

THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF FINANCE

A PERSONAL WEALTH MANAGEMENT GUIDE FOR COLLEGE STUDENTS

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ABSTRACT

The purpose of building this Excel project in financial planning is to help college graduates to make a smooth transition to be financially independent from their parents. Under ‘Main Display’ tab of the Excel Spreadsheet instructions are given for users to put in their input, and explanations are given for the table and graphic displays. It provided tax estimation, budget planning and retirement account management information for students with a minimum amount of complexity. You may access the project by clicking the link: <http://sdrv.ms/10j1SV2>

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Chapter 1

Introduction

Since the financial crisis, the job market for college students has been challenging. Lots of recent college graduates cannot find their ideal jobs and are working on temporary positions. The default rate of college loans have raised three constant years. Meanwhile, students usually go back to graduate school and/or purchase a mortgage within five to ten years after their graduation. It will be a tough time for students to pay back their college loans on time as well as build up savings for graduate school and mortgages with limited income. These phenomena created a need for students to have more knowledge on financial planning.

The purpose of building this Excel project for college graduates was to help them to make a smooth transition to be financially independent from their parents. The guide introduces students to very practical accounting and finance knowledge, such as balance sheets, taxes payable and consumption smoothing. Instructions and explanations were written in the linguistic pattern that students were familiar with, and graphics were widely applied to visualize the information. It aimed to help users to understand scenarios such as what will happen to their 401 K plan if they switch to another job, how to use a balance sheet to view the money inflows and outflows and budgeting expenses, and how to use investment tools efficiently to earn desirable rate of return. I want to assist college graduates through the transition period between schools and workforce to reach their goal of financial freedom as soon as possible.

Chapters discussed in the guide include tax, budgeting, rate of return on investment, consumption smoothing and income statements. Two case studies are provided to give a guideline on how the Excel spreadsheet can be used to satisfy basic users and users with advanced Excel skill.

Chapter 2

Literature Review

The original idea of writing my thesis on helping college graduates with optimal financial planning comes from an Excel spread sheet built by Christopher Conforti. The spread sheet calculates a person's yearly savings by deducting taxes and living expenses from the gross salary and bonus. Later, I searched on the internet for similar budgeting tools: for example, PNC bank provides Virtual Wallet to student for basic budgeting which categorized monthly expenses on user's debt card and presented them with pie charts. For more advanced budgeting, Microsoft provided a desktop tool "Microsoft Money" was the most comprehensive that you can link all your credit cards and investment accounts to it. On the Microsoft platform, users were able to see the whole picture of their financial situation by click on the charts and graphs they need. Unfortunately, Microsoft has essentially conceded that there's no demand for the product with banks, brokerage firms and Web sites now providing a range of options for managing personal finances. Nowadays, one of the most popular free personal wealth management tools online is considered to be mint.com which provided similar functions and services as "Microsoft Money" as well as a large scale BBS for users to interact with each other for saving ideas and budgeting tips.

My thesis is targeting on the recent graduated students and their specific needs. For example, paying off student loans, buying/renting apartments etc. To do this, I looked up the consumer expenditure survey on the Bureau of Labor Statistics webpage which provided household expenses breakdown with income brackets. In details, the survey report gives me a percentage of household income spending on food, alcohol, housing, transportation, health care,

entertainment, taxes and miscellaneous which varies with households of different income levels. Information from the survey report reveals the consumer behavior of different income group and can be used to provide estimate to the expense budget for college students. In addition, in chapter three of the book, “Personal finance – an interactive applications approach”, by Dan French and Megan Heffernon, it discusses how much loan or monthly rent would a person be able to take out based on his/her annual income and how to calculate the amount. Most graduated students are not likely to live at home when they start work after college; therefore, they are likely to consider either leasing an apartment or purchasing a house with a loan. I would like to build in such calculator in my project to meet such need.

On the other hand, neither does Christopher’s spread sheet nor do the online personal wealth management tools build in the idea of consumption smoothing when assisting users with budgeting. I plan to include this part in my project to give student users a general understanding on the influence of long term saving. David Bader compared the difference between traditional and roth 401k plans on consumption smoothing in his honors thesis. He modeled the consumption and savings habits of an individual throughout his/her lifetime. Dr. James Miles also recorded a series of Youtube videos on how to build a spread sheet for consumption smoothing which I can refer to while doing my project. Mohit Kudaravalli discussed using valuation ratios to predict retirement portfolio performance in his honors thesis. He used a variety of functions to build regression graphs that visualized the return for different asset allocation in the retirement portfolio. I may refer to his functions when providing estimations on expected returns for the overall consumption smoothing strategy in a bull, stable and bear market. Besides, Janathan Skinner’s paper, Are You Sure You’re Saving Enough for Retirement?, stated that health care cost after retirement is significant and the trend from the past indicated that the out-of-pocket health care costs after retirement were continuously growing. Since the budget for health care is

increasing significantly, he put doubts on the view that expenses after retirement would reduce by cutting the budget for children expenses (e.g. no more bills from college tuition, move to a smaller home when children left). For my project, I might give some additional analysis based on his thoughts and help students better foresee their needs after retirement. Dr. Skinner also paid attention to changes in wealth to income ratio throughout a person's life period mainly influenced by whether the person chooses to buy or rent for an apartment and when. Since housing plays such a significant role in retirement planning and living standard, I would talk about reverse mortgage as an alternative option for those people who don't have enough saving when retiring but own mortgage to achieve their consumption smoothing goal. Shawn Jiang wrote his honors thesis on implementing reverse mortgage in China which I would use as a reference. Last but not least, Dr. Skinner introduced ESPlanner as an online retirement planning tool in his paper. The website has a systematic explanation on the idea of consumption smoothing with a built-in calculator for users to try out the strategy with their own situation.

Chapter 3

Tax

Income tax was calculated at three levels: federal, state, and city; in addition, tax methods used before retirement and after retirement were different.

To begin with calculating federal tax before retirement, it could be divided into three different categories: federal annual income tax, Medicare tax, and social security tax. For the federal income tax, there is new adjustment on the highest tax bracket starting in fiscal year 2013. The table below shows the inflation adjusted new tax bracket (to 2012 dollars) using the average annual CPI during tax year.

2013			CPI: 234.345 (Projected)		
Married Filing Jointly			Married Filing Separately		
Marginal Tax Rate	Tax Brackets		Marginal Tax Rate	Tax Brackets	
	Over	But Not Over		Over	But Not Over
10.0%	\$0	\$17,488	10.0%	\$0	\$8,744
15.0%	\$17,488	\$71,030	15.0%	\$8,744	\$35,515
25.0%	\$71,030	\$143,432	25.0%	\$35,515	\$71,716
28.0%	\$143,432	\$218,528	28.0%	\$71,716	\$109,264
33.0%	\$218,528	\$390,273	33.0%	\$109,264	\$195,137
35.0%	\$390,273	-	35.0%	\$195,137	-
39.6%	\$440,876	-	39.6%	\$220,438	-

Note: Last law to change rates was the American Taxpayer Relief Act of 2012.

2012			CPI: 229.594		
Married Filing Jointly			Married Filing Separately		
Marginal Tax Rate	Tax Brackets		Marginal Tax Rate	Tax Brackets	
	Over	But Not Over		Over	But Not Over
10.0%	\$0	\$17,400	10.0%	\$0	\$8,700
15.0%	\$17,400	\$70,700	15.0%	\$8,700	\$35,350
25.0%	\$70,700	\$142,700	25.0%	\$35,350	\$71,350
28.0%	\$142,700	\$217,450	28.0%	\$71,350	\$108,725
33.0%	\$217,450	\$388,350	33.0%	\$108,725	\$194,175
35.0%	\$388,350	-	35.0%	\$194,175	-

Note: Last law to change rates was the Jobs and Growth Tax Relief Reconciliation Act of 2003.

Figure 3-1: Federal Individual Income Tax Rates History Inflation Adjusted (Federal Rates History in 2012 Real Dollar)

The Internal Revenue Service (IRS) has released the remainder of the 2013 inflation adjustments, including this year's tax rates and income brackets (which are now permanent). Below is a table of tax brackets with the nominal interest rate and the information highlighted in the red box below (for a single tax payer) were used in building my spreadsheet.

Nominal			2013								
Married Filing Jointly			Married Filing Separately			Single			Head of Household		
Marginal	Tax Brackets		Marginal	Tax Brackets		Marginal	Tax Brackets		Marginal	Tax Brackets	
Tax Rate	Over	But Not Over	Tax Rate	Over	But Not Over	Tax Rate	Over	But Not Over	Tax Rate	Over	But Not Over
10.0%	\$0	\$17,850	10.0%	\$0	\$8,925	10.0%	\$0	\$8,925	10.0%	\$0	\$12,750
15.0%	\$17,850	\$72,500	15.0%	\$8,925	\$36,250	15.0%	\$8,925	\$36,250	15.0%	\$12,750	\$48,600
25.0%	\$72,500	\$146,400	25.0%	\$36,250	\$73,200	25.0%	\$36,250	\$87,850	25.0%	\$48,600	\$125,450
28.0%	\$146,400	\$223,050	28.0%	\$73,200	\$111,525	28.0%	\$87,850	\$183,250	28.0%	\$125,450	\$203,150
33.0%	\$223,050	\$398,350	33.0%	\$111,525	\$199,175	33.0%	\$183,250	\$398,350	33.0%	\$203,150	\$398,350
35.0%	\$398,350	\$450,000	35.0%	\$199,175	\$225,000	35.0%	\$398,350	\$400,000	35.0%	\$398,350	\$425,000
39.6%	\$450,000		39.6%	\$225,000		39.6%	\$400,000		39.6%	\$425,000	

Note: Last law to change rates was the American Taxpayer Relief Act of 2012.

Figure 3-2: Federal Individual Income Tax Rates History Nominal (Federal Rates History Nominal)

The differences in tax brackets revealed the effects of the American Taxpayer Relief Act of 2012. Briefly speaking, the Act provide a partial solution to the fiscal cliff that it gives permanence to the lower rate of much of the Bush tax cuts, while retaining the higher tax rate at upper income levels (Estimate of the Budgetary Effects of H.R. 8, the American Taxpayer Relief Act of 2012, as passed by the Senate on January 1, 2013).

For a single taxpayer, the first \$8,925 of your income was taxed at ten percent. If the Relief Act hadn't made this Bush-era rate permanent, the income would have been taxed at 15 percent, so there was a five percentage point savings. On the other hand, a new tax bracket was added to the high-income class that a single taxpayer would pay a tax rate of 39.6 percent for income over \$400,000. Another thing worth mentioning was that the 35 percent income bracket was very thin for a single taxpayer which was from \$398,351 to \$400,000—a \$1,650 difference. According to Kay Bell, the thin bracket could be a problem in the way that a high-income single taxpayer would soon observe his/her maximum income tax rate jump from 33% to 39.6% with a slight increase in wage payment/inflation (Bell).

For my project, I used the tax brackets with the 2013 nominal rate for a single taxpayer. Excel 'IF' function was used to calculate the federal income tax payable. For example, for a single taxpayer who has taxable income of \$69,500 for fiscal year 2013, his/her taxable income was calculated as: $\text{IF}(\text{AND}(\$C\$3 < B7, \$C\$3 > B6), (D6 + D5 + (\$C\$3 - B6) * C7), 0)$

Federal Tax Brackets			
Annual Income:	\$ 69,500.00		
0		Full Tax	
\$ 8,950.00	10.00%	\$ 895.00	\$ -
\$ 36,250.00	15.00%	\$ 4,095.00	\$ -
\$ 87,850.00	25.00%	\$ 12,900.00	\$ 13,302.50
\$ 183,250.00	28.00%	\$ 26,712.00	\$ -
\$ 398,350.00	33.00%	\$ 70,983.00	\$ -
\$ 400,000.00	35.00%	\$ 577.50	\$ -
Over \$400,000	39.60%		\$ -
			\$ 13,302.50
Medicare	1.45%		\$ 1,007.75
Over \$200,000	2.35%		\$ -
Social Security	6.20%		
Max:	\$ 113,700.00		\$ 4,309.00
Total Federal Tax:			\$ 18,619.25

Figure 3-3: 2013 Federal Income Tax Brackets

The meaning of the code was that if his/her income is between \$36,250 (B6) and \$87,850 (B7) then his/her federal tax would be a summation of the full tax amount for the \$0-\$8950 (i.e. 10 percent) tax bracket, the full tax amount for the \$8,950-\$36,250 (i.e. 15 percent) tax bracket and the partial tax amount for the \$36,250-\$87,850 (i.e. 25 percent) tax bracket. To say it in numbers, $\$895 + \$4,095 + (\$69,500 - \$36,250) \times 0.25 = \$11,302.5$. Therefore, the person was expected to pay \$11,302.5 on his/her income of the year.

Besides federal income tax, Medicare tax and social security tax are charged on a federal level too. 2.9 percent Medicare payroll tax—split equally between employer and employee—was extracted from all wages. For fiscal year 2013, ObamaCare added an additional 0.9 percent to individuals with annual incomes of \$200,000 and above (Matthews). Therefore, in my spreadsheet, the individual taxpayer was charged by 1.45% Medicare tax for annual income below \$200,000 and 2.35% for any income amount that was above \$200,000. The new bracket on higher income taxpayers would raise roughly \$87 billion over ten years, and the Medicare tax on

net investment income was expected to raise an additional \$123 billion over ten years, according to the Congressional Research Service Report for Congress (Rosenow). The Medicare taxes are intended to help pay for health insurance subsidies. As for social security tax, 12.4 percent was shared equally between employer and employee; the maximum taxable earnings were adjusted to \$113,700 in 2013 from \$110,100 in 2012 (2013 Social Security Changes). I used the Excel function =IF(\$C\$3<C16,\$C\$3*C15,C16*C15) to calculate social security tax payable. The function means if a taxpayer's income was below the maximum taxable earnings then 'income*6.2%=social security tax'; while if above the maximum, the social security tax would be a fixed amount = \$113,700*6.2% = \$7,049.4.

Federal tax for retirement was calculated in a very similar manner as before retirement, while Medicare tax and social security tax became no longer applicable. A taxpayer may refer to form 1040 and worksheet provided by the Department of the Treasury website to get the retirement income tax payable. I rewrote the deduction rules into my Excel spreadsheet which gave tax payable prediction to my users.

Federal Tax on Retirement			
Social Security	\$ 26,182.08	\$ 26,182.08	\$ 26,182.08
1/2 Social Security	\$ 13,091.04	\$ 13,091.04	\$ 13,091.04
Other Income	\$ 262,048.18	\$ 33,396.22	\$ 13,247.38
1/2 Taxable Amount	\$ 125,069.61	\$ 10,743.63	\$ 669.21
Single	\$ 9,000.00	\$ 9,000.00	\$ 9,000.00
D3 Subtract F3	\$ 116,069.61	\$ 1,743.63	\$ -
sum of H3 and L3	\$ 111,750.21	\$ 2,353.90	\$ -
Take half	\$ 58,034.81	\$ 871.81	\$ -
Taxable Amount	\$ 250,139.22	\$ 21,487.26	\$ 1,338.42
Smaller of the D2 and D3	\$ 13,091.04	\$ 10,743.63	\$ 669.21
Smaller of D2 and J2	\$ 13,091.04	\$ 871.81	\$ -
Taxable Percent	85%	85%	85%
Taxable Total:	\$ 11,127.38	\$ 2,353.90	\$ -

Figure 3-4: Tax on Retirement Income Calculation

Federal Tax Brackets (Retirement)					
		Annual Income:	\$ 11,127.38	\$ 2,353.90	\$ -
0		Full Tax			
\$ 8,950.00	10.00%	\$ 895.00	\$ -	\$ 235.39	\$ -
\$ 36,250.00	15.00%	\$ 4,095.00	\$ 1,221.61	\$ -	\$ -
\$ 87,850.00	25.00%	\$ 12,900.00	\$ -	\$ -	\$ -
\$ 183,250.00	28.00%	\$ 26,712.00	\$ -	\$ -	\$ -
\$ 398,350.00	33.00%	\$ 70,983.00	\$ -	\$ -	\$ -
\$ 400,000.00	35.00%	\$ 577.50	\$ -	\$ -	\$ -
Over \$400,000	39.60%		\$ -	\$ -	\$ -
			\$ 1,221.61	\$ 235.39	\$ -
Medicare	1.45%	\$ -			
Social Security	6.20%				
Max:	\$ 113,700.00	\$ -			
Total Federal Tax:			\$ 1,221.61	\$ 235.39	\$ -

Figure 3-5: 2013 Federal Income Tax on Retirement Income

State and local taxes are only charged when a person was in the workforce and retirement income was exempt from being taxed. My project has built tax calculators for New York State and Pennsylvania State. New York State tax was charged by income brackets so the calculator I built was highly similar to the federal tax calculator. For example, a person with an annual income of \$73,000 would be charged \$4,391.5 on NY state tax. While Pennsylvania in comparison was more tax friendly, that income tax was charged at a flat rate of 3.07% (State-by-State Guide to Taxes on Retirees). So the person with the same income of \$73,000 would pay only \$2,241.1 on state tax if he/she lived in Pennsylvania instead of New York.

	B	C	D	E
20	State Tax Brackets			
21	Total Income:	\$ 73,000.00		
22				
23	0		Full Tax	
24	\$ 8,000.00	4.00%	\$ 320.00	\$ -
25	\$ 11,000.00	4.50%	\$ 135.00	\$ -
26	\$ 13,000.00	5.25%	\$ 105.00	\$ -
27	\$ 20,000.00	5.90%	\$ 413.00	\$ -
28	\$ 75,000.00	6.45%	\$ 3,547.50	\$ 4,391.50
29	\$ 200,000.00	6.65%	\$ 8,312.50	\$ -
30	\$ 1,000,000.00	6.85%	\$ 54,800.00	\$ -
31	Over \$1,000,000.00	8.82%		\$ -
32				
33	Total NY Tax:			\$ 4,391.50
34				
35	PA Tax:	3.07%	N/A	\$ 2,241.10

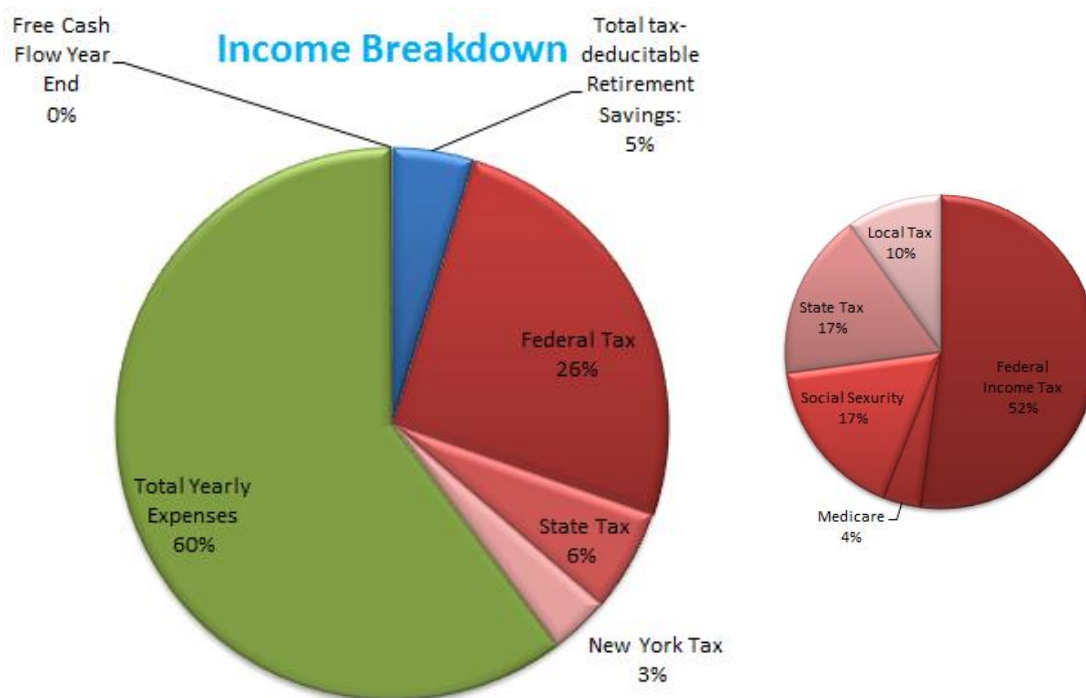
Figure 3-6: 2013 New York State Income Tax Brackets

For city tax, I provide calculations for the three most common cities that Penn State alumni went to: New York City, Philadelphia, and Pittsburgh. New York City tax was calculated by brackets while Philadelphia and Pittsburgh were calculated on flat rates of 3.93% and 3.00%.

	B	C	D	E
37	City Tax Brackets			
38	0		Full Tax	
39	\$ 12,000.00	2.91%	\$ 348.84	\$ -
40	\$ 25,000.00	3.53%	\$ 459.42	\$ -
41	\$ 50,000.00	3.59%	\$ 897.75	\$ -
42	\$ 500,000.00	3.65%	\$ 16,416.00	\$ 2,545.05
43	Over \$500,000.00	3.88%		\$ -
44				
45	Total NYC Tax			\$ 2,545.05
46				
47	Philadelphia Tax:	3.93%	N/A	\$ 2,867.44
48	Pittsburgh Tax:	3.00%	N/A	\$ 2,190.00

Figure 3-7: 2013 New York City Income Tax Brackets

According to the spreadsheet I built, a person with annual taxable income of \$69,500 was estimated to have an effective tax rate of 36.77% which was equivalent to \$25,555.8. See the graph below for the breakdown of \$25,555.8 in terms of federal, state and local levels.



*This breakdown was based on a person worked in New York City for state and local tax liabilities

Figure 3-8 Income Breakdown and Taxes Breakdown Tables

The main chart visualized the tax effects on an individual's income that tax payable was more than a third of the pie; the sub-chart visualized the tax effects on three levels that federal tax was almost 75 percent of the total tax payable.

Tax after retirement was significantly lower, in that a middle-income person would have a chance of paying NO tax if he/she doesn't have additional income besides social security income.

Chapter 4

Expenses

In my project, I built two functions related to expenses. The first function is an expenses budgeting sheet under the 'Main Display' tab and the second function is a budgeted vs. actual expenses comparison table under the 'Budget vs. Actual' tab.

For budgeting, I built a budgeting table by month, in which, however, food section was budgeted on a weekly basis:

	I	J	K	L	M	N	O	P	Q
2		Food Expenses				Other Monthly Expenses		% Gross Salary	% Net Income
3		Weekday			14	<i>Rent</i>	\$ 1,000.00	16.44%	27.31%
4	5	Breakfast	\$ 3.00		15	<i>Cable/Internet</i>	\$ 95.00	1.56%	2.59%
5	6	Lunch	\$ 10.00		16	<i>Transportation</i>	\$ 200.00	3.29%	5.46%
6	7	Dinner	\$ -		17	<i>Cell Phone</i>	\$ 60.00	0.99%	1.64%
7		Weekend			18	<i>Gym</i>	\$ 70.00	1.15%	1.91%
8		<i>Saturday</i>	<i>Eat In</i>			Food	\$ 793.00	13.04%	21.65%
9	8	Breakfast	\$ 3.00		19	<i>Clothes</i>	\$ 125.00	2.05%	3.41%
10	9	Lunch	\$ 25.00		20	<i>Social Networking</i>	\$ 300.00	4.93%	8.19%
11	10	Dinner	\$ 45.00		21	<i>Recreation</i>	\$ 80.00	1.32%	2.18%
12		<i>Sunday</i>	<i>Eat Out</i>		22	<i>Dry Cleaners</i>	\$ 40.00	0.66%	1.09%
13	11	Breakfast	\$ 12.00		23	<i>Misc</i>	\$ 300.00	4.93%	8.19%
14	12	Lunch	\$ 25.00						
15	13	Dinner	\$ 8.00		24	<i>Savings in Bank</i>	\$ 595.00	9.78%	16.25%
16		Total Weekly Food	\$ 183.00					60.13%	99.89%
17		Total Monthly Food	\$ 793.00			<i>Total Monthly:</i>	\$ 3,658.00		
18		Total Yearly Food	\$ 9,516.00			<i>Total Yearly Expenses:</i>	\$ 43,896.00		

Figure 4-1 Food and Other Expenses Inputs Tables

To explain my design in detail: In the food expenses table, 'Total Weekly Food' (cell 'K16') was calculated as weekday breakfast (cell 'K4')*5 + weekday lunch (cell 'K5')*5 + weekday dinner (cell 'K6')*5 + weekend expenses (sum of cell 'K9-11, K13-15'). 'Total Monthly Food' was calculated as 'Total Weekly Food' multiplied by 52 (number of weeks in a year) and then divided by 12 (number of months in a year). 'Total Yearly Food' was calculated as 52* 'Total Weekly Food'. Once the user fill out the food expenses table, the number in the 'Total Monthly Food'

would flow into cell 'O8' in the 'Other Monthly Expenses' table. The text contents in cell 'N3-6', which were grey and italic, stood for less elastic expenses categories. For example, rent and cable/internet are most likely to be a yearly contract with low deviation by month. Expense category 'Misc' (cell 'N13') was designed for users to put in their own personal expenses that were not listed in previous categories—vacation plans, etc. There was a trade-off between complexity and details; I preferred to make input cells as few as possible to give the users a big picture of their expenses situation with the least amount of complexity. And users could always have an option of customizing the budgeting sheet to their own needs since it was an open source. Column P gave a percentage breakdown of a person's expenses in terms of his/her gross income; Column Q gave a percentage breakdown of a person's expenses in terms of his/her net income. Below is a sample breakdown of my expenses budgeting:

Expenses Breakdown

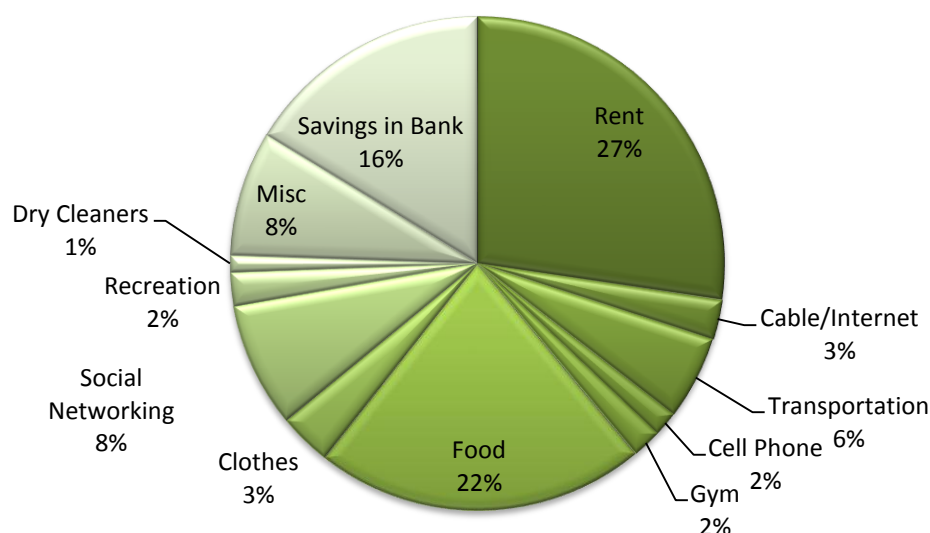


Figure 4-2 Expenses Breakdown Table

I looked up the Consumer Expenditure Survey that Professor James Miles recommended; the survey data gave a horizontal comparison of my expenses breakdown to others. The data I used

below was the 2011 survey results that were carried out by the U.S. Bureau of Labor Statistics in September, 2012. Data for more recent years was not available.

Average annual expenditures		Food		Housing	
All Consumer Units	\$49,705	\$ 6,458.00	13%	\$ 16,803.00	34%
Lowest 20 Percent	\$22,001	\$ 3,547.00	16%	\$ 8,771.00	40%
Second 20 Percent	\$32,092	\$ 4,659.00	15%	\$12,136.00	38%
Third 20 Percent	\$42,403	\$ 5,620.00	13%	\$14,944.00	35%
Fourth 20 Percent	\$57,460	\$ 7,466.00	13%	\$18,840.00	33%
Highest 20 Percent	\$94,551	\$10,991.00	12%	\$29,321.00	31%

Figure 4-3 Consumer Expenditure Survey Results Table

Since my budgeted total yearly expenses were \$43,896, I compared my expenses breakdown to the middle 20 percent with average yearly expenditure \$42.403 in the survey results table (the table above was a summary of it). I found that my food expenses budget was seven percent higher than my category while my housing expenses budget was seven percent lower. These provide reference information to me if I would like to further adjust my budget. However, the goal is not to have budgeted spending highly similar to the survey results but to the actual spending pattern.

For budgeted vs. actual expenses function, it was simply a table where users could put in their actual expenses every month to track how they were doing in comparison to their budget.

Budgeted		April	May	June	July	August	September	October	November	December	Yearly Total	Differences
\$ 1,000.00	Rent	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$12,000.00	0.00%
\$ 95.00	Cable/Internet	\$ 95.00	\$ 95.00	\$ 95.00	\$ 95.00	\$ 95.00	\$ 95.00	\$ 95.00	\$ 95.00	\$ 95.00	\$ 1,140.00	0.00%
\$ 200.00	Transportation	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 200.00	\$ 2,400.00	0.00%
\$ 60.00	Cell Phone	\$ 85.00	\$ 60.00	\$ 60.00	\$ 60.00	\$ 125.00	\$ 60.00	\$ 60.00	\$ 60.00	\$ 60.00	\$ 810.00	12.50%
\$ 70.00	Gym	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 840.00	0.00%
\$ 793.00	Food	\$ 793.00	\$ 793.00	\$ 793.00	\$ 793.00	\$ 793.00	\$ 793.00	\$ 793.00	\$ 793.00	\$ 793.00	\$ 9,516.00	0.00%
\$ 125.00	Clothes	\$ 125.00	\$ 125.00	\$ 125.00	\$ 125.00	\$ 125.00	\$ 125.00	\$ 125.00	\$ 125.00	\$ 125.00	\$ 1,500.00	0.00%
\$ 300.00	Social Networking	\$ 400.00	\$ 500.00	\$ 500.00	\$ 500.00	\$ 500.00	\$ 500.00	\$ 400.00	\$ 300.00	\$ 300.00	\$ 4,800.00	33.33%
\$ 80.00	Recreation	\$ 80.00	\$ 80.00	\$ 80.00	\$ 80.00	\$ 80.00	\$ 80.00	\$ 80.00	\$ 80.00	\$ 80.00	\$ 960.00	0.00%
\$ 40.00	Dry Cleaners	\$ 20.00	\$ 40.00	\$ 40.00	\$ 40.00	\$ 20.00	\$ 20.00	\$ 60.00	\$ 60.00	\$ 60.00	\$ 460.00	-4.17%
\$ 300.00	Misc	\$ 300.00	\$2,000.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 5,300.00	47.22%
\$ 595.00	Savings in Bank	\$ 595.00	\$ 595.00	\$ 595.00	\$ 595.00	\$ 595.00	\$ 595.00	\$ 595.00	\$ 595.00	\$ 595.00	\$ 7,140.00	0.00%
\$ 3,658.00	Total Monthly:	\$3,763.00	\$5,558.00	\$3,858.00	\$3,858.00	\$3,903.00	\$3,838.00	\$3,778.00	\$3,678.00	\$3,678.00		

Figure 4-4 Yearly Actual Vs. Budgeted Expenses Comparison Table

The column *yearly* total was the sum of total actual expenses for each category and the differences were the percentage differences between actual and budgeted. I used conditional formatting for the differences column to visualize the condition and make it more user-friendly. If

actual expense was equal to or below budgeted expense, it would show a green dot; if actual expense was above budgeted expense but didn't exceed 150 percent of the budgeted expense, it would have a yellow dot; if actual expense was more than 150 percent of the budgeted expense, it would have a red dot. In addition, a graph was also provided for user to track their performance on a *monthly* basis.

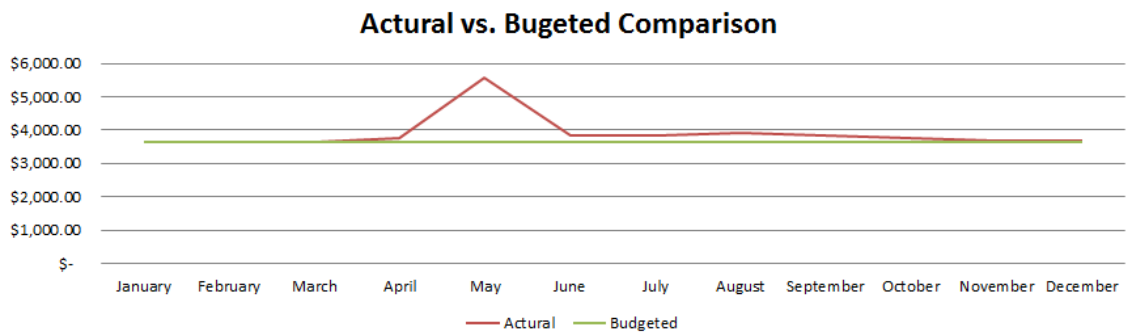


Figure 4-5 Monthly Actual Vs. Budgeted Expenses Comparison Chart

Chapter 5

401k Retirement Savings

Overview

There were 4 different tables and charts built for the 401k retirement savings display: the ‘401k Contribution/Withdraw Table’ was a table for the user to input the percentage they would like to invest under categories of deposit, T bond and stock; the ‘rate of return chart’ was the chart that visualized the rate of return on the 401k account investment based on the user’s input in the ‘401k Contribution/Withdraw Table’; the ‘Annual Consumption Spending Table’ was a table for the user to understand consumption smoothing ability of his/her 401k; the ‘401k Account Balance Chart’ was a chart to visualize the ‘Annual Consumption Spending Table’ which pointed out the maximum 401k balance before retirement withdraw.

In addition, the ‘Retirement’ tab was set up to run the background calculation for display of the 4 tables and charts mentioned. And the ‘Reference,’ ‘Stock Raw,’ ‘Stock,’ ‘Bond Raw,’ ‘Bond,’ ‘Tbill Raw,’ ‘Tbill’ tabs were used to calculate the rate of return by category.

In this chapter, I am going to explain the 401k retirement savings function in three sections: the calculation of the rates of return, the weighted average rate of return, and the consumption smoothing analysis.

Calculation of the Rates of Return

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		S&P500	T-Bonds	T-Bills	Inflation		Real	Real	Real		Year	Age	Year	Rate
2		large stk	(gov't)	(t bill)	Rate		Stock	T-bonds	Tbill		Predict		Assigned	Assigned
3	1926	11.62%	7.77%	3.27%	-1.49%		13.11%	9.26%	4.75%		2013	23	1993	15.48%
4	1927	37.49%	8.93%	3.13%	-2.08%		39.57%	11.01%	5.20%		2014	24	1983	-3.12%
5	1928	43.61%	0.10%	3.24%	-0.96%		44.57%	1.07%	4.21%		2015	25	1969	-11.18%
6	1929	-8.41%	3.42%	4.75%	0.20%		-8.61%	3.22%	4.55%		2016	26	1936	6.31%
7	1930	-24.90%	4.66%	2.41%	-6.03%		-18.87%	10.69%	8.44%		2017	27	1978	-10.19%
8	1931	-43.34%	-5.31%	1.07%	-9.53%		-33.81%	4.21%	10.60%		2018	28	1975	2.18%
9	1932	-8.19%	16.84%	0.96%	-10.30%		2.10%	27.14%	11.26%		2019	29	1987	-2.68%
10	1933	53.99%	-0.07%	0.30%	0.51%		53.48%	-0.58%	-0.21%		2020	30	1973	-9.91%
11	1934	-1.44%	10.02%	0.16%	2.03%		-3.47%	7.99%	-1.87%		2021	31	1957	4.43%
12	1935	47.67%	4.98%	0.17%	2.99%		44.68%	2.00%	-2.82%		2022	32	1964	2.32%
⋮														
80	2003	28.50%	2.70%	0.99%	1.80%		26.70%	0.90%	-0.81%					
81	2004	10.88%	7.70%	1.32%	3.30%		7.58%	4.40%	-1.98%					
82	2005	4.91%	6.61%	2.94%	3.39%		1.52%	3.22%	-0.45%					
83	2006	15.79%	1.74%	4.71%	3.24%		12.55%	-1.50%	1.47%					
84	2007	5.49%	9.81%	4.78%	3.50%		1.99%	6.31%	1.28%					
85	2008	-37.10%	23.10%	2.10%	0.00%		-37.10%	23.10%	2.10%					
86	2009	26.50%	-12.90%	1.00%	2.70%		23.80%	-15.60%	-1.70%					
87	2010	15.10%	9.40%	0.00%	1.50%		13.60%	7.90%	-1.50%					
88	2011	2.10%	29.90%	0.10%	3.00%		-0.90%	26.90%	-2.90%					
89	2012	15.96%	3.47%	1.00%	2.10%		13.86%	1.37%	-1.10%					

Figure 5-1 Historical Rate of Return Raw Data Table

Professor James Miles provided me data from Wharton Research Data Services on S&P500, T-bonds and T-Bills returns and inflation rates between the year 1926 and the year 2011. I found the 2012 data on Vanguard from its investment funds' returns. Real return is the nominal return minus the inflation rate. Therefore, in the spreadsheet, 'Real Stock' (Column G) was calculated as 'S&P500 large stk' (Column B) minus 'Inflation Rate' (Column E); the same concept was applied to the calculation of 'Real T bonds' (Column H) and 'Real Tbill' (Column I).

I am interested in having an estimation of future real returns under each category based on the historical real returns that I calculated so that my users can know how they are doing with their 401k savings. Therefore, I assigned a real rate of return to a future year by randomly selecting a real rate of return from historical years. For example, for year 2013 (cell B3) when a person is 23 years old (cell L3), I randomly assigned the historical year 1993 (cell M3) with stock

rate of return 7.24% (cell N3) by: first, I used function ‘RANDBETWEEN(1926,2012)’ to randomly select a year (in this case) to assign to the given year 2013. Second, I used function ‘=VLOOKUP(M3,\$A\$3:\$G\$89,6)’ to look for the 1993 real stock rate of return under the ‘Real Stock Rate’ column and found the rate to be 7.24%. The same method was used to generate ten sets of data and store them under the ‘Stock Raw’ tab; ‘Bond Raw’ and ‘Tbill Raw’ tabs were generated in the similar manner using slightly different VLOOKUP commands.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	2013	23	1962	-9.95%	1962	-9.95%	1934	-3.47%	1983	18.72%	1974	-38.67%	2012	13.86%	1985	28.45%	1955	31.19%	1931	-33.81%	1990	-9.52%
2	2014	24	2000	-12.55%	1998	26.97%	1941	-21.31%	1967	20.93%	1973	-23.46%	2004	7.58%	1993	7.24%	1957	-13.80%	1950	25.92%	1966	-13.42%
3	2015	25	1958	41.60%	1959	10.46%	1989	26.85%	2007	1.99%	2008	-37.10%	1942	11.06%	1960	-1.01%	1976	19.03%	1937	-38.13%	1946	-26.24%
4	2016	26	2005	1.52%	1975	30.19%	1994	-1.36%	1990	-9.52%	1998	26.97%	1975	30.19%	1967	20.93%	1971	10.95%	2004	7.58%	1970	-1.48%
5	2017	27	1976	19.03%	1949	20.60%	1973	-23.46%	1988	12.39%	1937	-38.13%	1981	-13.85%	1935	44.68%	1952	17.49%	1938	33.90%	1928	44.57%
6	2018	28	1965	10.52%	2006	12.55%	2011	-0.90%	2006	12.55%	1974	-38.67%	1926	13.11%	1992	4.78%	1926	13.11%	1988	12.39%	1930	-18.87%
7	2019	29	1987	0.82%	1979	5.13%	1992	4.78%	1975	30.19%	1996	19.75%	1979	5.13%	1943	22.74%	1987	0.82%	2001	-13.49%	1970	-1.48%
8	2020	30	1939	0.06%	1938	33.90%	1950	25.92%	1987	0.82%	1957	-13.80%	1951	18.14%	1999	18.42%	1940	-10.74%	1946	-26.24%	1980	20.02%
9	2021	31	1971	10.95%	1989	26.85%	1939	0.06%	1949	20.60%	1937	-38.13%	1967	20.93%	1976	19.03%	1927	39.57%	1945	34.18%	1959	10.46%
10	2022	32	1930	-18.87%	1940	-10.74%	1981	-13.85%	1975	30.19%	2003	26.70%	1940	-10.74%	1987	0.82%	1958	41.60%	1969	-14.61%	1939	0.06%
64	2076	86	1994	-1.36%	1956	3.70%	1935	44.68%	1994	-1.36%	1941	-21.31%	1969	-14.61%	1939	0.06%	1980	20.02%	2000	-12.55%	1990	-9.52%
65	2077	87	2007	1.99%	1963	21.15%	1927	39.57%	1943	22.74%	1987	0.82%	1987	0.82%	1962	-9.95%	1940	-10.74%	1944	17.65%	1967	20.93%
66	2078	88	1986	17.72%	1938	33.90%	1959	10.46%	1944	17.65%	2003	26.70%	1960	-1.01%	1965	10.52%	1972	15.56%	1972	15.56%	1960	-1.01%
67	2079	89	1927	39.57%	2005	1.52%	1929	-8.61%	1988	12.39%	1993	7.24%	2010	13.60%	2005	1.52%	1982	17.54%	1964	15.29%	1987	0.82%
68	2080	90	1993	7.24%	1981	-13.85%	1976	19.03%	1974	-38.67%	1951	18.14%	2012	13.86%	1950	25.92%	1993	7.24%	1959	10.46%	2002	-24.30%
69	2081	91	1990	-9.52%	1967	20.93%	1956	3.70%	2009	23.80%	1935	44.68%	1929	-8.61%	2011	-0.90%	1935	44.68%	1972	15.56%	1984	2.32%
70	2082	92	1939	0.06%	1962	-9.95%	1933	53.48%	1928	44.57%	1938	33.90%	1967	20.93%	1970	-1.48%	1975	30.19%	1963	21.15%	1971	10.95%
71	2083	93	2009	23.80%	1953	-1.61%	2009	23.80%	1998	26.97%	1969	-14.61%	2012	13.86%	1957	-13.80%	1971	10.95%	1989	26.85%	1928	44.57%
72	2084	94	1983	18.72%	1939	0.06%	1969	-14.61%	1980	20.02%	1992	4.78%	1956	3.70%	1994	-1.36%	1967	20.93%	1947	-3.30%	1942	11.06%
73	2085	95	1982	17.54%	1967	20.93%	1987	0.82%	1977	-13.96%	1967	20.93%	2001	-13.49%	1940	-10.74%	1997	31.65%	1934	-3.47%	1961	26.22%
74	Taxes & SSN Retirement reference Stock raw Stock Bond raw Bond Thill raw Thill Survey																					

Figure 5-2 Randomly Generated Stock Return Data Table

The table above was a record of ten sets of stock return data generated under the ‘Stock Raw’ tab. For my consumption smoothing analysis in the next section, I am interested in finding out the highest, median, and lowest cumulative returns for the years 2013 to 2085. Therefore, I further processed the data into the ‘Stock’ tab in which I copied and pasted the table in ‘Stock Raw’ for value only and had it transposed.

	A	B	C	D	E	F	G	H		BS	BT	BU	BV
1	product	2013	2014	2015	2016	2017	2018	2019		2082	2083	2084	2085
2	2126.652	1.1386	1.0758	1.110556	1.301902	0.861507	1.131115	1.051329		1.20934	1.1386	1.036959	0.8651
3	1203.201	0.96525	0.786914	1.268465	0.986361	0.765401	0.991	1.04784		1.534817	1.238	0.853852	1.008158
4	589.381	1.187176	1.20934	1.0199	0.904818	1.123937	1.1255	1.301902		1.445736	1.2697	1.200219	0.860438
5	572.6823	0.661887	1.259225	0.618701	1.0758	1.33898	1.123937	0.8651		1.211524	1.268465	0.966997	0.96525
6	556.9769	1.311898	0.861964	1.190307	1.10953	1.17486	1.131115	1.008158		1.301902	1.10953	1.20934	1.316541
7	74.27628	0.900481	1.2697	1.104564	1.301902	1.20595	1.1255	1.051329		0.900481	0.983857	1.000648	1.20934
8	70.07715	0.613291	0.765401	0.629	1.2697	0.618701	0.613291	1.197461		1.33898	0.853852	1.04784	1.20934
9	62.5479	0.900481	0.8745	1.416025	1.0152	1.190307	1.105244	1.008158		1.000648	1.238	1.187176	1.175368
10	27.31777	0.904818	0.865829	0.737648	0.985153	1.445736	0.81135	0.985153		1.10953	1.445736	1.110556	1.26218
11	15.89948	1.284469	1.072371	0.989924	1.20934	1.44683	1.04784	1.227375	...	0.985153	0.861964	0.986361	0.892576

Figure 5-3 Processed Stock Return Data Table

The newly added Column A was calculated by the PRODUCT function. For example, the formula used in cell A2 was =PRODUCT(B2:BV2). Therefore, the value in Column A stood for the cumulative rate of return for stock. By using the 'sort: from highest to lowest' tool in the Excel Data tool bar, I reordered the ten rates of return. Then, under the 'Retirement' tab, the highest, median, and lowest stock rates of return were identified. Row 64 was calculated as Row 53 – 1 starting from Column D. For example, the formula used for cell D64 was =D53 – 1. Row 65 and Row 66 were created in similar manner as Row 65 and these three rows were prepared for a future purpose which will be further explained in the next section.

	B	C	D	E	F	G	H	I		BU	BV	BW	BX
52	Stock	Cumulative	2013	2014	2015	2016	2017	2018		2082	2083	2084	2085
53	High	212665%	1.1386	1.0758	1.11055629	1.30190183	0.86150661	1.13111486		1.20933967	1.1386	1.0369592	0.8651
54		120320%	0.965250131	0.78691438	1.2684648	0.98636093	0.76540086	0.991		1.53481729	1.238	0.85385238	1.00815846
55		58938%	1.187176079	1.20933967	1.0199	0.90481758	1.12393741	1.1255		1.44573632	1.2697	1.20021914	0.8604377
56		57268%	0.661886694	1.25922468	0.61870135	1.0758	1.33898019	1.12393741		1.21152432	1.2684648	0.96699687	0.96525013
57		55698%	1.311897714	0.86196415	1.19030688	1.10953041	1.17485991	1.13111486		1.30190183	1.10953041	1.20933967	1.31654144
58	Median	7428%	0.900480583	1.2697	1.10456423	1.30190183	1.20595013	1.1255		0.90048058	0.98385731	1.00064755	1.20933967
59		7008%	0.613291147	0.76540086	0.629	1.2697	0.61870135	0.61329115		1.33898019	0.85385238	1.04783972	1.20933967
60		6255%	0.900480583	0.8745	1.41602464	1.0152	1.19030688	1.10524386		1.00064755	1.238	1.18717608	1.17536826
61		2732%	0.904817577	0.86582876	0.73764752	0.98515257	1.44573632	0.81134977		1.10953041	1.44573632	1.11055629	1.2621801
62	Low	1590%	1.284468695	1.07237071	0.98992355	1.20933967	1.44682991	1.04783972		0.98515257	0.86196415	0.98636093	0.89257638
63													
64	High		13.86%	7.58%	11.06%	30.19%	-13.85%	13.11%		20.93%	13.86%	3.70%	-13.49%
65	Median		-9.95%	26.97%	10.46%	30.19%	20.60%	12.55%		-9.95%	-1.61%	0.06%	20.93%
66	Low		28.45%	7.24%	-1.01%	20.93%	44.68%	4.78%	...	-1.48%	-13.80%	-1.36%	-10.74%

Figure 5-4 Stock Return Data by Scenarios Table

Identical steps were applied to 'Bond Raw' and 'Tbill Raw' tabs and created two tables, which are attached below under the 'Retirement' tab.

	TBond	Cumulative	2013	2014	2015	2016	2017	2018	2082	2083	2084	2085
36												
37	High	2964%	0.898134016	1.0631	1.079	0.92149301	1.00690857	0.92556275	1.05167346	1.0631	0.88815058	0.8364779
38		2230%	0.895517194	0.985	1.05663339	1.05130142	0.8547463	0.91216448	0.89813402	1.13453135	1.13453135	1.08483939
39		1044%	1.002965691	1.28280177	0.88815058	0.8364779	1.36474973	1.0631	1.269	0.95753475	1.10689133	1.269
40		923%	1.0322	1.29119045	1.08252176	1.02268682	1.0322	1.0631	1.0261	1.10689133	0.96241162	0.985
41		419%	0.900929277	1.0007071	1.06614093	1.05251033	0.8864	0.97127189	1.0322	0.88815058	1.05663339	0.8547463
42	Median	406%	0.987841846	1.06614093	0.91216448	1.00271634	0.92144125	1.0231685	1.16193776	0.96881586	1.03006847	1.05167346
43		269%	1.021798715	0.81730833	0.89813402	1.05130142	1.28280177	1.16193776	0.81730833	0.92908213	0.89813402	1.04212104
44		259%	1.084839389	1.29119045	1.09257577	1.0322	0.92556275	1.231	0.91549816	1.36474973	0.81730833	0.98784185
45		174%	1.161937762	1.02179872	0.87771391	1.16193776	0.8547463	1.00297999	0.90092928	1.12297707	1.09257577	1.11946615
46	Low	144%	1.063050704	0.95011187	0.90189239	0.9891863	1.00296569	1.1682	1.00296569	1.04212104	0.95753475	0.8364779
47												
48	High		-10.19%	6.31%	7.90%	-7.85%	0.69%	-7.44%	5.17%	6.31%	-11.18%	-16.35%
49	Median		-1.22%	6.61%	-8.78%	0.27%	-7.86%	2.32%	16.19%	-3.12%	3.01%	5.17%
50	Low		6.31%	-4.99%	-9.81%	-1.08%	0.30%	16.82%	0.30%	4.21%	-4.25%	-16.35%

Figure 5-5 Treasury Bond Return Data by Scenarios Table

	Tbill	Cumulative	2013	2014	2015	2016	2017	2018	2082	2083	2084	2085
68												
69	High	276%	0.9802	1.04754474	1.04207117	1.0576902	0.99050141	1.01871859	1.01236853	1.01452745	1.00145052	1.04551914
70		248%	0.914976603	1.01510834	1.00119153	0.99780968	1.04551914	1.00495417	1.00495417	1.0438	0.9963	1.00427351
71		194%	1.045519141	1.04754474	1.0128	1.08442539	0.90982524	0.98154008	1.00145052	1.00119153	0.98223604	1.02002112
72		183%	0.989	0.9810651	0.9955	1.06670703	1.0438	1.03540235	1.0128	0.9834702	0.98969295	1.04754474
73		174%	0.985	1.00495417	1.00427351	1.0254	1.01510834	1.0254	1.04754474	1.02761346	1.0256	1.11259525
74	Median	168%	1.029040673	1.01452745	1.03730682	1.03540235	1.01186992	0.99780968	1.01197829	1.01941984	1.00119153	1.01197829
75		140%	0.997878729	1.0438	0.972063	0.9919	1.02527438	1.021	1.04207117	1.04551914	0.8218964	0.98790289
76		84%	1.004733308	1.01941984	0.972063	1.01236853	1.05429495	0.9963	1.01467612	1.04551914	0.8218964	0.97184503
77		72%	1.084425385	1.0256	1.01510834	0.9706907	0.9813241	1.00473331	1.01406457	1.00119153	1.00618761	1.01452745
78	Low	67%	1.012368532	1.00145052	0.97184442	1.0147	1.03061202	1.05429495	0.99050141	1.08442539	1.021	1.0438
79												
80	High		-1.98%	4.75%	4.21%	5.77%	-0.95%	1.87%	1.24%	1.45%	0.15%	4.55%
81	Median		2.90%	1.45%	3.73%	3.54%	1.19%	-0.22%	1.20%	1.94%	0.12%	1.20%
82	Low		1.24%	0.15%	-2.82%	1.47%	3.06%	5.43%	-0.95%	8.44%	2.10%	4.38%

Figure 5-6 Treasury Bill Return Data by Scenarios Table

Weighted Average Rate of Return

From the section above, I have set up the high, median and low case scenarios for stock, bond, and Tbill returns. 401k retirement account investment is a combination of investment in stock, bond, and bank deposit (using the Tbill return rates) with different weights in each category according to an account owner's choice. Therefore, in this section, I am going to explain my calculations on obtaining the weighted average rate of return for a 401k account holder. First, a user gives their desired weight on stock, bond, and bank deposit under the 'Main Display' tab. There are two sets of weights to enter: the '401k Contribute' (desired weight on each category during the working period) and the '401k Withdraw' (desired weight on each category after retirement). Under both sets, a user inputs his/her desired weights on '% Invest in bonds' and '% Investment in Stocks' then '% Deposit' will be calculated automatically by formula =1- '% Invest in bonds' - '% Investment in Stocks.' Generally speaking, a reasonable person is willing to

take more risk when he/she is young and has an income than when he/she is retired. Therefore, ‘% invest in Stocks’ is likely to be higher in ‘401k Contribute’ period, while ‘% Deposit’ is likely to be higher in ‘401k Withdraw’ period.

401K Contribute	
25 % Invest in Bond	20%
26 % Invest in Stock	70%
% Deposit	10%
401K Withdraw	
27 % Invest in Bond	50%
28 % Invest in Stock	10%
% Deposit	40%

Figure 5-7 401k Investment User Input Table

The user inputs were linked to the weighted average rate of return table under ‘Retirement’ tab.

	B	C	D	E	F	G	H	I	BU	BV	BW	BX
2	Year		2013	2014	2015	2016	2017	2018	2082	2083	2084	2085
3	Rate of Return (High)		7.47%	7.04%	9.74%	20.14%	-9.65%	7.88%	5.17%	5.12%	-5.16%	-7.70%
4	Rate of Return (Median)		-6.92%	20.35%	5.94%	21.54%	12.96%	9.23%	7.58%	-0.94%	1.56%	5.16%
5	Rate of Return (Low)		21.30%	4.08%	-2.95%	14.58%	31.64%	7.26%	-0.38%	4.10%	-1.42%	-7.50%

Figure 5-8 Weighted Average Rate of Return Table

Here are samples of two cells that explain how the value in this table is calculated. Cell D3 is the weighted average rate of return under high return scenario for year 2013. It is calculated as ‘bond return under high return scenario in 2013 (cell D48)’ * ‘401k Contribute: % Invest in Bonds’ + ‘stock return under high return scenario in 2013 (cell D64)’ * ‘401k Contribute: % Invest in Stocks’ + ‘Tbill return under high return scenario in 2013 (cell D80)’ * ‘401k Contribute: % Deposit’ = $20\%*(-10.19\%) + 70\%*13.86\% + 10\%*(-1.98\%) = 7.47\%$. Cell BX5 is the weighted average rate of return under low return scenario for year 2085. It is calculated as ‘bond return under low return scenario in 2085 (cell BX48)’ * ‘401k Withdraw: % Invest in bonds’ + ‘stock return under low return scenario in 2085 (cell BX64)’ * ‘401k Withdraw: % Invest in Stocks’ + ‘Tbill return under low return scenario in 2086 (cell BX80)’ * ‘401k Withdraw: % Deposit’ = $50\%*(-16.35\%) + 10\%*(-10.74\%) + 40\%*4.38\% = -7.50\%$.

The ‘Rate of Return’ chart under the ‘Main Display’ tab visualized the variability of a user’s weighted investment returns for the years 2013 to 2085.

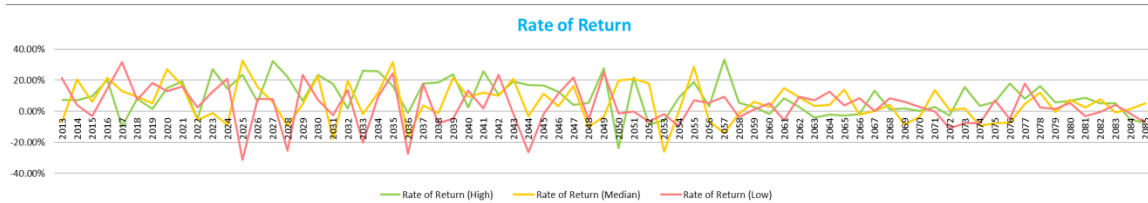


Figure 5-9 Stock, TBond, and TBill Rates of Return Chart

Consumption Smoothing Analysis

The concept of consumption smoothing is as simple as having the similar amount of deposable income before and after retirement; in other words, maintain the same expenditure level. Based on the percentage of income a user put into the 401k account and his/her choice of 401k investment under three categories, a table and a chart are provided in my project to visualize his/her consumption smoothing effort.

To begin with how the table and chart were calculated and drawn. Under the ‘Retirement’ tab, there is a table as below (all the numbers were in 2012 real dollars):

	B	C	D	E	F	AV	AW	AX	BV	BW	BX
2	Year		2013	2014	2015	2057	2058	2059	2083	2084	2085
3	Rate of Return (High)		7.47%	7.04%	9.74%	33.37%	5.27%	2.77%	5.12%	-5.16%	-7.70%
4	Rate of Return (Median)		-6.92%	20.35%	5.94%	-14.06%	-1.33%	6.21%	-0.94%	1.56%	5.16%
5	Rate of Return (Low)		21.30%	4.08%	-2.95%	9.25%	-3.89%	1.03%	4.10%	-1.42%	-7.50%
6											
7	Age	22	23	24	25	67	68	69	93	94	95
8	% salary growth	0%									
9	Salary		\$73,000	\$73,000	\$73,000	\$73,000	\$26,182	\$26,182	\$26,182	\$26,182	\$26,182
10	Saving	Withdraw (H)	\$3,500	\$3,500	\$3,500	\$3,500	\$262,048	\$262,048	\$262,048	\$262,048	\$262,048
11		Withdraw (M)					\$33,396	\$33,396	\$33,396	\$33,396	\$33,396
12		Withdraw (L)					\$13,247	\$13,247	\$13,247	\$13,247	\$13,247
13	Tax	Tax (H)	\$25,556	\$25,556	\$25,556	\$25,556	\$1,222	\$1,222	\$1,222	\$1,222	\$1,222
14		Tax (M)					\$235	\$235	\$235	\$235	\$235
15		Tax (L)					\$0	\$0	\$0	\$0	\$0
16	Consumption Spending (H)		\$43,944	\$43,944	\$43,944	\$43,944	\$287,009	\$287,009	\$287,009	\$287,009	\$287,009
17	Consumption Spending (M)		\$43,944	\$43,944	\$43,944	\$43,944	\$59,343	\$59,343	\$59,343	\$59,343	\$59,343
18	Consumption Spending (L)		\$43,944	\$43,944	\$43,944	\$43,944	\$39,429	\$39,429	\$39,429	\$39,429	\$39,429
19	% withdraw	5%									
20	401K Account \$	-	\$3,500	\$7,247	\$11,452	\$5,240,964	\$5,241,272	\$5,117,367	\$815,065	\$524,455	\$242,190
21	401K Account Balance (M)		\$3,500	\$7,712	\$11,670	\$667,924	\$626,070	\$629,499	\$122,490	\$90,481	\$60,029
22	401K Account Balance (L)		\$3,500	\$7,143	\$10,432	\$264,948	\$241,908	\$231,019	\$6,453	-\$6,698	-\$18,450

Figure 5-10 401k Account Balance Calculation Table

For advanced users, they could put in a percentage in ‘% salary growth’ (cell C8) to customize their situation. For general users, I put in an initial value of zero percent to simplify the case. The

table assumed a user start to work in 2013 at age 23, retire in 2057 at age 67, and died in 2085 at age 95. The initial salary at age 23 is 'Salary' (cell D9) is linked to the user's inputs under 'Main Display' tab which is the sum of 'Annual Income' (cell D4) and 'Bonus' (cell D5). The initial 'Saving' (cell D10) is linked to the 'Total Tax-deductible Retirement Savings' (cell D8) under 'Main Display' tab which is. The initial 'Tax' (cell D13) is linked to the 'Total Tax Payable' (cell D18) under 'Main Display' tab. In addition, on the first year of retirement, the social security benefit (cell AW 9) is linked to the calculated output from 'SSN benefit Calculator' under 'Tax & SSN' tab. For a wage earner who has annual income of \$73,000, his/her social security retirement benefit was calculated as: $=IF(\$H\$37>G41,(I40+I41+(\$H\$37-G41)*H42),0)$

	G	H	I	J
35	Social Security Benefit Calculator			
36	Annual Income:	\$ 73,000.00		
37	Monthly Income:	\$ 6,083.33		
38	Monthly Income Brackets		Maximum Amount	
39	\$ -			
40	\$ 791.00	90.00%	\$ 711.90	\$ -
41	\$ 4,768.00	32.00%	\$ 1,272.64	\$ -
42	Over \$4,768.00	15.00%		\$ 2,181.84
43	Monthly Benefit:			\$ 2,181.84
44	Yearly Benefit:			\$ 26,182.08

Figure 5-11: Social Security Benefit Calculation Table

The monthly income of the wage earner was equal to 'Annual Income'/12. If the monthly income is 'Over \$4,768' (cell G42) then the 'Monthly Benefit' would be a summation of the 'Maximum Amount' for bracket \$0-\$791 (cell I40) of the 'Maximum Amount' for bracket \$791-\$4,768 (cell I41) and partial amount for the 'Over \$4,768' bracket. To say it in numbers, \$711.9 + \$1,272.64 + (\$6,083.33-\$4,768) * 15% = \$2,181.84/month. Therefore, the yearly payment was \$26,182.08. The withdraw amount at age 67 with optimistic market expectation (cell AW 16) was calculated as '% withdraw' * '401k account balance' at age 67 = cell \$C\$19 * cell AV20 = 5% * \$5,240,964 = 262,048.18.

Follow are two samples of how each row is calculated that the first sample is on 401k contribution period and the second sample is on 401k withdraw period.

- Sample 1: the calculation on 401k account balance when a person is 24 (Column E).

First, 'Salary' (cell E9) is calculated as 'Salary' of previous year * (1 + % salary growth) = cell D9 * (1 + cell \$C\$8) = \$73,000 * (1 + 0%) = \$73,000. Second, 'Saving' (cell E10) and 'Tax' (cell E13) are the same as previous year. Third, 'Consumption Spending' (cell E16) is calculated as 'Salary' - 'Saving' - 'Tax' = cell E9 - cell E10 - cell E13 = \$73,000 - \$3,500 - \$25,556 = \$43,944. The 401k account balance under optimistic scenario (cell E20) is calculated as '401k account balance' from previous year * (1+ high rate of return) + 'Saving' for this year = cell D20 * (1+cell D3)+ cell E10 = \$3,500 * (1+7.47%) + \$3500 = \$7,247. The 401k account balance under neutral and pessimistic scenarios (cell E21 and E22) are calculated in similar manners.

- Sample 2: the calculation on 401k account balance when a person is 69 (column AX).

First, 'Salary' (cell E9) and 'Withdraw (H)' (cell AX10) are the same as previous year. Second, 'Tax' (AX13) was linked to 'Total federal tax' (cell J18) under 'Tax& SSN' tab. Third, 'Consumption Spending' (cell AX16) is calculated as 'Salary' + 'Withdraw (H)' - 'Tax' = cell AX9 + cell AX10 - cell AX13 = \$26,182 + \$262,048 - \$33,396 = \$287,009. The 401k account balance under optimistic scenario (cell AX20) is calculated as ('401k account balance' from previous year- 'Withdraw (H)') * (1+ high rate of return) = (cell AX20 - cell AX10) * (1+cell AX3) = (\$5,241,272 - \$ 262,048)* (1+2.77%) = \$5,117,367. The 401k account balance under neutral and pessimistic scenarios (cell AX21 and AX22) are calculated in similar manners.

The chart under the 'Main Display' tab visualized the change over years in the 401k account for all three scenarios.

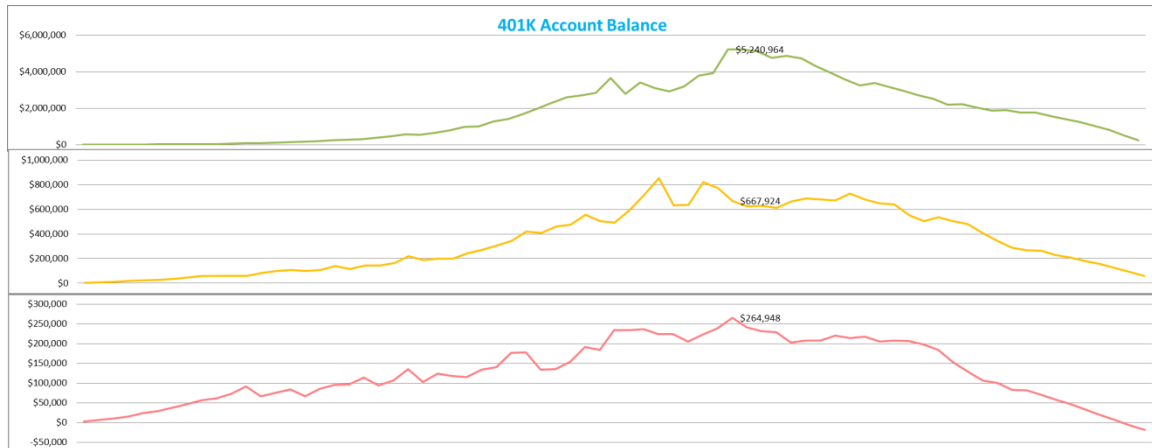


Figure 5-12 401k Account Balance Chart

The green line stood for the optimistic rate of return scenario; the yellow line stood for neutral scenario; the red line stood for pessimistic scenario. The number marked was the 401k account balance at age of 67 (year of retirement) which is the turning point for a person to stop deposit money and to start withdraw from the account. However, it did not necessarily be the maximum account balance because of the influence of rate of return on your 401k investment. For example, the yellow line given was showing the maximum account balance was reached before retirement date. It indicated that the the loss due to poor rate of return on 401k investment was larger than the yearly contribution made to the account that cause the 401k account balance to decrease.

The 'Annual Consumption Spending' table was constructed for my user to have a easy view of his/her consumption smoothing effort. The goal is to minimize the difference between consumptable income before and after retirement. The consumptable income for retirement period should be greater than, if not at least equal to the working period. And a user is expected to observe a positive ending balance for their 401k account, otherwise it means the account run out of money before he/she passes away which is undesirable.

Annual Consumption Spending Table				Ending Balance
	Retired	Working	Difference	
High ROR	\$ 287,008.66	\$ 43,944.20	\$ 243,064.46	\$ 242,189.65
Median ROR	\$ 59,342.91	\$ 43,944.20	\$ 15,398.71	\$ 60,028.62
Low ROR	\$ 39,429.46	\$ 43,944.20	● \$ (4,514.74)	● \$ (18,450.06)

Figure 5-13 Annual Consumption Spending Table

In this table, for the ‘*Difference*’ column: if consumption spending in retirement period was smaller than it during working period, it would show a red dot; for ‘Ending Balance’ if the value was less than zero, it would display a red dot. These two ‘red dot’ functions are designed warn the user about the risk of their 401k strategy. He/she may increase his/her 401k contribution percentage of income or reweight his/her investment in deposit, bond and stock to achieve a more successful consumption spending strategy.

Chapter 6

Income Statement

The ‘Income Statement’ table is the first table under ‘Main Display’ tab. It involves a series of user inputs and calculation output from other tabs. Detailed explanations on calculation were already given in previous chapters and this chapter is a brief summary of everything mentioned.

	A	B	C	D
2			Crear Your Personal Wealth Management Report	
3			Income Statement	
4	1	Annual Income:	\$	70,000.00
5	2	Bonus:	\$	3,000.00
6		<u>Retirement Saving</u>		
7	3	401K Saving Rate		5%
8		Total tax-deductible Retirement Savings:	\$	3,500.00
9		Health Insurance		
10		Health Savings		
11		Federal Taxable Income	\$	69,500.00
12				
13		<u>Taxes Estimate</u>		
14	4	City		New York Tax
15		Federal Tax	\$	18,619.25
16		State Tax	\$	4,391.50
17		New York Tax	\$	2,545.05
18		Total Tax Payable	\$	25,555.80
19		<i>Effective Tax Rate</i>		36.77%
20				
21		Yearly Net Income	\$	43,944.20
22		Monthly Net Income	\$	3,662.02
23		<u>Total Yearly Expenses</u>	\$	36,756.00
24				
25	*	Free Cash Flow Year End	\$	7,188.20

Figure 6-1: Income Statement Table

Cells with orange background were user input cells. When a user input ‘Annual Income’ (cell D4), ‘Bonus’ (cell D5), and selected a desirable ‘401k Saving Rate’ (cell D7)—5%, 10% or

15% from a drop down list, 'Federal Taxable Income' (cell D11) was calculated as 'Annual Income' + 'Bonus' - 'Total tax-deductible Retirement Savings' = \$70,000 + \$3,000 - \$3,500 = \$69,500. Then, the user chose the city that he/she resident in via the drop down list with choices of New York, Pittsburgh, and Philadelphia. Calculations were done under the 'Tax and SSN' tab and results of federal, state and city taxes flowed back to the income statement table in cell D15, D16, D17 and D18. The '*Effective Tax Rate*' (cell D19) was calculated as 'Total Tax Payable' divided by 'Federal Taxable Income'. The 'Yearly Net Income' (cell D21) was equal to 'Total Tax Payable' minus 'Federal Taxable Income'. The 'Monthly Net Income' (cell D22) was the 'Yearly Net Income'/12. The 'Total Yearly Expense' was the ending number from the 'Expense' table. The 'Free Cash Flow Year End' was the 'Yearly Net Income' deducted 'Total Yearly Expense'.

Chapter 7

Case Analysis

This chapter discusses two cases on the applications of my project: the first one with basic input and the second one with advanced input and modification of formulas. Both of them are real life examples.

- **Case Scenario 1:**

Sue is a Penn State student at the Smeal College of Business majoring in Actuarial Science. Sue accepted a full-time job in New York City with one of the largest asset management firms. Her annual salary is \$70,000 with a one-time sign on bonus of \$10,000 if she stays with the firm for 12 months. She decides to have a five percent savings rate on her 401k account. Since she is a risk taker, she allocates 80 percent of her 401k investment into stocks, 20 percent into bonds and zero percent into deposit before her retirement. After retirement, she would like to switch to a more conservative investment strategy: 50 percent in bonds, 30 percent in stocks and 20 percent in bank deposit.

Sue is on a healthy diet: on workdays she makes cereal for breakfast, which costs about \$1/bag; she dines in the cafeteria located in the office building for lunch with an estimated cost of \$12/meal; in the evening she leaves office around 9 pm and went to Subway or a Chinese food take-out booth for dinner which on average costs her \$10/meal.

In addition, her studio lease in midtown Manhattan costs her \$21,600/year which includes everything (gas, heating, electricity and wireless). Sue uses dry cleaning service for her business attires which on average costs \$50/month. She purchased a 30-day unlimited Metro card for daily

transportation which costs \$112/month. The company provides Sue with a Blackberry work phone and pays for the telephone bills so she is able to avoid cell phone expenses. Sue has a gym membership of \$150/month and she also attends yoga class one time per week which costs \$10/class. She spends around \$300 on clothes in store or online every month. Sue estimates the average cost for her to drink with colleagues and buy gifts to be \$200/month. And she also has a budgeted \$100 for movies and other entertainments.

Last but not least, Sue has plan for pursuing a CFA designation in the next three years and attending a full-time MBA program in the next five years.

On the next page is a view of 'Main Display' tab after recording all the information given above. Analyses were provided on Sue's expenses breakdown and consumption spending effort. And advice is written based on the analyses.

Creat Your Personal Wealth Management Report		
Income Statement		
1 Annual Income:	\$	70,000.00
2 Bonus:	\$	10,000.00
Retirement Saving		
3 401K Saving Rate		5%
Total tax-deductible Retirement Savings:	\$	3,500.00
Health Insurance		
Health Savings		
Federal Taxable Income	\$	76,500.00
Taxes Estimate		
4 City	New York Tax	
Federal Tax	\$	20,904.75
State Tax	\$	4,853.00
New York Tax	\$	2,800.41
Total Tax Payable	\$	28,558.16
Effective Tax Rate		37.33%
Yearly Net Income	\$	47,941.84
Monthly Net Income	\$	3,995.15
Total Yearly Expenses	\$	44,064.00
Free Cash Flow Year End	\$	3,877.84

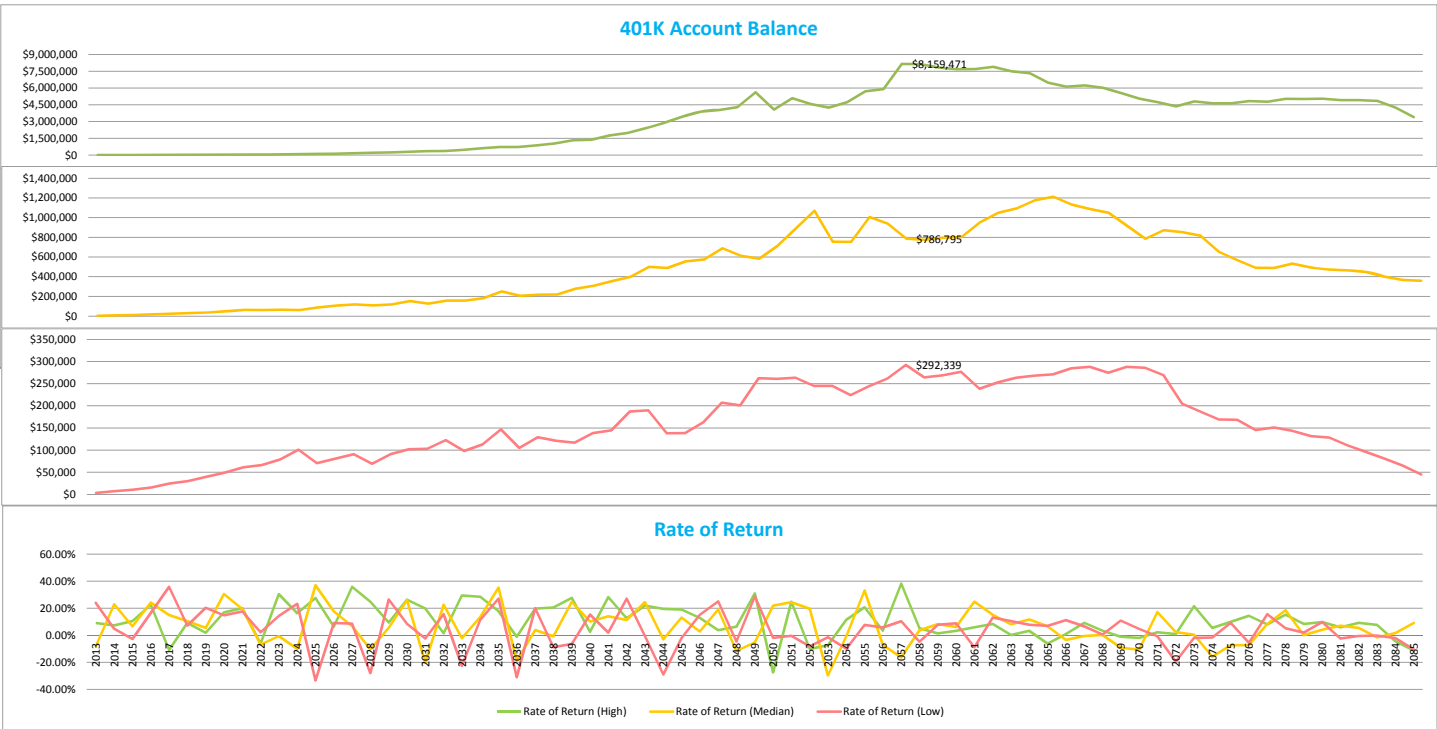
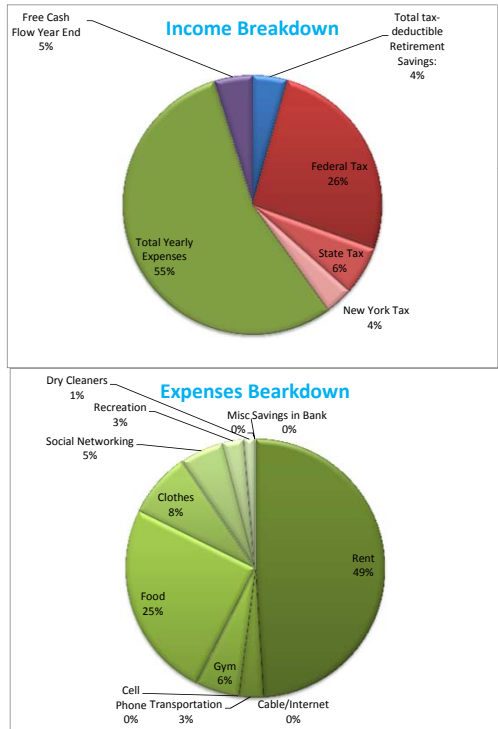
Food Expenses		
Weekday		
5 Breakfast	\$	1.00
6 Lunch	\$	12.00
7 Dinner	\$	10.00
Weekend		
Saturday		
Eat In		
8 Breakfast	\$	-
9 Lunch	\$	25.00
10 Dinner	\$	35.00
Sunday		
Eat Out		
11 Breakfast	\$	-
12 Lunch	\$	25.00
13 Dinner	\$	10.00
Total Weekly Food	\$	210.00
Total Monthly Food	\$	910.00
Total Yearly Food	\$	10,920.00
401K Contribute		
25 % Invest in Bond		20%
26 % Invest in Stock		80%
% Deposit		0%
401K Withdraw		
27 % Invest in Bond		50%
28 % Invest in Stock		30%
% Deposit		20%

Other Monthly Expenses			% Gross Salary	% Net Income
14 Rent	\$	1,800.00	27.00%	45.05%
15 Cable/Internet	\$	-	0.00%	0.00%
16 Transportation	\$	112.00	1.68%	2.80%
17 Cell Phone	\$	-	0.00%	0.00%
18 Gym	\$	200.00	3.00%	5.01%
Food	\$	910.00	13.65%	22.78%
19 Clothes	\$	300.00	4.50%	7.51%
20 Social Networking	\$	200.00	3.00%	5.01%
21 Recreation	\$	100.00	1.50%	2.50%
22 Dry Cleaners	\$	50.00	0.75%	1.25%
23 Misc	\$	-	0.00%	0.00%
24 Savings in Bank	\$	-	0.00%	0.00%
Total Monthly:	\$	3,672.00		
Total Yearly Expenses:	\$	44,064.00	55.08%	91.91%

Annual Consumption Spending Table					Ending Balance
	Retired	Working	Difference		
High ROR	\$ 433,917.07	\$ 47,941.84	\$ 385,975.23	\$	3,401,578.94
Median ROR	\$ 65,899.82	\$ 47,941.84	\$ 17,957.98	\$	358,502.39
Low ROR	\$ 41,849.02	\$ 47,941.84	\$ (6,092.82)	\$	44,927.24

Read your report:
Annual Consumption Spending Table: your goal is to have ultimate consumption smoothing (minimum difference amount for what you can spend before and after your retirement) with positive account ending balance. Under this model, you started to work with you are 23 and retired when you are 67 and your life expectation is 95. It provides three senerios: high return on investment, neutral return on investment and low return on investment for your 401K account.
If you observe a 'red dot' in *difference* , this indicate under that return senerios you will have less to spend after retirement than before retirement. If you observe a 'red dot' in **Ending balance**, this indicate under that return senerio, your account run out of money before age 95.

Instructions:
1&2: input your annual income and bonus
3: decide an annual percentage contribution you want to make to your tax-exempt retirement account from the drop down list
4: choose the city of your residence from the drop down list
5-23: input your daily food expenses or monthly other expenses accordingly
24: decide the amount of emergency savings you would like to have in bank, when you do it, make sure you minimize the 'Free Cash Flow Year End' on the balance sheet
25-28: while you are working, put the percentage of your retirement funding you would like to put into each investment categories under '401K contribute'- % Invest in T Bond + % Invest in Stock + % Deposit = 100%; while you retired, put the percentage breakdown into '401K withdraw' . Generally speaking, your investment strategy would be more conservative after retirement (invest heavier in 'T bond' than 'Stock')



First, we took a look at her income breakdown. Sue's yearly expenses counted for 55 percent of her income, and followed by 36 percent tax, five percent free cash and four percent in retirement savings. Under the expenses category, which was the largest category, rent counted for 49 percent, and followed by 25 percent on food. We refer to the expenditure survey and located Sue's expenses level under the 'third 20 percent' and comparing the national average amount by household to Sue's case:

Average annual expenditures	Food			Housing	
All Consumer Units	\$49,705	\$ 6,458.00	13%	\$16,803.00	34%
Lowest 20 Percent	\$22,001	\$ 3,547.00	16%	\$ 8,771.00	40%
Second 20 Percent	\$32,092	\$ 4,659.00	15%	\$12,136.00	38%
Third 20 Percent	\$42,403	\$ 5,620.00	13%	\$14,944.00	35%
Fourth 20 Percent	\$57,460	\$ 7,466.00	13%	\$18,840.00	33%
Highest 20 Percent	\$94,551	\$10,991.00	12%	\$29,321.00	31%

Figure 7-2: 2011 Household Consumption Expenditure

It indicated that Sue was spending about 200 percent on food and 145 percent on housing comparing to the national average. This might be reasonable since New York City has a living expense adjustment point of 144 (the national-wide expense adjustment point is set as 100). And food and housing are two main drivers for living expenses.

Second, we looked at the 'Rate of Return' chart for Sue's 401k investment. The lines fluctuated more before retirement and less after retirement which aligned with Sue's data inputs—she was heavily invested in stock (a higher risk category) in the 401k contribution period and switched to bond (a more moderate risk category) in the 401k withdraw period.

Third, we moved on to the '401k Account Balance' chart. Under the worst case scenario, Sue would still have \$292,339 in her 401k account by the time she retired which was considered as relatively sufficient. Under the optimistic case scenario, Sue would have more than \$1,000,000 in her 401k account at the age of 48. And under the neutral case scenario, she would reach the amount by the age of 72. It was interesting to point out that her 401k account continued to grow and reached \$1,000,000 bar during the 401k withdraw period. This was because the outstanding weighted average rate of return overcame the effect of yearly retirement withdrawing amount and

continue to build up the savings in the account. In other words, the investment strategy Sue chose in the retirement period happened to be very successful.

Forth, the 'Annual Consumption Spending' table offers the best summary for Sue's consumption smoothing goal. By having positive 'ending balance' under all three circumstances, Sue's 401k account management was generally successful. The 'red dot' popped up in the '*Difference*' column under the 'Low ROR' scenario indicating Sue would have less money (by 13 percent) for consumption after retirement under the worst case scenario. To resolve the risk under 'Low ROR' case, Sue may increase her annual 401k contribution amount or adjust her weights under three investment categories.

Last but not least, the 'Free Cash Flow Year End' line in the 'Income Statement' table gave Sue a broad idea of how much she would be able to save to achieve her further education goals and if there would be a need to take out student loan for MBA School.

- **Case Scenario 2:**

Lucy is a student at Penn State majoring in advertising. She took out \$35,000 student loan from a national bank and is required to make monthly repayment of \$500 for 10 years to repay the loan. After graduation, Lucy plans on going to Spain to teach students in poor community for 2 years. She decided to pay the minimum amount (interest payment on the total amount of student loan which is allowed by the bank for a maximum of 2 years after graduation) during the period she lives in Spain. Afterwards, Lucy is going to work full time in Pittsburgh area with a small marketing firm for a starting salary of \$55,000 and she expects her salary to grow 0.5 percent over years. She decided to contribute five percent every year to her 401k account every year. After inputting all the information required on the 'Main Display' tab, she found out she was in short of \$ 100 for her monthly loan repayment obligation (student loan is considered as a 'misc expense' in the table). Lucy feels that her monthly expenses are lack in

flexibility for further cut that she have to contribute \$1,200 less every year into her 401k account for the first ten years when she is trying to pay off her student loan.

Based on the criteria given, the ‘retirement’ tab was modified as follow: first, I deleted two columns and reset the calculation starting year to 2015. Second, I put in 0.5 percent in ‘% Salary Growth’ (cell C8). Then I went to ‘saving’ row and minus \$1,200 for the year 2015 to 2024 (cell D10-M10). However, because of the limitation of my project, tax is not able to be modified with the chances I made above.

	B	C	D	E	F	G	H	I	J	K	L	M
2	Year		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
3	Rate of Return (High)		7.37%	9.01%	-4.33%	2.45%	-1.62%	8.28%	15.83%	0.41%	17.06%	8.51%
4	Rate of Return (Median)		1.99%	10.55%	4.30%	4.37%	3.72%	15.04%	3.75%	-0.41%	-3.61%	-3.00%
5	Rate of Return (Low)		-4.37%	6.54%	14.72%	8.65%	9.85%	5.40%	9.88%	3.56%	5.50%	11.61%
6												
7	Age	22	25	26	27	28	29	30	31	32	33	34
8	% salary growth	0.5%										
9	Salary		\$55,000	\$55,275	\$55,551	\$55,829	\$56,108	\$56,389	\$56,671	\$56,954	\$57,239	\$57,525
10	Saving	Withdraw (H)	\$1,550	\$1,564	\$1,578	\$1,591	\$1,605	\$1,619.44	\$1,633.54	\$1,647.71	\$1,661.94	\$1,676.25
11		Withdraw (M)										
12		Withdraw (L)										
13	Tax	Tax (H)	\$16,326	\$16,326	\$16,326	\$16,326	\$16,326	\$16,326	\$16,326	\$16,326	\$16,326	\$16,326
14		Tax (M)										
15		Tax (L)										
16	Consumption Spending (H)		\$37,124	\$37,386	\$37,648	\$37,912	\$38,177	\$38,444	\$38,712	\$38,981	\$39,251	\$39,523
17	Consumption Spending (M)		\$37,124	\$37,386	\$37,648	\$37,912	\$38,177	\$38,444	\$38,712	\$38,981	\$39,251	\$39,523
18	Consumption Spending (L)		\$37,124	\$37,386	\$37,648	\$37,912	\$38,177	\$38,444	\$38,712	\$38,981	\$39,251	\$39,523
19	% withdraw	5%										
20	401K Account \$	-	\$1,550	\$3,253	\$4,690	\$6,396	\$7,898	\$10,172	\$13,416	\$15,118	\$19,359	\$22,683
21	401K Account Balance (M)		\$1,550	\$3,277	\$4,996	\$6,806	\$8,664	\$11,587	\$13,654	\$15,245	\$16,358	\$17,543
22	401K Account Balance (L)		\$1,550	\$3,215	\$5,266	\$7,313	\$9,639	\$11,779	\$14,575	\$16,743	\$19,326	\$23,245

Figure 7-3: Case Scenario 2 Consumption Spending Calculation

After the modifications above, I realized that in the ‘Annual Consumption Spending’ table both neutral and worst case scenarios ended with negative ending balance. I traced back to ‘Retirement’ tab and found out that her 401k account will run out of money at age 94 under neutral scenario and 91 under worst case scenario.

Annual Consumption Spending Table				Ending Balance
	Retired	Working	Difference	
High ROR	\$ 51,614.47	\$ 42,084.09	\$ 9,530.38	\$ 66,018.35
Median ROR	\$ 34,498.05	\$ 42,084.09	\$ (7,586.03)	\$ (9,576.19)
Low ROR	\$ 29,535.34	\$ 42,084.09	\$ (12,548.74)	\$ (21,910.81)

Figure 7-4: Case Scenario 2 Annual Consumption Spending

Therefore, further adjustments were necessary. The simplest solution would be lower the annual 401k account withdraw rate to 4.5 percent to achieve a possible balance. However, as

observed, besides issue with ending balance Lucy's consumption smoothing effort was not very successful. (Notice that the consumption spending amounts during working period were different every year driven by the 0.5 percent in salary increase; therefore, the consumption spending amount in the table is an average over the entire working period.) Lucy is likely to have a significantly lower amount for consumption after retirement for the two scenarios mentioned. Therefore, in addition to lower the withdraw rate, Lucy should also consider increasing the 401k contribution amount during working period. As I increased Lucy's 401k account contribution to ten percent a year, I also needed to cut the contribution amount by \$3,000 for the first ten years in order to leave enough money to meet her college loan obligation.

	B	C	D	E	F	G	H	I	J	K	L	M
2	Year		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
3	Rate of Return (High)		7.37%	9.01%	-4.33%	2.45%	-1.62%	8.28%	15.83%	0.41%	17.06%	8.51%
4	Rate of Return (Median)		1.99%	10.55%	4.30%	4.37%	3.72%	15.04%	3.75%	-0.41%	-3.61%	-3.00%
5	Rate of Return (Low)		-4.37%	6.54%	14.72%	8.65%	9.85%	5.40%	9.88%	3.56%	5.50%	11.61%
6												
7	Age	22	25	26	27	28	29	30	31	32	33	34
8	% salary grow	0.5%										
9	Salary		\$55,000	\$55,275	\$55,551	\$55,829	\$56,108	\$56,389	\$56,671	\$56,954	\$57,239	\$57,525
10	Saving	Withdraw (H)	\$2,500	\$2,528	\$2,555	\$2,583	\$2,611	\$2,638.88	\$2,667.08	\$2,695.41	\$2,723.89	\$2,752.51
11		Withdraw (M)										
12		Withdraw (L)										
13	Tax	Tax (H)	\$15,428	\$15,428	\$15,428	\$15,428	\$15,428	\$15,428	\$15,428	\$15,428	\$15,428	\$15,428
14		Tax (M)										
15		Tax (L)										
16	Consumption Spending (H)		\$37,072	\$37,320	\$37,568	\$37,818	\$38,070	\$38,322	\$38,576	\$38,831	\$39,087	\$39,345
17	Consumption Spending (M)		\$37,072	\$37,320	\$37,568	\$37,818	\$38,070	\$38,322	\$38,576	\$38,831	\$39,087	\$39,345
18	Consumption Spending (L)		\$37,072	\$37,320	\$37,568	\$37,818	\$38,070	\$38,322	\$38,576	\$38,831	\$39,087	\$39,345
19	% withdraw	4.5%										
20	401K Account \$	-	\$2,500	\$5,253	\$7,581	\$10,349	\$12,793	\$16,491	\$21,768	\$24,552	\$31,464	\$36,895
21	401K Account Balance (M)		\$2,500	\$5,291	\$8,074	\$11,010	\$14,030	\$18,779	\$22,150	\$24,753	\$26,584	\$28,539
22	401K Account Balance (L)		\$2,500	\$5,191	\$8,510	\$11,830	\$15,605	\$19,087	\$23,639	\$27,177	\$31,396	\$37,793

Figure 7-5: Case Scenario 2 Consumption Spending Calculation with New Condition

I rechecked the 'Annual Consumption Spending' table which was given a slightly negative ending balance under the worst case scenario (account run out of money at age 95) and this was considered acceptable. Besides, the consumption smoothing results were significantly improved.

Annual Consumption Spending Table					Ending Balance
	Retired	Working	Difference		
High ROR	\$ 69,574.94	\$ 40,341.06	\$ 29,233.88	\$	358,385.22
Median ROR	\$ 42,701.02	\$ 40,341.06	\$ 2,359.96	\$	57,157.62
Low ROR	\$ 34,350.42	\$ 40,341.06	\$ (5,990.64)	\$	(1,810.61)

Figure 7-6: Case Scenario 2 Annual Consumption Spending with New Condition

Creat Your Personal Wealth Management Report		
Income Statement		
1 Annual Income:	\$	55,000.00
2 Bonus:	\$	-
Retirement Saving		
3 401K Saving Rate		10%
Total tax-deductible Retirement Savings:	\$	5,500.00
Health Insurance		
Health Savings		
Federal Taxable Income	\$	49,500.00
Taxes Estimate		
4 City	Pittsburgh Tax	
Federal Tax	\$	12,089.25
State Tax	\$	1,688.50
Pittsburgh Tax	\$	1,650.00
Total Tax Payable	\$	15,427.75
Effective Tax Rate		31.17%
Yearly Net Income	\$	34,072.25
Monthly Net Income	\$	2,839.35
Total Yearly Expenses	\$	34,040.00
Free Cash Flow Year End	\$	32.25

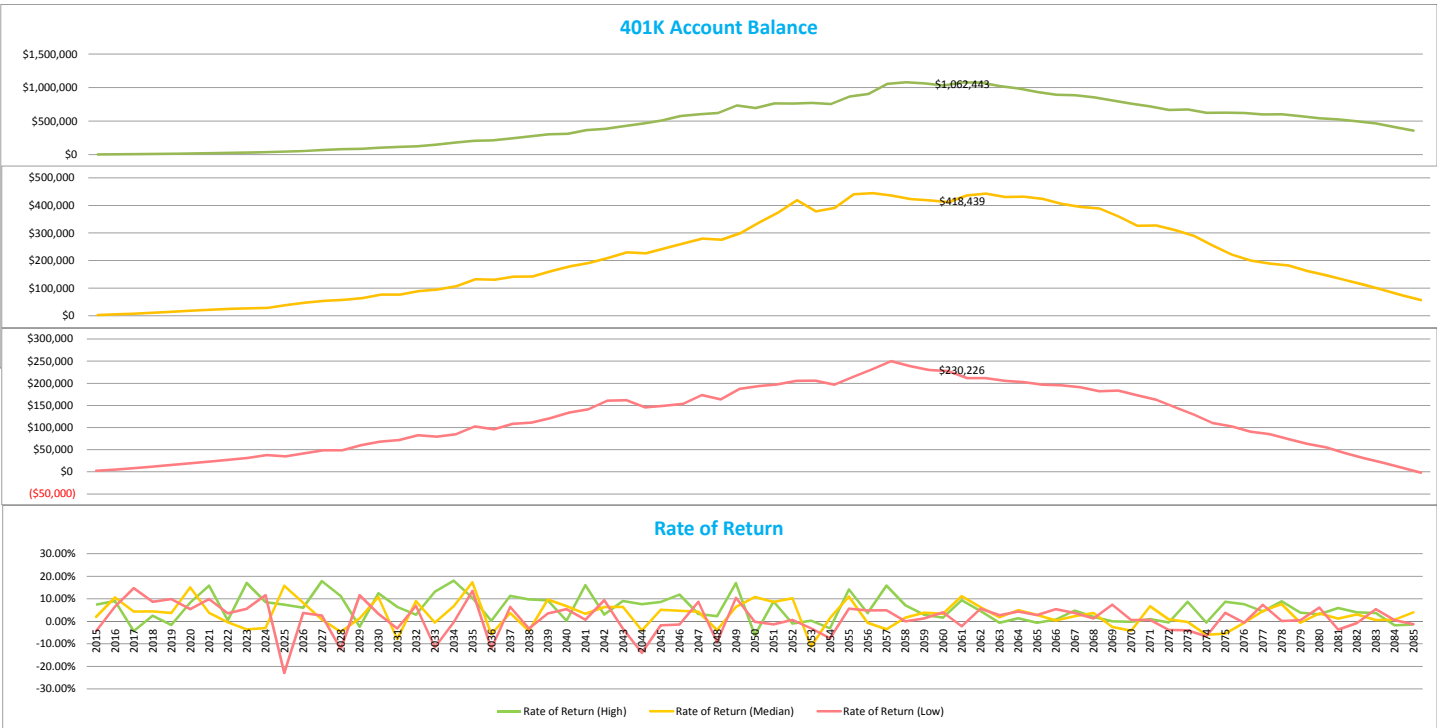
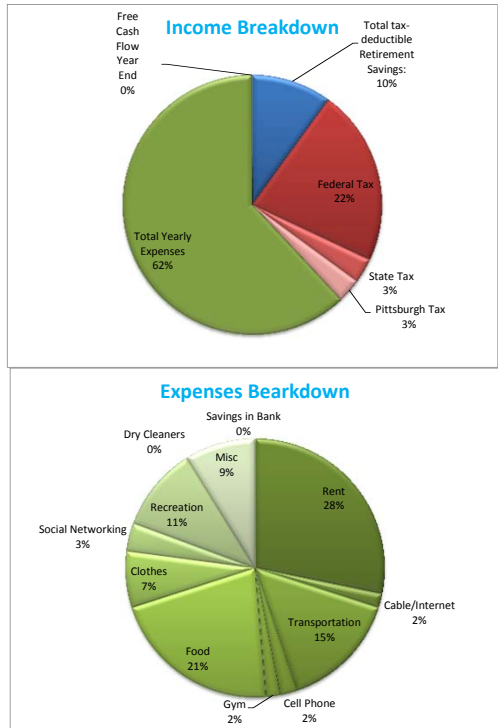
Food Expenses		
Weekday		
5 Breakfast	\$	2.00
6 Lunch	\$	5.00
7 Dinner	\$	8.00
Weekend		
Saturday		
Eat In		
8 Breakfast	\$	-
9 Lunch	\$	20.00
10 Dinner	\$	25.00
Sunday		
Eat Out		
11 Breakfast	\$	-
12 Lunch	\$	10.00
13 Dinner	\$	10.00
Total Weekly Food	\$	140.00
Total Monthly Food	\$	606.67
Total Yearly Food	\$	7,280.00
401K Contribute		
25 % Invest in Bond		30%
26 % Invest in Stock		30%
% Deposit		40%
401K Withdraw		
27 % Invest in Bond		20%
28 % Invest in Stock		10%
% Deposit		70%

Other Monthly Expenses			% Gross Salary	% Net Income
14 Rent	\$	800.00	17.45%	28.18%
15 Cable/Internet	\$	50.00	1.09%	1.76%
16 Transportation	\$	420.00	9.16%	14.79%
17 Cell Phone	\$	60.00	1.31%	2.11%
18 Gym	\$	50.00	1.09%	1.76%
Food	\$	606.67	13.24%	21.37%
19 Clothes	\$	200.00	4.36%	7.04%
20 Social Networking	\$	100.00	2.18%	3.52%
21 Recreation	\$	300.00	6.55%	10.57%
22 Dry Cleaners	\$	-	0.00%	0.00%
23 Misc	\$	250.00	5.45%	8.80%
24 Savings in Bank	\$	-	0.00%	0.00%
Total Monthly:	\$	2,836.67		
Total Yearly Expenses:	\$	34,040.00	61.89%	99.91%

Annual Consumption Spending Table					Ending Balance
	Retired	Working	Difference		
High ROR	\$ 69,574.94	\$ 40,341.06	\$ 29,233.88	\$ 358,385.22	
Median ROR	\$ 42,701.02	\$ 40,341.06	\$ 2,359.96	\$ 57,157.62	
Low ROR	\$ 34,350.42	\$ 40,341.06	\$ (5,990.64)	\$ (1,810.61)	

Read your report:
Annual Consumption Spending Table: your goal is to have ultimate consumption smoothing (minimum difference amount for what you can spend before and after your retirement) with positive account ending balance. Under this model, you started to work with you are 23 and retired when you are 67 and your life expectation is 95. It provides three senerios: high return on investment, neutral return on investment and low return on investment for your 401K account.
If you observe a 'red dot' in difference, this indicate under that return senerios you will have less to spend after retirement than before retirement. If you observe a 'red dot' in Ending balance, this indicate under that return senerio, your account run out of money before age 95.

Instructions:
1&2: input your annual income and bonus
3: decide an annual percentage contribution you want to make to your tax-exempt retirement account from the drop down list
4: choose the city of your residence from the drop down list
5-23: input your daily food expenses or monthly other expenses accordingly
24: decide the amount of emergency savings you would like to have in bank, when you do it, make sure you minimize the 'Free Cash Flow Year End' on the balance sheet
25-28: while you are working, put the percentage of your retirement funding you would like to put into each investment categories under '401K contribute'- % Invest in T Bond + % Invest in Stock + % Deposit = 100%; while you retired, put the percentage breakdown into '401K withdraw'. Generally speaking, your investment strategy would be more conservative after retirement (invest heavier in 'T bond' than 'Stock')



To conclude, the first case scenario analysis only involves the use of basic tools for users. And it meets the major purpose of this thesis which was to obtain a big picture of a student's performance in financial planning. It minimizes the requirement for Excel proficiency and applies to a large student base. For advanced users, the second case scenario shows by modifying functions under the 'Retirement' tab, the spreadsheet could be tailored to meet specific needs. One of the build-in features haven't been introduced in the second case study was 'cell C20' which allows users to put in a starting 401k account balance. It would be helpful to students who switched jobs over time. The other feature not mentioned was that users could use other seven sets of data with few steps to generate new rate of return for their investments besides the high, median and low sets used in the model. So users who feel the three case scenarios were over-optimistic or over-pessimistic could choose a new rate of return level that they think is appropriate.

Chapter 8

Conclusion

In Chapter 7 Case Analysis, I have discussed how to use my project to learn about self-financial planning for users of different Excel knowledge levels. The project mainly provided users with tax estimation, expenditure breakdown and retirement saving performance and visualized them in charts and tables. Next, I would like to discuss some limitations and points of improvement.

The main limitation on my project is tax since tax brackets and tax law were reviewed and modified every year. In my project, all the calculations were based on 2013 tax brackets, which is not desirable given how different the tax law could be 72 years from now in year 2085 (for tax prediction at the age of 95). However, there was very little and impractical to make tax trend prediction to improve the accuracy on tax payables. Therefore, I would expect and warn users of high uncertainty on the tax payable amounts used in 401k account performance.

Moreover, to put my project online and make it accessible by clicking a link brought another limitation: Excel VBA was not available for online versions. My original plan was to have users click on a button to generate a series of random rate of return. They could repeat the process to generate multiple trials to see their 401k account performance under different scenarios. However, this was not realizable without the use of VBA. I had to pre-generate ten sets of random data as an alternative, which reduced the interactive level of my project.

Last but not least, the design of expenses category was hard to tailor. I only created the very basic amount of categories to minimize the input cells for users; however, this may limit the

useful information users can obtain from the expenses breakdown when the 'Misc' category counted for a high percentage.

Appendix A

Department of the Treasury Worksheet for Tax on Retirement Income

Worksheet 1. Figuring Your Taxable Benefits

Keep for Your Records



Before you begin:

- If you are married filing separately and you lived apart from your spouse for all of 2012, enter "D" to the right of the word "benefits" on Form 1040, line 20a, or Form 1040A, line 14a.
- Do not use this worksheet if you repaid benefits in 2012 and your total repayments (box 4 of Forms SSA-1099 and RRB-1099) were more than your gross benefits for 2012 (box 3 of Forms SSA-1099 and RRB-1099). None of your benefits are taxable for 2012. For more information, see [Repayments More Than Gross Benefits](#).
- If you are filing Form 8815, Exclusion of Interest From Series EE and I U.S. Savings Bonds Issued After 1989, do not include the amount from line 8a of Form 1040 or Form 1040A on line 3 of this worksheet. Instead, include the amount from Schedule B (Form 1040A or 1040), line 2.

1. Enter the total amount from box 5 of ALL your Forms SSA-1099 and RRB-1099. Also enter this amount on Form 1040, line 20a, or Form 1040A, line 14a **1.** _____
2. Enter one-half of line 1 **2.** _____
3. Combine the amounts from:
Form 1040: Lines 7, 8a, 9a, 10 through 14, 15b, 16b, 17 through 19, and 21
Form 1040A: Lines 7, 8a, 9a, 10, 11b, 12b, and 13 **3.** _____
4. Enter the amount, if any, from Form 1040 or 1040A, line 8b **4.** _____
5. Enter the total of any exclusions/adjustments for:
 - Adoption benefits (Form 8839, line 24),
 - Foreign earned income or housing (Form 2555, lines 45 and 50, or Form 2555-EZ, line 18), and
 - Certain income of bona fide residents of American Samoa (Form 4563, line 15) or Puerto Rico
 **5.** _____
6. Combine lines 2, 3, 4, and 5 **6.** _____
7. **Form 1040 filers:** Enter the amounts from Form 1040, lines 23 through 32, and any write-in adjustments you entered on the dotted line next to line 36.
Form 1040A filers: Enter the amounts from Form 1040A, lines 16 and 17 **7.** _____
8. Is the amount on line 7 less than the amount on line 6?
No. None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b, or Form 1040A, line 14b.
Yes. Subtract line 7 from line 6 **8.** _____
9. If you are:
 - Married filing jointly, enter \$32,000
 - Single, head of household, qualifying widow(er), or married filing separately and you **lived apart** from your spouse for all of 2012, enter \$25,000**Note.** If you are married filing separately and you lived with your spouse at any time in 2012, skip lines 9 through 16; multiply line 8 by 85% (.85) and enter the result on line 17. Then go to line 18.
 **9.** _____
10. Is the amount on line 9 less than the amount on line 8?
No. None of your benefits are taxable. Enter -0- on Form 1040, line 20b, or on Form 1040A, line 14b. If you are married filing separately and you **lived apart** from your spouse for all of 2012, be sure you entered "D" to the right of the word "benefits" on Form 1040, line 20a, or on Form 1040A, line 14a.
Yes. Subtract line 9 from line 8 **10.** _____
11. Enter \$12,000 if married filing jointly; \$9,000 if single, head of household, qualifying widow(er), or married filing separately and you **lived apart** from your spouse for all of 2012 **11.** _____
12. Subtract line 11 from line 10. If zero or less, enter -0- **12.** _____
13. Enter the **smaller** of line 10 or line 11 **13.** _____
14. Enter one-half of line 13 **14.** _____
15. Enter the **smaller** of line 2 or line 14 **15.** _____
16. Multiply line 12 by 85% (.85). If line 12 is zero, enter -0- **16.** _____
17. Add lines 15 and 16 **17.** _____
18. Multiply line 1 by 85% (.85) **18.** _____
19. **Taxable benefits.** Enter the **smaller** of line 17 or line 18. Also enter this amount on Form 1040, line 20b, or Form 1040A, line 14b **19.** _____



If you received a lump-sum payment in 2012 that was for an earlier year, also complete Worksheet 2 or 3 and Worksheet 4 to see if you can report a lower taxable benefit.

Bibliography

2013 Social Security Changes. 16 10 2012.

<http://www.ssa.gov/pressoffice/factsheets/colafacts2013.htm>. 27 2 2013.

Bell, Kay. *Taxes Blog*. 15 1 2013. <http://www.bankrate.com/financing/taxes/2013-tax-rates-income-brackets/>. 27 2 2013.

"Estimate of the Budgetary Effects of H.R. 8, the American Taxpayer Relief Act of 2012, as passed by the Senate on January 1, 2013." 1 1 2013. *Congressional Budget Office*.
<http://www.cbo.gov/sites/default/files/cbofiles/attachments/American%20Taxpayer%20Relief%20Act.pdf>. 22 2 2013.

"Federal Rates History in 2012 Real Dollar." n.d. *Taxfoundation*.

http://taxfoundation.org/sites/taxfoundation.org/files/docs/fed_rates_history_real_1913_2013_0.pdf. 17 3 2013.

"Federal Rates History Nominal." n.d. *TaxFoundation*. <http://taxfoundation.org/article/us-federal-individual-income-tax-rates-history-1913-2013-nominal-and-inflation-adjusted-brackets>.
17 3 2013.

Matthews, Merrill. *Forbes*. 17 1 2013.

<http://www.forbes.com/sites/merrillmatthews/2013/01/17/you-know-that-new-3-8-medicare-tax-double-it/>. 27 2 2013.

Rosenow, Kathleen. *High-Income Individuals to Pay Higher Medicare Taxes Starting in 2013*. 9 2012. <http://www.towerswatson.com/en-US/Insights/Newsletters/Americas/insider/2012/high-income-individuals-to-pay-higher-medicare-taxes-starting-in-2013>. 27 2 2013.

State-by-State Guide to Taxes on Retirees. 9 2012.

<http://www.kiplinger.com/tool/retirement/T055-S001-state-by-state-guide-to-taxes-on-retirees/index.php>. 27 2 2013.

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Education

B.S., Finance, 2013, The Pennsylvania State University, University Park, PA

B.S., Statistics (Apply Statistics Option), 2013, The Pennsylvania State University, University Park, PA

Honors and Awards

Beta Gamma Sigma, National Business Honor Society

The Evan Pugh Scholar Award – Junior, *April 2012*

Division of Undergraduate Studies Award for Exploratory Students, *March 2011*

The President Sparks Award for Academic Excellence, *March 2011*

President Freshman Award for Academic Excellence, *April 2010*

Study Abroad

University of Oxford, Oxford, United Kingdom (British History, and Economics), *Fall 2012*

Schreyer Honors College, London, United Kingdom (Theater Studies), *Spring Break 2012*

University of Hong Kong, Hong Kong, China (Social Science), *Summer 2010*

Association Memberships/Activities

Smeal Career and Corporate Connections

University Park, PA

HR Intern

Aug 2011 – May 2013

2011 Johnson & Johnson University Case Competition

University Park, PA

Team Secretary

Feb 2011 – Apr 2011

Professional Experience

Ernst & Young LLP

New York, NY

Risk & Performance Analyst

Jun 2012 – Aug 2012

- Assisted the partner and senior managers with a 5M sales pitch to a pharmaceutical client by communicating with the global team members and making the presentation slides
- Teamed with a senior staff on a project to reduce national cell phone expenses and learned to use SAS for data cleaning and Spotfire for data presenting

Goldman Sachs & Co.

Jersey City, NJ

Finance Analyst

Jun 2011 – Aug 2011

- Calculated revenue and earnings for Goldman tax entities and produced tax forms
- Created a data bank for 300+ entities under Goldman Sachs to identify future tax planning opportunity