.00	72,231.11	8,754.40	296,199.20	296,199.20	296,199.20	296,199.20	296,199.20
2042	64	129,200.00	7,000.00	8,000.00	32,200.00	73,571.11	8,754.40	305,043.60	305,043.60	305,043.60	305,043.60	305,043.60
2043	65	131,000.00	7,000.00	8,000.00	33,000.00	74,911.11	8,754.40	313,888.00	313,888.00	313,888.00	313,888.00	313,888.00
2044	66	132,800.00	7,000.00	8,000.00	33,800.00	76,251.11	8,754.40	322,732.40	322,732.40	322,732.40	322,732.40	322,732.40
2045	67	134,600.00	7,000.00	8,000.00	34,600.00	77,591.11	8,754.40	331,576.80	331,576.80	331,576.80	331,576.80	331,576.80
2046	68	136,400.00	7,000.00	8,000.00	35,400.00	78,931.11	8,754.40	340,421.20	340,421.20	340,421.20	340,421.20	340,421.20
2047	69	138,200.00	7,000.00	8,000.00	36,200.00	80,271.11	8,754.40	349,265.60	349,265.60	349,265.60	349,265.60	349,265.60
2048	70	140,000.00	7,000.00	8,000.00	37,000.00	81,611.11	8,754.40	358,110.00	358,110.00	358,110.00	358,110.00	358,110.00
2049	71	141,800.00	7,000.00	8,000.00	37,800.00	82,951.11	8,754.40	366,954.40	366,954.40	366,954.40	366,954.40	366,954.40
2050	72	143,600.00	7,000.00	8,000.00	38,600.00	84,291.11	8,754.40	375,798.80	375,798.80	375,798.80	375,798.80	375,798.80
2051	73	145,400.00	7,000.00	8,000.00	39,400.00	85,631.11	8,754.40	384,643.20	384,643.20	384,643.20	384,643.20	384,643.20
2052	74	147,200.00	7,000.00	8,000.00	40,200.00	86,971.11	8,754.40	393,487.60	393,487.60	393,487.60	393,487.60	393,487.60
2053	75	149,000.00	7,000.00	8,000.00	41,000.00	88,311.11	8,754.40	402,332.00	402,332.00	402,332.00	402,332.00	402,332.00
2054	76	150,800.00	7,000.00	8,000.00	41,800.00	89,651.11	8,754.40	411,176.40	411,176.40	411,176.40	411,176.40	411,176.40
2055	77	152,600.00	7,000.00	8,000.00	42,600.00	90,991.11	8,754.40	420,020.80	420,020.80	420,020.80	420,020.80	420,020.80
2056	78	154,400.00	7,000.00	8,000.00	43,400.00	92,331.11	8,754.40	428,865.20	428,865.20	428,865.20	428,865.20	428,865.20
2057	79	156,200.00	7,000.00	8,000.00	44,200.00	93,671.11	8,754.40	437,709.60	437,709.60	437,709.60	437,709.60	437,709.60
2058	80	158,000.00	7,000.00	8,000.00	45,000.00	95,011.11	8,754.40	446,554.00	446,554.00	446,554.00	446,554.00	446,554.00
2059	81	159,800.00	7,000.00	8,000.00	45,800.00	96,351.11	8,754.40	455,398.40	455,398.40	455,398.40	455,398.40	455,398.40
2060	82	161,600.00	7,000.00	8,000.00	46,600.00	97,691.11	8,754.40	464,242.80	464,242.80	464,242.80	464,242.80	464,242.80
2061	83	163,400.00	7,000.00	8,000.00	47,400.00	99,031.11	8,754.40	473,087.20	473,087.20	473,087.20	473,087.20	473,087.20
2062	84	165,200.00	7,000.00	8,000.00	48,200.00	100,371.11	8,754.40	481,931.60	481,931.60	481,931.60	481,931.60	481,931.60
2063	85	167,000.00	7,000.00	8,000.00	49,000.00	101,711.11	8,754.40	490,776.00	490,776.00	490,776.00	490,776.00	490,776.00
2064	86	168,800.00	7,000.00	8,000.00	49,800.00	103,051.11	8,754.40	499,620.40	499,620.40	499,620.40	499,620.40	499,620.40
2065	87	170,600.00	7,000.00	8,000.00	50,600.00	104,391.11	8,754.40	508,464.80	508,464.80	508,464.80	508,464.80	508,464.80
2066	88	172,400.00	7,000.00	8,000.00	51,400.00	105,731.11	8,754.40	517,309.20	517,309.20	517,309.20	517,309.20	517,309.20
2067	89	174,200.00	7,000.00	8,000.00	52,200.00	107,071.11	8,754.40	526,153.60	526,153.60	526,153.60	526,153.60	526,153.60
2068	90	176,000.00	7,000.00	8,000.00	53,000.00	108,411.11	8,754.40	535,000.00	535,000.00	535,000.00	535,000.00	535,000.00
2069	91	177,800.00	7,000.00	8,000.00	53,800.00	109,751.11	8,754.40	543,844.40	543,844.40	543,844.40	543,844.40	543,844.40
2070	92	179,600.00	7,000.00	8,000.00	54,600.00	111,091.11	8,754.40	552,688.80	552,688.80	552,688.80	552,688.80	552,688.80
2071	93	181,400.00	7,000.00	8,000.00	55,400.00	112,431.11	8,754.40	561,533.20	561,533.20	561,533.20	561,533.20	561,533.20
2072	94	183,200.00	7,000.00	8,000.00	56,200.00	113,771.11	8,754.40	570,377.60	570,377.60	570,377.60	570,377.60	570,377.60
2073	95	185,000.00	7,000.00	8,000.00	57,000.00	115,111.11	8,754.40	579,222.00	579,222.00	579,222.00	579,222.00	579,222.00
2074	96	186,800.00	7,000.00	8,000.00	57,800.00	116,451.11	8,754.40	588,066.40	588,066.40	588,066.40	588,066.40	588,066.40
2075	97	188,600.00	7,000.00	8,000.00	58,600.00	117,791.11	8,754.40	596,910.80	596,910.80	596,910.80	596,910.80	596,910.80
2076	98	190,400.00	7,000.00	8,000.00	59,400.00	119,131.11	8,754.40	605,755.20	605,755.20	605,755.20	605,755.20	605,755.20
2077	99	192,200.00	7,000.00	8,000.00	60,200.00	120,471.11	8,754.40	614,599.60	614,599.60	614,599.60	614,599.60	614,599.60
2078	100	194,000.00	7,000.00	8,000.00	61,000.00	121,811.11	8,754.40	623,444.00	623,444.00	623,444.00	623,444.00	623,444.00

## Input Parameters

The first step was to gather all relevant financial data, including current retirement savings, annual salary, assets, liabilities, and retirement goals (J S, 2016a). These inputs were categorized into fixed variables such as age, current savings, and retirement withdrawal rate. See blue cells in Figure 2.

## **Decisions**

The model allows for adjustable variables, such as investment allocation, retirement age, and inflation rate (J S, 2016e). These decisions can be modified to test different scenarios and their impact on the retirement plan. See gold cells in Figure 2.

## **Calculations**

The model performs automated calculations using Excel formulas to project future savings and income. Key calculations include the return on investment (ROI), estimated retirement income, and projected retirement savings at retirement age. See violet cells in Figure 2.

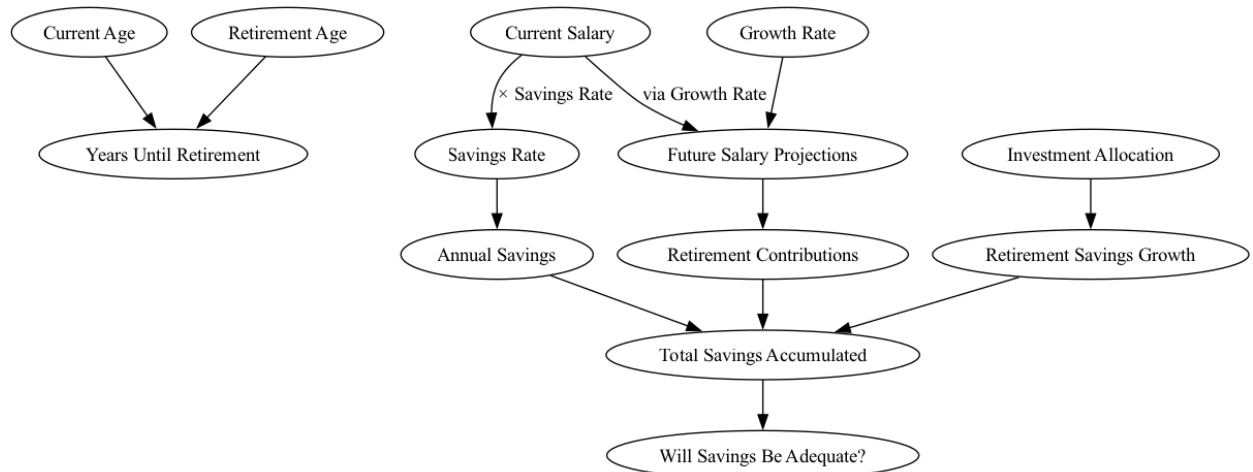
## **Outputs**

The fourth step is to generate actionable insights (or) results based on the model's calculations. The output provides answers to Bob's key questions, such as whether his current savings rate is adequate, and how long his retirement savings will last.

To answer one of Bob's questions if his current savings are adequate for retirement (model output), I created a concept map as shown in Figure 3 (Lucidchart, n.d.). This concept map is identifying the key variables and establishing the relationships between them. It is linking the variables across three modules (or) tables in Figure 2.

For example, input parameter of current age is linked with decision of retirement age to arrive at the calculation of years until retirement = current age – retirement age. Concept maps not only help us create the model accurately but also arrive at the model outputs with clarity.

Figure 3

*Concept Map***Bob's Retirement Planning Questions****Will Bob's current savings rate be adequate?**

Based on the model in Figure 2, Bob's current yearly investment rate of \$48,111.11, which includes extra income (J S, 2016e) is projected to result in total retirement savings of \$1,695,469.51 by age 65, adjusted for 2% inflation.

Applying the 4% withdrawal rule, Bob can withdraw approximately \$45,640.10 annually (adjusted for 2% inflation). Combined with social security benefits and inheritances from his mom and mother-in-law, this should allow him to maintain his current standard of living.

**How much should he set aside each year?**

To ensure his retirement savings last 30+ years, Bob should ideally invest \$60,596.81 annually (See PMT value in Calculations table in Figure 2) instead of his current \$48,111.11 (Erin Talks Money, 2022a). Given his good health and potential longevity, increasing his personal

contributions to at least \$10,000 per year is highly recommended. This adjustment would ensure financial security well beyond age 90.

**How much will he have to live on when he retires?**

If Bob retires at 65, he will have approximately \$1,695,469.51 in his retirement fund, allowing him to withdraw around \$45,640.10 annually (adjusted for 2% inflation).

**How long can he live comfortably after retirement?**

Bob's retirement savings are projected to last for 25 years with the projected withdrawal plan shown in Figure 2. After he hits age 91, his savings would be depleted. Hence, Bob can live comfortably after retirement for 25 years under 4% withdrawal rule (Erin Talks Money, 2022b).

**What risks does he face, and how should his retirement plan account for them?**

Bob should allocate a portion of his salary towards long-term health & care insurance to protect against unforeseen healthcare & medical costs. Bob should also set aside funds for his daughter's welfare until she secures stable employment, providing a safety net for unexpected care needs.

Bob should consider discussing potential inheritances with his mother and mother-in-law early on and factor this into his retirement plan. This could help cover unforeseen medical expenses and provide an opportunity to reduce housing costs. If he inherits his mother-in-law's home, he could eliminate mortgage payments (Ermilova, 2021), redirecting those funds into his retirement savings. This strategic shift would enhance his financial security and potentially allow for a higher withdrawal rate post-retirement.

## **Personal Retirement Analysis**

### **Describe the process you used to analyze your personal situation.**

I began by gathering all relevant financial data, including my current savings, income, and retirement goals. I then input this data into the retirement planning model tables of input parameters, decisions in in Figure 2. Finally, I verified the Excel generated calculations of FV (Hijazi, 2016), PMT (Gharani, 2020), future projections and withdrawal rates, which are adjusted for inflation.

### **How many scenarios did you run, how long did it take to feel comfortable with the numbers?**

I conducted a scenario analysis with four different scenarios to evaluate the impact of key variables on my retirement plan.

In the first scenario, I adjusted investment allocation rates and ROI (Return on Investment) percentage on withdrawal savings. In the second scenario, I modified the retirement age to 60 instead of 65. In the third scenario, I altered savings rates from salary and additional income values (J S, 2016e). In the fourth scenario, I adjusted the inflation rate from 2% to 3%.

Through multiple iterations, I refined the projections and gained a deeper understanding of how different variables influence my retirement outlook.

### **Is the amount you are currently accumulating at your current savings rate adequate?**

Based on my model, my current savings rate is projected to support a comfortable retirement. However, increasing my annual contributions would enhance financial security and flexibility.

By incorporating social security benefits and additional income generated from renting a portion of my home after retirement, my total retirement income is projected to align with my



current annual salary. This would help me to sustain my current standard of living throughout retirement (Erin Talks Money, 2022b).

**How much should you be setting aside each year?**

I should aim to save at least 15-20% of my annual income to ensure a secure retirement, taking into account inflation and potential market volatility.

**How much will you have to live on when you retire?**

My projected retirement savings of around \$20 Million, when combined with Social Security benefits, should provide me with sufficient income to maintain the desired lifestyle after retirement.

**How long after retirement will you be able to live comfortably?**

My retirement savings are projected to last for 25 years with the current model. To extend my retirement savings beyond 25 years, I could either increase my additional income, reduce my withdrawal rate from 4% to 3%, or relocate to a suburban area with a slightly adjusted standard of living.

**What risks do you face and how should retirement planning take these risks into account?**

By spreading investments in various assets such as real estate, equities, and bonds, I can better handle market fluctuations and protect my pension from substantial losses. Furthermore, regular revisions of my investment strategies to align with changing personal financial goals and market conditions can help maintain the purchasing power over time, particularly with rising inflation.,

To improve my financial security further, I need to plan a longer retirement horizon by looking at opportunities to increase my savings rate and reduce healthcare premiums and medical bills (This Is Our Retirement, 2022a). For example, smaller monthly investments in long-term

health insurance or health savings accounts (HSAs) can manage the hefty outgoing cashflow, which can be utilized to save for retirement funds and also help manage future medical costs with slightly higher deductibles (Medicare on Video - Free Medicare Help, 2022).

Moreover, including annuities as part of my retirement plan will provide a steady income source, which can be a reliable source of funds throughout my retirement years. These steps, combined with a diverse investment approach, will provide additional security when preparing for a financially stable retirement.

### **Reflection**

**Thinking back to week one experience with spreadsheet, do you feel more confident today in your ability to analyze data and build financial models using MS Excel? Why?**

Looking back to week one, I am more confident now in my ability to analyze data and create financial models with Microsoft Excel. I re-used week one's loan payment calculator model as the basis for developing the retirement plan model in week seven. The hands-on experience building the retirement planning model deepened my understanding of Excel's advanced features, such as financial formulas, and scenario analysis.

This practical application demonstrated how to use Excel to address real-world financial challenges effectively. The most valuable takeaway is understanding how different variables such as savings rate, retirement age and investment returns relate to one another. This knowledge has been crucial to creating dynamic and flexible models that can adapt to changing circumstances to arrive at informed financial decisions. This experience enhanced my technical skills and strengthened my trust in using Excel as a powerful tool for financial planning.

**After your experience in this class, do you see MS Excel as an essential workplace skill? Why?**

I can say that mastering MS Excel is a valuable skill in financial modeling, data analysis, and scenario planning through my experiences in this class from week one till week 7. Excel is a great tool for informed decision-making. Whether it's for creating dynamic retirement plans, budget forecasts, loan payments or simply for tracking performance metrics. Excel's functionality enhances productivity and it is an essential skill in fields like accounting, finance and project management.

**What surprises did you experience while using the Retirement Planning Model to analyze your personal situation?**

I am surprised how even small changes in input parameters and decisions, such as savings rate or retirement age, could hugely impact the overall retirement plan. This taught me the importance to review and adjust financial strategies regularly.

**What changes do you plan to make to retirement planning strategy because of this project?**

I will increase my annual savings rate, adjust retirement plan to consider my personal financial situation and market conditions. Further, I also plan to better manage risks by diversifying my investment portfolio.

**Discuss three things you learned while completing this project. Be specific.**

The following three findings improved both my financial modeling skills and planning.

### **Scenario Analysis**

Scenario analysis have taught me how even small changes like retirement age or savings rate, can greatly affect outcomes, highlighting the need for flexible financial planning.

For example, retirement at 60 compared to 65 required a much higher annual savings to maintain current lifestyle. This highlighted the importance of preparing for various what-if situations (This Is Our Retirement, 2022b).

**Role of Inflation**

I also learnt how slightest change in inflation rates can erode purchasing power over time, showing the need for inflation-adjusted returns and regularly planning reviews.

**The Value of Diversification**

Diversifying of investment portfolio helped reduce risks and improved long-term returns, facilitating greater financial security in retirement.

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