THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF FINANCE

TRADITIONAL-STYLE VS. ROTH-STYLE 401K PLANS: CALCULATING THE OPTIMAL SAVINGS RATE FOR CONSUMPTION-SMOOTHING

DAVID BADER

SPRING 2012

A thesis
submitted in partial fulfillment
of the requirements
for baccalaureate degrees
in Finance and Economics
with honors in Finance

Reviewed and approved* by the following:

Dr. James Miles
Professor of Finance, Joseph F. Bradley Fellow of Finance
Thesis Supervisor/Honors Advisor

Dr. Louis Gattis
Clinical Associate Professor of Finance
Thesis Reader

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

The question of how much to save for retirement has been hotly debated in the world of finance for years now. With a struggling economy and an uncertain future, this issue has never been more relevant than right now. It has become a widely-accepted belief that the goal of an individual saving for retirement should be to achieve consumption-smoothing throughout his/her lifetime, ensuring that the same quality of life enjoyed in working years can be experienced in retirement.

This thesis aims to determine an optimal savings rates for individuals in various financial circumstances by using a model constructed in Microsoft Excel. The optimal savings rate is based on the idea of consumption-smoothing, which states that an individual will maintain the same consumption level throughout an entire lifetime. Additionally, the advantages and disadvantages of Roth-style versus traditional-style savings accounts will be considered, and a recommendation will be given as to which method is better for each scenario. In the end, this paper will help to provide a sense of security by reassuring individuals that they are indeed saving enough to retire comfortably.

TABLE OF CONTENTS

LIST OF FIGURES

ACKNOWLEDGEMENTS

I would like to thank Dr. James Miles for all of his help during the writing process of this thesis while serving as my Honors Adviser and Thesis Supervisor. Without his guidance and expertise in the field, I doubt that this thesis would have been possible.

Additionally, I would like to thank Dr. Louis Gattis for agreeing to act as the Faculty Reader for my thesis. I cannot thank him enough for taking the time out of his busy schedule to help me complete this project.

CHAPTER 1: INTRODUCTION

Given the recent uncertainty regarding the United States economy, saving for retirement has become more important than ever. Countless people have lost large portions of their savings as a result of the stock market crashes and recessions of the early 21st century. Thus, the topic of retirement savings has become increasingly relevant in the realm of personal finance.

The main focus of this paper is to model the consumption and savings habits of an individual throughout his/her lifetime. The overall goal is to achieve consumption-smoothing, the idea that a person will consume at the same level in retirement as he/she does during the working life, thereby ensuring that no drastic changes in quality of life will be experienced. In order to achieve consumption-smoothing, an optimal savings rate must be found so that consumption in retirement years exactly matches consumption during working years.

The Microsoft Excel model created for the purposes of this thesis calculates an optimal savings rate by taking into account lifetime earnings, projected Social Security benefits, an assumed rate of return on savings, and the number of years over which a person is saving for retirement. In addition, the model has incorporated the current U.S. tax code in order to determine federal income taxes based on the individual's salary.

Both Roth-style and traditional-style savings accounts are considered. These two devices differ in terms of their tax implications. Traditional-style accounts are taxed as money is withdrawn in retirement. Roth-style accounts, however, are taxed in the year of contribution and money withdrawn in retirement is tax-free. Whether or not a traditional or Roth-style account is preferred depends on future tax brackets. In the past, retirees would almost always move to a lower tax bracket, making the traditional-style the better option. However, in the case that an individual's investments earn large profits and he/she moves into a higher tax bracket in

retirement, a Roth account would be more attractive (Saunders and Cornett 521-522). The challenge is that it is difficult to forecast a person's future tax bracket, and that is why my model aims to achieve consumption-smoothing because this would mean that the individual has the same amount of after-tax money during working years as he/she does in retirement, thus avoiding any confusion about different tax brackets over time. As a result, we are able to compare the savings rates and amount of consumption more easily.

Optimal savings rates decrease as the number of years of savings increase, and this finding is easily explained since a longer savings period obviously gives the opportunity for a larger accumulation of retirement funds. Also of note, as salary increases, the optimal savings rate also increases. The reason behind this is that higher earning individuals cannot replace as high a percentage of their salary with Social Security benefits. Finally, higher rates of return lead to lower optimal savings rates because retirement funds grow considerably faster than if the rates of return were low. By the end of this paper, a person will be able to determine how much they need to save each year in order to retire on-time and live out their days in comfort and financial security.

CHAPTER 2: LITERATURE REVIEW

Before beginning a discussion of the results of my thesis, it is important to research what others have written on the subject and examine how my work may expand upon their findings. First, I examined an article called "Are You Sure You're Saving Enough for Retirement?" by Jonathan Skinner, a professor of economics at Dartmouth College. Skinner begins by highlighting the diverging viewpoints of his colleagues. On one hand, many experts warn people are not saving enough for retirement, while on the other hand, people are being encouraged to retire sooner and live off of less. This is why I have chosen to use the practice of consumption-smoothing as a measuring stick for intelligent savings habits. By achieving consumption-smoothing, an individual ensures that they have not over-saved, since he/she will not be living a more luxurious lifestyle than the one lived during working years, but also guarantees that he/she has enough put away to avoid becoming homeless and penniless at the end of life.

Skinner goes a step beyond the basic understanding of consumption-smoothing by explaining that, in reality, people probably don't actually need as much money in retirement as they do during their working life. For example, he notes that many retired people find they don't need as much living space and move into smaller houses, thereby decreasing their consumption. Additionally, it is assumed that, if an individual has children to support, as that person reaches the age of retirement, those children will be moving out of the house and beginning their own independent lives. This eliminates a huge cost, which decreases the individual's necessary consumption amount even further.

However, there are some added costs to retirement, and Skinner identifies health care as the biggest new expenditure. While in one's working years, many health care costs will likely be covered by the health insurance plan provided by an employer. Once a person retires, many of

these medical bills will be paid out-of-pocket. Despite this and other added expenses, Skinner cautions against "over-saving". In the article, he states, "One wants to avoid the sense of futility and avoidance expressed in a 1997 *New Yorker* cartoon by Roz Chaz: 'Who can plan, like, next week? Because an asteroid could smash into the Earth tomorrow, so what's the point?'" (Skinner 76).

While the cartoon cited is humorous, and something to laugh about, it also delivers a very potent message. Is it really worthwhile to resist consumption today when one could die tomorrow and never realize the benefits of the savings they have put away? Thus, Skinner seems to be a proponent of consumption smoothing throughout retirement, but recognizes that the future is uncertain and indulging in some purchases here and there should not be discouraged.

It is important to note that for every person who saves too much and loses out on consumption, there is another person who hasn't saved enough and struggles to get by in the last few years of life. In "The Life Cycle Model of Consumption and Saving" by Martin Browning and Thomas F. Crossley, the research shows that some individuals fail to smooth consumption throughout retirement. In the first couple of years, people can lead a very comfortable lifestyle, but towards the end of their life, their savings begin to run out and they must reduce consumption dramatically.

Ignoring the desire most people have to leave money to loved ones, thereby ensuring the financial security of family and friends, it would seem the optimal amount of savings is one that runs out at the precise moment a person dies. Obviously, it is impossible to predict the time of an individual's death; a person could be hit by a bus and killed while crossing the street five minutes from now or could live well beyond the age of one hundred. It is impossible to know for

sure. This uncertainty is the reason I maintain that consumption-smoothing across one's lifetime is the appropriate method of determining an optimal savings rate.

Another article I found in my research was "The Retirement Consumption Puzzle: Anticipated and Actual Declines in Spending at Retirement" by Michael Hurd and Susann Rohwedder. This paper highlights the fact that most experts suggest consumption smoothing is not practiced by individuals in reality and consumption is severely decreased at retirement age. It is as if people at the age of retirement are not ready to adjust to life without a steady income. However, Hurd and Rohwedder argue that people who prepare for retirement are actually pleasantly surprised at retirement, saying, "If anything, people seem to be more worried ex ante than ex post about the adequacy of retirement income" (Hurd and Rohwedder 16).

A fourth paper by David M. Blau entitled "Retirement and Consumption in a Life Cycle Model" provides comments further on the lack of consumption-smoothing in the real world. Blau begins by describing how most American households experience a decline in consumption after the age of retirement is reached and notes that many experts use this evidence to challenge the practice of consumption-smoothing. However, in his conclusions, Blau provides a reasonable explanation for changing consumption habits when he says:

> The results in this paper show that a drop in consumption at retirement is not a puzzle for a life cycle model. In a life cycle model with a reasonable amount of uncertainty, the date of retirement is inherently uncertain. Retirement is a discrete event and is not easily reversible, so when it does occur it often represents a shock to lifetime resources. Thus it should not be surprising that consumption behavior is discontinuous at retirement. (31)

He goes on to explain that increasing the amount of saving and forfeiting consumption during working years, may in fact be more costly than simply decreasing consumption at retirement.

The two previous articles return us to the earlier discussion sparked by Skinner cautioning individuals against over-saving and unnecessarily foregoing consumption in the here-and-now to save for a future where the money is not needed. Again, I believe that straight consumption-smoothing, which is achieved by my model, is still the goal that people should aim to achieve. I agree wholeheartedly that people can most likely get by on less money in retirement for reasons that have already been identified, but as the age-old saying goes, it is better to be safe than sorry. In the event that a person finds he/she has saved too much for retirement, there will always be some sort of outlet on which that money can be used. Extravagant purchases, such as expensive trips to foreign lands, or large donations to charities can be made in the last few years of life. Or the extra money can be set aside and left for loved ones, perhaps in the form of college funds for grandchildren. The point is, through the use of wills and other legal devices, a person can always ensure that excess savings can be used appropriately. Contrast this with a person who saves too little and can't afford exorbitant health bills should disease strike in old age and it is clear that the situation of a person who saves too much is always preferred to the one who saves too little.

Finally, "How Much Should Americans Be Saving for Retirement?", by B. Douglas Bernheim, Lorenzo Forni, Jagadeesh Gokhale, and Laurence J. Kotlikoff, looks at the problems with Social Security and how this may affect Americans in their savings for retirement. The issues with Social Security have been well-documented over the past few years. With an exploding population, the Social Security system has been pushed almost to the point of collapse. There are too many dependents of the system and too few contributors towards it. Therefore, as a direct result of the uncertainty of the Social Security system, it has become necessary for Americans to save for retirement at much higher rates than ever before. As the paper notes in its

conclusion, "…American households close to retirement, be their incomes high or low, need to save at much higher rates than would otherwise be the case because of the risk of major cuts in Social Security benefits" (Bernheim et al. 11).

While the authors raise a very relevant point, there is too much uncertainty surrounding the future of Social Security to accurately adjust for possible cuts. Therefore, I have decided to design the model under the assumptions of the current Social Security system. Should this change drastically in the future, the model will obviously need to be updated in order to become a more accurate tool.

After conducting this research, the goal of my thesis has become clearer. I must find the optimal savings strategy so that a person can smooth consumption throughout retirement and lead the lifestyle they have become accustomed to living without being in danger of either leaving too much savings behind or running out of savings and dramatically cutting consumption. With that being said, the event in which too much money is saved is clearly preferred to the alternative in which the individual runs out of money.

Of course there are many risks inherent with such a project. Death cannot be predicted and neither can factors such as disease or injury which could drastically increase medical bills. With this in mind, I will keep my model simple and concentrate on achieving consumption-smoothing without wasting time trying to predict an uncertain future. This of course means that there will likely be cases in which my model is not a useful financial planning tool. However, by keeping it simple and focusing on an average individual, I can create a model representative of the population as a whole. Hopefully, this will allow me to give accurate recommendations on savings and consumption habits for individuals who fit into a broad demographic (lower-class,

middle-class, upper-class, etc.) ensuring adequate preparation for a comfortable retirement living out their days with financial security.

CHAPTER 3: EXPLANATION OF APPROACH TAKEN

Using Microsoft Excel, I was able to create a model that can track an individual's consumption and savings habits over a lifetime. In order to keep the body of the thesis interesting and easy-to-read, I will not go into great details of the construction of the model. For a more in-depth explanation, please see Appendix A at the end of this paper.

In order for any model to be successful, assumptions must be made because the real world is far too complex to incorporate every single detail. For the purposes of this thesis, I made key assumptions in working and retirement age, salary and salary growth rate, the calculation of consumption, and the rate of return on investments. After explaining every assumption and the reasoning behind each, I will go into a brief explanation of the calculation of Social Security benefits. For more detail on the subject, please see Appendix A.

The first assumption that had to be made dealt with age. I decided to start an individual's working life at age 22, the time when most people are graduating from college. While there is still a large percentage of the population that holds only a high school degree, and therefore can start working before 22, recent history shows that more people are going to college every year. Additionally, the higher earnings potential of college graduates affords those people more of an opportunity to save money for retirement, whereas individuals who do not possess a college degree tend to make less money and must dedicate more funds to immediate basic necessities, like food and shelter, rather than contributing it to savings for the future. For these reasons, I decided to create a model assuming the individual does go to college and delays joining the workforce by four years.

In reality, the decision of when to retire is an individual choice. However, for the model, I needed to assume a retirement age for most people. This is how I arrived at the age of 67 for

the start of retirement years. Some companies offer the option to retire at 65 while others only require a certain number of years of service. However, age 67 is the Social Security full-retirement age for the majority of workers, so most people will work until then. For these reasons, I arrived at the assumptions of a period of working years from age 22 to age 66, and then retirement from age 67 to the end of life (since death is uncertain, I modeled out until age 95).

Next, I had to assume a salary. The model is built in a way that this can be easily changed, so I decided to look at three different income levels: lower-class, middle-class, and upper-class. Since there isn't really a concrete cutoff line between these classes, I settled on yearly incomes of $30,000 for lower-class, $60,000 for middle-class, and $90,000 for upper-class. Additionally, I built in a salary growth rate factor, but for the purposes of this thesis decided to keep the growth rate at 0% so that the individual is earning one constant income throughout his/her life. Obviously, this doesn't mirror reality, but it is vital to keep things simple rather than taking on too large of a project. Perhaps a future scholar can revisit my model and examine the effects on savings of changing salary growth rates.

In reality, the calculation of consumption can be quite complex. Everything from car payments to tuition bills needs to be taken into account to arrive at the correct amount of consumption. For the purposes of this thesis, I simplified the calculation. During working years, consumption is equal to income minus retirement savings minus taxes. In retirement, consumption becomes Social Security benefits plus withdrawal from savings minus taxes. Of course the taxes depend on whether an individual uses a Traditional-style or Roth-style account given that the two have different tax implications, which was discussed earlier in the paper. While the model certainly neglects several factors in the calculation of consumption, in the end

the simplistic approach used helps to create a more accurate model since these other expenses can change dramatically from person to person.

Given the uncertainty surrounding the American economy, I felt it was important to use several different rates of return on investments. I decided to use a worst case estimate of 2.0%, a base case estimate of 5.0%, and a best case estimate of 8.0%. Everything is in real terms, so there is no need to estimate inflation.

The calculation of Social Security benefits was done following the same protocol established by the United States government. Essentially, an individual's highest-earning 35 working years are averaged together. Then, this number is used, in addition with a set of "bend points" that are produced by the IRS. For the most current year, the bend points are as follows:

SOCIAL SECURITY BEND POINTS	
Percentage	**Excess Over**
90%	$9,204
32%	$55,488
15%	---

Since Social Security replaces a higher percentage of the lower incomes, this means that higher earning individuals will need to rely on retirement savings more than Social Security benefits to achieve consumption-smoothing.

Finally, I used an Excel tool called Goal Seek to find the optimal savings rates that would smooth consumption. I took the average consumption amount during working years and subtracted the average consumption amount during retirement years. I then used Goal Seek to set this difference to zero by changing the percentage saved each year. By finding these optimal savings rates that lowered the difference to zero, I was able to perfectly smooth consumption throughout an individual's entire lifetime. For a detailed explanation of the process just described, please see Appendix A.

CHAPTER 4: RESULTS

I conducted an analysis for three different income levels (lower-class, middle-class, and upper-class). As I described earlier in the paper, I chose $30,000 as the income level for a lower-class individual, $60,000 for a member of the middle-class, and $90,000 for someone in the upper-class. Next, I ran the analysis on several different assumed rates of return on investment (2.0%, 5.0%, and 8.0%). This helps to counteract the uncertainty surrounding the state of the economy. A series of tables summarizing the optimal savings rates that smooth consumption can be found below. The tables also show the level of consumption, the wealth-to-income at retirement ratio, and the replacement rate for all of the cases.

The last two metrics were discussed by Skinner, so I thought it would be a good way to compare and contrast my findings with his. Wealth-to-Income ratio is simply the wealth a person has at retirement (in this case the individual's account balance) divided by the income (or salary) at retirement. The replacement rate is a measure of how much of a person's working life income is replaced by withdrawals from savings. Thus, it's simply the yearly 401K withdrawal divided by the salary realized during working years.

2.0% Assumed Rate of Return on Investments (savings starts at age 22)			
	Lower-Class	**Middle-Class**	**Upper-Class**
Yearly Income	$30,000	$60,000	$90,000
Optimal Savings Rate (Traditional)	9.8492%	10.9392%	14.1041%
Optimal Savings Rate (Roth)	9.4485%	9.9269%	11.3516%
Consumption Level (Traditional)	$22,875.95	$42,369.86	$57,977.21
Consumption Level (Roth)	$22,552.96	$41,336.37	$57,281.09
Wealth-to-Income Ratio (Traditional)	7.0809	7.8645	10.1398
Wealth-to-Income Ratio (Roth)	6.7928	7.1367	8.1609
Replacement Rate (Traditional)	26.4588%	29.3868%	37.8890%
Replacement Rate (Roth)	25.3821%	26.6674%	30.4946%

5.0% Assumed Rate of Return on Investments (savings starts at age 22)			
	Lower-Class	**Middle-Class**	**Upper-Class**
Yearly Income	$30,000	$60,000	$90,000
Optimal Savings Rate (Traditional)	5.3017%	5.8755%	8.0912%
Optimal Savings Rate (Roth)	5.1833%	5.4458%	6.2274%
Consumption Level (Traditional)	$24,035.57	$44,648.50	$62,035.97
Consumption Level (Roth)	$23,832.50	$44,025.03	$61,892.88
Wealth-to-Income Ratio (Traditional)	8.4668	9.3833	12.9216
Wealth-to-Income Ratio (Roth)	8.2778	8.6969	9.9451
Replacement Rate (Traditional)	30.3242%	33.6066%	46.2792%
Replacement Rate (Roth)	29.6473%	31.1484%	35.6188%

8.0% Assumed Rate of Return on Investments (savings starts at age 22)			
	Lower-Class	**Middle-Class**	**Upper-Class**
Yearly Income	$30,000	$60,000	$90,000
Optimal Savings Rate (Traditional)	2.4820%	2.7737%	3.8772%
Optimal Savings Rate (Roth)	2.4557%	2.5801%	2.9504%
Consumption Level (Traditional)	$24,754.59	$46,044.33	$64,880.40
Consumption Level (Roth)	$24,650.78	$45,744.45	$64,842.16
Wealth-to-Income Ratio (Traditional)	9.5930	10.7205	14.9855
Wealth-to-Income Ratio (Roth)	9.4916	9.9722	11.4034
Replacement Rate (Traditional)	32.7209%	36.5666%	51.1142%
Replacement Rate (Roth)	32.3749%	34.0141%	38.8958%

I thought it would be interesting to apply the model to individuals who don't start saving for retirement until later in life. Given the fact that many young adults prefer to spend money traveling or paying off student loans, it is likely that there will be many individuals who avoid saving for retirement in order to have more money to spend on the things just described. Thus, I decided to run an analysis for each of the cases above, but this time for a late-starter (someone who doesn't save for retirement until the age of 40). The results can be seen in the tables below:

2.0% Assumed Rate of Return on Investments (savings starts at age 40)			
	Lower-Class	**Middle-Class**	**Upper-Class**
Yearly Income	$30,000	$60,000	$90,000
Optimal Savings Rate (Traditional)	16.3431%	18.2086%	22.2386%
Optimal Savings Rate (Roth)	15.2685%	16.0416%	18.3438%
Consumption Level (Traditional)	$21,220.01	$39,098.64	$52,486.47
Consumption Level (Roth)	$20,806.96	$37,667.55	$50,988.06
Wealth-to-Income Ratio (Traditional)	5.7764	6.4357	7.8601
Wealth-to-Income Ratio (Roth)	5.3965	5.6698	6.4835
Replacement Rate (Traditional)	20.9390%	23.3290%	28.4923%
Replacement Rate (Roth)	19.5621%	20.5527%	23.5023%

5.0% Assumed Rate of Return on Investments (savings starts at age 40)			
	Lower-Class	**Middle-Class**	**Upper-Class**
Yearly Income	$30,000	$60,000	$90,000
Optimal Savings Rate (Traditional)	12.6240%	14.0397%	17.5962%
Optimal Savings Rate (Roth)	11.9730%	12.5793%	14.3847%
Consumption Level (Traditional)	$22,168.39	$40,974.61	$55,620.05
Consumption Level (Roth)	$21,795.59	$39,744.92	$54,551.31
Wealth-to-Income Ratio (Traditional)	6.9014	7.6754	9.6197
Wealth-to-Income Ratio (Roth)	6.5456	6.8770	7.8640
Replacement Rate (Traditional)	24.1002%	26.8031%	33.5927%
Replacement Rate (Roth)	22.8576%	24.0149%	27.4615%

8.0% Assumed Rate of Return on Investments (savings starts at age 40)			
	Lower-Class	**Middle-Class**	**Upper-Class**
Yearly Income	$30,000	$60,000	$90,000
Optimal Savings Rate (Traditional)	9.2285%	10.2467%	13.3275%
Optimal Savings Rate (Roth)	8.8758%	9.3252%	10.6635%
Consumption Level (Traditional)	$23,034.23	$42,681.47	$58,501.45
Consumption Level (Roth)	$22,724.77	$41,697.39	$57,900.34
Wealth-to-Income Ratio (Traditional)	8.0612	8.9506	11.6417
Wealth-to-Income Ratio (Roth)	7.7530	8.1456	9.3147
Replacement Rate (Traditional)	26.9864%	29.9639%	38.9727%
Replacement Rate (Roth)	25.9548%	27.2691%	31.1826%

While a late-starter would only try to smooth his/her consumption beginning at age 40 rather than over an entire lifetime, the optimal savings rates are still considerably higher than for

someone who starts saving at age 22. This is understandable because the late-starter needs to build up his/her savings much more rapidly since there are fewer years before retirement when saving begins.

CHAPTER 5: CONCLUSION

According the tables above, Roth-style accounts always result in a lower optimal savings rate than traditional-style accounts. However, it is important to note that the gap between the two closes significantly as a person's yearly income decreases. Therefore, people with low incomes would not see much of a difference in the optimal savings rates between the two.

Another important conclusion is that optimal savings rates for both Roth-style and traditional-style accounts decrease as the rate of return on investments increase. This is self-explanatory. If investments are making higher returns, the savings account balances will grow faster and people will not have to save as much money.

As mentioned previously, the optimal savings rates for late-starters are much higher than for a person who starts saving at age 22. The same trends still apply; Roth-style accounts result in a lower rate than traditional-style accounts, though the gap narrows at lower income levels, and savings rates decrease as the rate of return increases.

Skinner identifies a wealth-to-income ratio at retirement of 5.1 as a simple life-cycle benchmark in "Are You Sure You're Saving Enough for Retirement?" (Skinner 63). For every case run on the model, the wealth-to-income ratio exceeded this benchmark. Thus, for every individual case in the model, by the individuals have more than enough wealth to live comfortably in retirement, according to Skinner's estimates. It makes sense that my model would return a higher wealth-to-income ratio at retirement because Skinner operated under the assumption that consumption during retirement would decrease while I wanted to achieve consumption-smoothing over the entire lifetime.

In conclusion, it is important for a person to start saving for retirement at an early age to avoid high savings rates that come with a late start. Additionally, the tables above show that a

Roth-style account allows achieves consumption-smoothing at a lower rate than a traditional-style account. While the traditional-style account provides a higher consumption level, as seen in the tables, the difference between the consumption levels is actually not a substantial one. In most cases, it amounts to only a few hundred dollars. For late-starters, the gap between consumption levels is a little larger, though the gap never reaches $2,000 in any case. Therefore, in my opinion, Roth-style accounts seem to be the better investment on a whole. Finally, for a person who wants to begin saving as soon as he/she starts work, I believe the optimal savings rate should be around 6.0%. I ran analyses using three different rates of return, but in actuality, I believe that the real rate of return will fall somewhere slightly below the 5.0% used as a base case.

CHAPTER 6: WORKS CITED

Works Cited

Bernheim, B. Douglas, Lorenzo Forni, Jagadeesh Gokhale, and Laurence J. Kotlikoff. *How Much Should Americans Be Saving for Retirement?* Working paper no. 00-02. Cleveland: Federal Reserve Bank of Cleveland, 1999. Print.

Blau, David M. "Retirement and Consumption in a Life Cycle Model." August 2007. IZA Discussion Paper No. 2986. *Social Science Research Network*. Web. 10 Nov. 2011. <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1012346>.

Browning, Martin, and Thomas F. Crossley. "The Life-Cycle Model of Consumption and Saving." *Journal of Economic Perspectives* 15.3 (2001): 3-22. *American Economic Association*. Web. 12 Nov. 2011. <http://www.aeaweb.org/articles.php?doi=10.1257/jep.15.3.3>.

Hurd, Michael, and Susann Rohwedder. *The Retirement Consumption Puzzle: Anticipated and Actual Declines in Spending at Retirement*. Working paper no. UM03-10. Ann Arbor: University of Michigan Retirement Research Center, 2004. Print.

Saunders, Anthony, and Marcia Millon. Cornett. "Chapter 18: Pension Funds." *Financial Markets and Institutions: An Introduction to the Risk Management Approach*. 3rd CPCU Edition ed. Boston, MA: McGraw-Hill/Irwin, 2007. 521-22. Print.

Skinner, Jonathan. "Are You Sure You're Saving Enough for Retirement?" *Journal of Economic Perspectives* 21.3 (2007): 59-80. Print.

APPENDIX A: CONSTRUCTING THE MODEL

In order to construct a model to represent a lifetime of savings and consumption habits, I used Microsoft Excel. In this section, I will take the reader through the construction of the model step-by-step in order to make my methodology as clear as possible.

First, I will discuss simple identifying factors, which can be seen below in Figure 1. In Row 1, I included a field called "Age". This runs from 22 (Column H) to 95 (Column CC). This simply allowed me to treat each year of an individual's life as a separate event. Thus, I was able to deal with salary differences, tax effects, etc., on a yearly basis. In Row 3, I created a "Salary Percentage Increase/Decrease from Previous Year" section. Though I initially only dealt with an individual whose salary remained constant, I realized that, in the real world, people are eligible for raises and bonuses and so I wanted to be able to reflect this reality in the spreadsheet. Additionally, there is the possibility that an individual will be fired from a job and will be forced to take a lower-paying position. Thus, it's important to also account for the possibility of salary decreases. This field was added with the idea that my thesis could be expanded upon and used for very specific cases in the future.

Figure 1: Identifying Factors

	G	H	I	J	K	L
1	**Age**	22	23	24	25	26
2						
3	**Salary Percentage Increase/Decrease from Previous Year**		0.0000%	0.0000%	0.0000%	0.0000%
4						

The next section deals with "Cash In", which can be seen in Figure 2. As the name implies, this deals with any sources of income to the individual. During the working years, this is limited to "Salary" in the initial model. However, when the individual retires at age 67 (Column BA), the 401K withdrawals and Social Security come into play. There are two 401K withdrawal lines to reflect the fact that a person could invest in a Traditional account or a Roth

account. These are linked to another cell further down the spreadsheet called "Account Balances". It's a commonly accepted practice to withdraw 4% of your savings every year in retirement. Thus, once the individual gets to age 67 and retires, the withdrawal each year will be 4% of whatever is currently in the account balance.

Figure 2: Cash In

	G	H	I	J	K	L
5	**Cash In**					
6	Salary	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
7	401K withdrawal (Traditional)	-	-	-	-	-
8	401K withdrawal (Roth)	-	-	-	-	-
9	Social Security	-	-	-	-	-
10						

The Social Security calculation is more complicated. Essentially, an individual's highest-earning 35 working years are averaged together. Then, this number is used, in addition with a set of "bend points" that are produced by the IRS. For the most current year, the bend points are as follows:

SOCIAL SECURITY BEND POINTS	
Percentage	**Excess Over**
90%	$9,204
32%	$55,488
15%	---

This means that an individual earning an average of $100,000 will have a Social Security benefit equal to 90% of the first $9,204 plus 32% of the next $46,284 to reach the next bend point, plus 15% of the remaining $44,512 of his/her income. This works out to be $29,771.28. As another example, an individual who earns an average of $50,000 will have a Social Security benefit equal to 90% of the first $9,204 plus 32% of the remaining $40,796 of his/her yearly salary. This works out to a benefit of $21,338.32.

I have embedded this calculation in the Social Security cells (Row 9, Columns H through CC) using two tools I built into the spreadsheet. These can be seen below in Figure 3. I reproduced the bend points table in the spreadsheet so that I could easily reference them in other cells. A complicated IF statement was needed in order to allow the model to change the Social Security benefit correctly as salary changed. Additionally, I created another reference called "Average of 35 Highest Earning Working Years". Embedded in this cell is the command to search all working years in an individual's life and then average out the highest 35 years. Again, this allows the model to automatically adjust to any changes in salary throughout one's lifetime.

Figure 3: Social Security Calculation Tools

	A	B
29	**Social Security Bend Points**	
30	Percentage	Of Excess Over
31	90%	$9,204
32	32%	$55,488
33	15%	--
34		
35	**Average of 35 Highest-Earning Working Years**	
36	$50,000.00	

The next section of the model deals with Cash Outflows. After careful consideration and discussion with my adviser, we decided to limit this to deposits into the 401K account. In the future, the model could be adjusted to show other Cash Out factors, such as car bills, tuition payments, etc., but to begin, we wanted to simplify the discussion before getting too far ahead of ourselves. The 401K Deposit cells are linked to the Account Contribution Rate Cells. Referencing Figure 4 below, if the account contribution rate for the Traditional 401K is 6% in column H, then the Traditional 401K deposit in column H will be 6% of the individual's salary (in the case of this screenshot, the individual was making $50,000 a year, so the deposit was 6% of $50,000, or $3,000, which is shown below). The rationale behind the Roth account contribution rate and the Roth deposit is the same as for the Traditional. I have built the model

in a way that the contribution rate can be changed, but it is important to remember that most individuals would like to contribute the same percentage towards retirement each year.

Figure 4: Cash Out

	G	H	I	J	K	L
11	**Cash Out**					
12	401K Deposit (Traditional)	$ 3,000.00	$ 3,000.00	$ 3,000.00	$ 3,000.00	$ 3,000.00
13	401K Deposit (Roth)	$ -	$ -	$ -	$ -	$ -
	G	H	I	J	K	L
26	**Account Contribution Rate**					
27	Traditional 401K	6.0000%	6.0000%	6.0000%	6.0000%	6.0000%
28	Roth 401K	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%

The next section was one of the most complicated portions of the model to build. It deals with taxes and can be seen below in Figure 5. First I will deal with the simpler aspects of the calculations before diving into the more complicated realm of income tax calculations. The Adjusted Gross Income is simply Cash In minus Cash Out. Thus, in working years, this is just Salary minus Traditional 401K Deposit. However, if a Roth account is used, this is not subtracted from Salary because of the tax implications of such an account. Roth accounts are taxed as you put money in, and therefore must be included in Adjusted Gross Income so that a person is not underpaying their income taxes. Once a person retires, withdrawals from a Traditional 401K are included in Adjusted Gross Income, but those from a Roth account are not. Since Roth accounts are taxed when the deposits are made, no taxes are due when funds are withdrawn. Traditional accounts act in the opposite way, so since no taxes are paid when deposits are made, the individual is taxed when funds are withdrawn.

Additionally, the IRS charges a Social Security tax of 6.2% (Row 21) and a Medicare Tax of 1.45% (Row 22). I have built the model to reflect these taxes. Additionally, there is a rule in the tax code that says no Social Security taxes are owed if a person makes over $110,100 per year, and so the model has been built to automatically decrease this tax to zero should a person's salary be high enough to qualify them for this exemption.

A portion of Social Security may also be included in the Adjusted Gross Income if part of the benefit is subject to taxation. However, I will wait to discuss this in a few paragraphs because the concept behind it is somewhat complicated and requires further explanation.

Figure 5: Taxes

	G	H	I	J	K	L
15	**Taxes**					
16	Adjusted Gross Income	$ 47,000.00	$ 47,000.00	$ 47,000.00	$ 47,000.00	$ 47,000.00
17	Standard Deductions	5,800.00	5,800.00	5,800.00	5,800.00	5,800.00
18	Exemptions	3,700.00	3,700.00	3,700.00	3,700.00	3,700.00
19	Taxable Income	37,500.00	37,500.00	37,500.00	37,500.00	37,500.00
20	Income Taxes (Single)	4,867.50	4,867.50	4,867.50	4,867.50	4,867.50
21	Social Security Taxes	3,100.00	3,100.00	3,100.00	3,100.00	3,100.00
22	Medicare Taxes	$ 725.00	$ 725.00	$ 725.00	$ 725.00	$ 725.00
23	**Consumption Amount**	$ 38,307.50	$ 38,307.50	$ 38,307.50	$ 38,307.50	$ 38,307.50
24	Consumption per Person	$ 38,307.50	$ 38,307.50	$ 38,307.50	$ 38,307.50	$ 38,307.50

The federal government recognizes that it is more difficult to provide in a household where there are other people to take care of than in a situation where there is only an individual. As a result, the IRS allows for deductions and exemptions. In Figure 6 below, there is a table describing the standard deductions available. This deduction is subtracted from Adjusted Gross Income before taxes are taken. Thus, it is essentially tax-free. By allowing married couples and heads of household to claim a higher deduction, more of their salary is sheltered from income taxes so that they will have more money with which to provide for their family. I have built in a section of the model to allow for a change between the different deductions in Rows 37 through 39. For example, if a person starts caring for an elderly relative in a certain year, all they have to do is change the "Head of Household" cell to "Yes" and make sure the "Single" and "Married/Widow(er)" cells are set to "No". By doing so, the model will automatically apply the correct deduction.

The idea behind exemptions is the same as the logic underlying deductions. The more people in the household, the more money an individual is allowed to keep from being considered

as taxable income. Thus, they will have to pay fewer taxes. Figure 6 below illustrates the method I used to incorporate exemptions into the model. The IRS allows people to claim an exemption of $3,700 for each person in the household. One needs only to fill in the correct number of adults, elderly family members, and children living in the home (Rows 42 through 44), and the model will calculate and apply the appropriate amount of exemptions.

Figure 6: Deductions & Exemptions

	G	H	I	J	K	L
36	**Tax Info (Standard Deductions)**					
37	Single	Yes	Yes	Yes	Yes	Yes
38	Married/Widow(er)	No	No	No	No	No
39	Head of Household	No	No	No	No	No
40						
41	**Tax Info (Exemptions)**					
42	Standard Adult	1	1	1	1	1
43	Over 65	0	0	0	0	0
44	Children	0	0	0	0	0

	A	B
1	**Standard Deductions**	
2	Single	$5,800
3	Married/Widow(er)	$11,600
4	Head of Household	$8,500
5		
6	**Exemptions**	
7	Number of People times	$3,700

Now I will return to a discussion about the taxable portion of Social Security. The IRS has created a Social Security Benefits Worksheet (this can be seen in Appendix B) to help individuals determine what portion, if any, of their Social Security benefit was taxable. In order to accurately build my model, I needed to recreate this worksheet in Excel (shown below in Figure 7). The worksheet is pretty self-explanatory, but it is worth noting that there is a new marital status deduction in lines 7 and 9 (Rows 56 and 59). These deductions depend on whether the person filing is single/head of household/widow(er)/separated, married filing jointly, or married filing separately. Depending on the individuals marital status (which is accounted for in Rows 70 through 72 by entering "Yes" for the appropriate category and "No" for the other two),

they will receive a different deduction. After working through the worksheet, which the model will do automatically, the taxable portion of the Social Security Benefit can be determined and added to the Adjusted Gross Income cell that was discussed previously so that the correct amount of taxes will be paid in the end.

Figure 7: Social Security Benefit Worksheet

	G	H	I	J	K	L
49	**Social Security Benefits Worksheet**					
50	1. Income from Social Security	$ -	$ -	$ -	$ -	$ -
51	2. One-half of SS benefits	-	-	-	-	-
52	3. Other Income	-	-	-	-	-
53	4. Combine lines 2 and 3	-	-	-	-	-
54	5. Deductions	-	-	-	-	-
55	6. Net Income	-	-	-	-	-
56	7. Marital Status Deduction	25,000.00	25,000.00	25,000.00	25,000.00	25,000.00
57	8. New Net Income	-	-	-	-	-
58	9. Added Marital Status Deduction	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
59	10. New New Net Income	-	-	-	-	-
60	11. Smaller of line 9 and 10	-	-	-	-	-
61	12. One-half of line 11	-	-	-	-	-
62	13. Smaller of line 2 and line 12	-	-	-	-	-
63	14. 85% of line 10	-	-	-	-	-
64	15. Sum of lines 13 and 14	-	-	-	-	-
65	16. 85% of line 1	-	-	-	-	-
66	17. Smaller of line 15 and 16	-	-	-	-	-
67	**Taxable Social Security Benefits**	$ -	$ -	$ -	$ -	$ -
68						
69	**Social Security Marital Status**					
70	Single/Head of Household/Widow(er)/Separated	Yes	Yes	Yes	Yes	Yes
71	Married filing jointly	No	No	No	No	No
72	Married filing separately	No	No	No	No	No

Finally, we are able to get into a discussion of how income taxes are actually calculated. The IRS publishes a set of income tax tables each year (these are shown in Appendix C, with the relevant table highlighted) in order to help explain the income tax process. Essentially, an individual looks at his/her taxable income, and then consults the chart to figure out how much he/she must pay in taxes. The idea is that people earning more money will pay more taxes so that lower-earning individuals can keep more money to maintain the best quality of life possible. In order to embed these tax rules in the model, I had to recreate the tax tables in Excel, shown below in Figure 8.

Figure 8: Income Tax Tables

	A	B	C	D	E
9	Income Tax Table (Single)				
10	Over	But Not Over	Base	Percentage	Of Excess Over
11	$0	$2,150	$0.00	--	--
12	$2,150	$10,850	$0.00	10%	$2,150
13	$10,850	$37,500	$870.00	15%	$10,850
14	$37,500	$87,800	$4,867.50	25%	$37,500
15	$87,800	$180,800	$17,442.50	28%	$87,800
16	$180,800	$390,500	$43,482.50	33%	$180,800
17	$390,500	--	$112,683.50	35%	$390,500
18					
19	Income Tax Table (Married)				
20	Over	But Not Over	Base	Percentage	Of Excess Over
21	$0	$8,100	$0.00	--	--
22	$8,100	$25,500	$0.00	10%	$8,100
23	$25,500	$78,800	$1,740.00	15%	$25,500
24	$78,800	$150,800	$9,735.00	25%	$78,800
25	$150,800	$225,550	$27,735.00	28%	$150,800
26	$225,550	$396,450	$48,665.00	33%	$225,550
27	$396,450	--	$105,062.00	35%	$396,450

	G	H	I	J	K	L
46	Tax Info (Income Taxes)					
47	Single	Yes	Yes	Yes	Yes	Yes

As the table shows, marital status is a big factor when determining income taxes. Married individuals have higher income thresholds to meet before being bumped up to the next tax bracket. As was mentioned before, this is to allow households with more than one person to pay fewer taxes. In order to incorporate all of this into the model, I created a field in Row 47 where a person can indicate his/her marital status. If he/she is single, simply say "Yes", otherwise say "No". A "Yes" causes the model to reference the Income Tax Table for singles while a "No" obviously leads it to reference the Income Tax Table for married individuals.

Through the usage of another complicated IF statement, I was able to compare the taxable income each year, to the thresholds listed in the tax tables. Thus, the model produces the appropriate base tax (a constant payment) as well as the percentage tax of any remaining money to accurately portray the appropriate income tax in Row 20 (see Figure 5). Referring back to Figure 5, the Consumption Amount is determined by adding up all of the Cash In inputs and subtracting all Cash Out variables and taxes. Finally, there is a field called Consumption per

Person, which is simply the Consumption Amount divided by the number of people living in the household (found by totaling the number of exemptions, as seen in Figure 6). The Consumption per Person metric is a simple way of showing the quality of life that can be enjoyed by each person in the household. Even though an individual may end up with a Consumption Amount of $50,000, if there is another person in the household, he/she can theoretically only enjoy $25,000 of that amount.

The next portion of the model that will be discussed is the Account Balances section, shown below in Figure 9. It was important to keep track of how much money was accumulated in an individual's retirement account. As a result, these sections (Rows 33 and 34) have been linked to the deposit fields discussed above so that each year the account balance will grow by the size of the deposit. Additionally, it is important to factor in interest that will be earned by the accounts. This is reflected in the Investment Return section (Row 30). The way I have set up the model, the investment return can change every year. Thus, if someone was to create a set of random returns to realistically model the random walk of the stock market, it would be simple to add these hypothetical returns into the model.

Figure 9: Account Balances

	G	H	I	J	K	L
30	**Investment Return**		3.0000%	3.0000%	3.0000%	3.0000%
31						
32	**Account Balances**					
33	Traditional 401K	$ 3,000.00	$ 6,090.00	$ 9,272.70	$ 12,550.88	$ 15,927.41
34	Roth 401K	$ -	$ -	$ -	$ -	$ -

Finally, I incorporated a way to account for Consumption Smoothing in the model. Looking at Figure 10 below, I set up a table to compare consumption during an individual's working years to his/her retirement years. All I had to do was set up an equation to take the average consumption amount during the years spent working in cell B49, and then do the same

for retirement years in cell B50. Next, I found the difference between the two by simply subtracting B50 from B49 and putting the difference in cell B51.

Figure 10: Consumption Smoothing

	A	B	
47	CONSUMPTION SMOOTHING		
48	Average Consumption per Year		
49	Working Years	$	38,307.50
50	Retirement Years	$	31,596.39
51	Difference	$	6,711.11

The idea of this table is to use Goal Seek, an application within Excel's "What-If Analysis" data package, to set the difference to zero by changing the percentage of salary saved. If there is no difference between consumption in working years and retirement years, then an individual has perfectly smoothed consumption throughout his/her lifetime. This is the ideal outcome because it means that the individual can enjoy the same quality of life whether working or in retirement and will not have to make any drastic changes to his/her lifestyle.

APPENDIX B: SOCIAL SECURITY BENEFITS WORKSHEET

2011 Form 1040—Lines 20a and 20b

Social Security Benefits Worksheet—Lines 20a and 20b

Keep for Your Records

Before you begin:

- ✓ Complete Form 1040, lines 21 and 23 through 32, if they apply to you.
- ✓ Figure any write-in adjustments to be entered on the dotted line next to line 36 (see the instructions for line 36).
- ✓ If you are married filing separately and you lived apart from your spouse for all of 2011, enter "D" to the right of the word "benefits" on line 20a. If you do not, you may get a math error notice from the IRS.
- ✓ Be sure you have read the **Exception** in the line 20a and 20b instructions to see if you can use this worksheet instead of a publication to find out if any of your benefits are taxable.

1.	Enter the total amount from **box 5** of **all** your **Forms SSA-1099** and **Forms RRB-1099.** Also, enter this amount on Form 1040, line 20a . . . . . 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	3.	
4.	Enter the amount, if any, from Form 1040, line 8b	4.	
5.	Combine lines 2, 3, and 4	5.	
6.	Enter the total of the amounts from Form 1040, lines 23 through 32, plus any write-in adjustments you entered on the dotted line next to line 36	6.	
7.	Is the amount on line 6 less than the amount on line 5? ☐ **No.** STOP None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b. ☐ **Yes.** Subtract line 6 from line 5	7.	
8.	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 2011, enter $25,000 • Married filing separately and you lived with your spouse at any time in 2011, skip lines 8 through 15; multiply line 7 by 85% (.85) and enter the result on line 16. Then go to line 17	8.	
9.	Is the amount on line 8 less than the amount on line 7? ☐ **No.** STOP None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b. If you are married filing separately and you **lived apart** from your spouse for all of 2011, be sure you entered "D" to the right of the word "benefits" on line 20a. ☐ **Yes.** Subtract line 8 from line 7	9.	
10.	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 2011 . .	10.	
11.	Subtract line 10 from line 9. If zero or less, enter -0-	11.	
12.	Enter the **smaller** of line 9 or line 10	12.	
13.	Enter one-half of line 12	13.	
14.	Enter the **smaller** of line 2 or line 13	14.	
15.	Multiply line 11 by 85% (.85). If line 11 is zero, enter -0-	15.	
16.	Add lines 14 and 15	16.	
17.	Multiply line 1 by 85% (.85)	17.	
18.	**Taxable social security benefits.** Enter the **smaller** of line 16 or line 17. Also enter this amount on Form 1040, line 20b	18.	

TIP *If any of your benefits are taxable for 2011* ***and*** *they include a lump-sum benefit payment that was for an earlier year, you may be able to reduce the taxable amount. See Pub. 915 for details.*

APPENDIX C: FEDERAL INCOME TAX TABLES

Percentage Method Tables for Income Tax Withholding (continued)
(For Wages Paid in 2012)

TABLE 5—QUARTERLY Payroll Period

(a) SINGLE person (including head of household)—

If the amount of wages (after subtracting withholding allowances) is:

The amount of income tax to withhold is:

Not over $538 . . . . . $0

Over—	But not over—		of excess over—
$538	—$2,713	$0.00 plus 10%	—$538
$2,713	—$9,375	$217.50 plus 15%	—$2,713
$9,375	—$21,950	$1,216.80 plus 25%	—$9,375
$21,950	—$45,200	$4,360.55 plus 28%	—$21,950
$45,200	—$97,625	$10,870.55 plus 33%	—$45,200
$97,625		$28,170.80 plus 35%	—$97,625

(b) MARRIED person—

If the amount of wages (after subtracting withholding allowances) is:

The amount of income tax to withhold is:

Not over $2,025 . . . . . $0

Over—	But not over—		of excess over—
$2,025	—$6,375	$0.00 plus 10%	—$2,025
$6,375	—$19,700	$435.00 plus 15%	—$6,375
$19,700	—$37,700	$2,433.75 plus 25%	—$19,700
$37,700	—$56,388	$6,933.75 plus 28%	—$37,700
$56,388	—$99,113	$12,166.39 plus 33%	—$56,388
$99,113		$26,265.64 plus 35%	—$99,113

TABLE 6—SEMIANNUAL Payroll Period

(a) SINGLE person (including head of household)—

If the amount of wages (after subtracting withholding allowances) is:

The amount of income tax to withhold is:

Not over $1,075 . . . . . $0

Over—	But not over—		of excess over—
$1,075	—$5,425	$0.00 plus 10%	—$1,075
$5,425	—$18,750	$435.00 plus 15%	—$5,425
$18,750	—$43,900	$2,433.75 plus 25%	—$18,750
$43,900	—$90,400	$8,721.25 plus 28%	—$43,900
$90,400	—$195,250	$21,741.25 plus 33%	—$90,400
$195,250		$56,341.75 plus 35%	—$195,250

(b) MARRIED person—

If the amount of wages (after subtracting withholding allowances) is:

The amount of income tax to withhold is:

Not over $4,050 . . . . . $0

Over—	But not over—		of excess over—
$4,050	—$12,750	$0.00 plus 10%	—$4,050
$12,750	—$39,400	$870.00 plus 15%	—$12,750
$39,400	—$75,400	$4,867.50 plus 25%	—$39,400
$75,400	—$112,775	$13,867.50 plus 28%	—$75,400
$112,775	—$198,225	$24,332.50 plus 33%	—$112,775
$198,225		$52,531.00 plus 35%	—$198,225

TABLE 7—ANNUAL Payroll Period

(a) SINGLE person (including head of household)—

If the amount of wages (after subtracting withholding allowances) is:

The amount of income tax to withhold is:

Not over $2,150 . . . . . $0

Over—	But not over—		of excess over—
$2,150	—$10,850	$0.00 plus 10%	—$2,150
$10,850	—$37,500	$870.00 plus 15%	—$10,850
$37,500	—$87,800	$4,867.50 plus 25%	—$37,500
$87,800	—$180,800	$17,442.50 plus 28%	—$87,800
$180,800	—$390,500	$43,482.50 plus 33%	—$180,800
$390,500		$112,683.50 plus 35%	—$390,500

(b) MARRIED person—

If the amount of wages (after subtracting withholding allowances) is:

The amount of income tax to withhold is:

Not over $8,100 . . . . . $0

Over—	But not over—		of excess over—
$8,100	—$25,500	$0.00 plus 10%	—$8,100
$25,500	—$78,800	$1,740.00 plus 15%	—$25,500
$78,800	—$150,800	$9,735.00 plus 25%	—$78,800
$150,800	—$225,550	$27,735.00 plus 28%	—$150,800
$225,550	—$396,450	$48,665.00 plus 33%	—$225,550
$396,450		$105,062.00 plus 35%	—$396,450

TABLE 8—DAILY or MISCELLANEOUS Payroll Period

(a) SINGLE person (including head of household)—

If the amount of wages (after subtracting withholding allowances) divided by the number of days in the payroll period is:

The amount of income tax to withhold per day is:

Not over $8.30 . . . . . $0

Over—	But not over—		of excess over—
$8.30	—$41.70	$0.00 plus 10%	—$8.30
$41.70	—$144.20	$3.34 plus 15%	—$41.70
$144.20	—$337.70	$18.72 plus 25%	—$144.20
$337.70	—$695.40	$67.10 plus 28%	—$337.70
$695.40	—$1,501.90	$167.26 plus 33%	—$695.40
$1,501.90		$433.41 plus 35%	—$1,501.90

(b) MARRIED person—

If the amount of wages (after subtracting withholding allowances) divided by the number of days in the payroll period is:

The amount of income tax to withhold per day is:

Not over $31.20 . . . . . $0

Over—	But not over—		of excess over—
$31.20	—$98.10	$0.00 plus 10%	—$31.20
$98.10	—$303.10	$6.69 plus 15%	—$98.10
$303.10	—$580.00	$37.44 plus 25%	—$303.10
$580.00	—$867.50	$106.67 plus 28%	—$580.00
$867.50	—$1,524.80	$187.17 plus 33%	—$867.50
$1,524.80		$404.08 plus 35%	—$1,524.80

David Bader Academic Vita

David A. Bader
610-217-0696
dab5282@psu.edu

School Address:
348 Blue Course Drive
Building 17, Apartment 263A
State College, PA 16803

Home Address:
542 Trails End
Easton, PA 18040

EDUCATION:

PENNSYLVANIA STATE UNIVERSITY, Smeal College of Business, State College, PA
Bachelor of Science, Anticipated Graduation: May 2012, Double Major – Finance & Economics
The Schreyer Honors College
Honors Thesis: "Calculating the Optimal Savings Rate for Consumption-Smoothing"
Dean's List: Fall 2008 – Fall 2012

AWARDS AND ACTIVITIES:

Schreyer Honors College Scholarship: Four-Year Academic Scholarship
YMCA of Centre County Youth Pioneer Basketball League: Winter 2010 – Spring 2012
- Volunteer Head Coach

Tippy Taps for Africa (Health and sanitation projects to benefit Africa): Spring 2009
- Treasurer, designed a financial plan (budget) to allocate grant money

Member of Phi Beta Kappa and Beta Gamma Sigma Honors Societies

EXPERIENCE:

MUNICH REINSURANCE — Princeton, NJ
Enterprise Content & Business Processes Management Intern — Summer 2011
- Created a comprehensive database of company clients, using Microsoft Excel
- Populated a new Client Contacts Portal to improve efficiency among 20 client analysts

PENNSYLVANIA STATE UNIVERSITY — State College, PA
Teaching Assistant, ECON 106 (Statistical Foundations for Econometrics) — Spring 2011
- Graded homework assignments for 200 students
- Maintained log of grades on Angel, Pennsylvania State University's record keeping system

TOTAL MARKETING RESOURCES, INC. — Allentown, PA
Marketing Intern — Summer 2010
- Compiled database of potential clients for senior management using Microsoft Excel
- Designed print advertisement campaign and composed text for new company website

EASTON AREA SCHOOL DISTRICT — Easton, PA
Technology Associate — Summer 2008, 2009, and 2010
- Reported weekly progress to Technology Director
- Deployed technology assets as part of District's annual technology plan

PROJECTS:

VICTORY SPORTS PERFORMANCE AND FITNESS — State College, PA
Marketing Consultant — Spring 2010
- Collaborated on print advertising campaign and distributed throughout community
- Produced and directed a series of viral videos to advertise business

NITTANY NIGHT LIFE — State College, PA
Consultant — Spring 2010
- Developed a strategic business plan for the owners of the company
- Contacted potential clients and set up sales meetings