“Attention all Spenders: Life-Cycle Hypothesis for Sale”

by

Tina R. Ziemek
College of the Holy Cross: Spring 2003

Spending money is inevitable; but how much money one spends or on the contrary, how much one saves, may depend upon his or her personal characteristics. Out of sheer will or necessity, some people are spenders, whereas for others saving money may come naturally and be more manageable. This paper examines savings behavior in terms of a modified life-cycle hypothesis. Using the 1998 Survey of Consumer Finances I find some inconsistencies within the life-cycle hypothesis, such as the concept of fungibility and to what extent demographic characteristics affect savings.

Acknowledgements

I would like to express my gratitude to all those who guided me through the process of completing my thesis. I would first and foremost like to thank Professor John F. O'Connell, whose direction, suggestions, and encouragement has helped to guide my research and shape my ideas into a polished thesis. I would also like to thank Professor Kolleen Rask and Professor Katherine Kiel for all of their support and patience. Finally, I thank my family and friends, who have been the best listeners and the source of my inspiration.

TABLE OF CONTENTS

I. INTRODUCTION

"Thrift is the source of national wealth, and the more thrifty a nation is the more wealthy it becomes. Such is the common teaching of almost all economists; many of them assume a tone of ethical dignity as they plead the infinite value of thrift; this note alone in all their dreary song has caught the favour of the public ear." – J.A. Hobson in *The General Theory of Employment, Interest, and Money* by John Maynard Keynes.

"The long economic expansion, dating from 1992 to 2000, was fueled by an unprecedented rise in private expenditure relative to income, financed by a growing flow of net credit to the private (household and business) sector. The ensuing boom was therefore attended by an unprecedented rise in the private sector's debt relative to its income." – *Strategic Analysis*, Levy Economics Institute

The above quotes demonstrate the complex role of savings in society. The purpose of this paper is to examine the life-cycle hypothesis of savings. What first interested me in researching savings was that the number of personal bankruptcy filings increased even in the robust economy from 1994 to 1998. The number of nonbusiness bankruptcy filings in the United States increased faster than during the four-year period that included the 1991 recession, reaching more than one filing per 100 households in 1998 (Stavins, 2000). There was a 19.2 percent increase in personal bankruptcy filings from 2000 to 2001. More shocking, the total number of personal bankruptcy cases filed in the federal courts broke all records in June 2002. In the 12-month period ending June 30, 2002, bankruptcy filings totaled over 1.5 million; this is the largest number of cases ever filed in any 12-month period.[1]

Such behavior is difficult to interpret in the context of a life-cycle model. Some researchers argue that high bankruptcy rates may be due to the greater availability of credit. Credit cards were not as common in 1960 as they are today. Now that credit via a

[1] Data from BankruptcyAction.com: http://www.bankruptcyaction.com/USbankstats.htm.

credit card is accessible to almost everyone, people have a way to finance goods or services they want now, but cannot necessarily afford. People are inherently human, and the assumption of rational behavior in the credit market may not hold.

The essence of the life-cycle theory is that in any year, compute the present value of your wealth, including current income, net assets, and future income; figure out the level annuity you could purchase with that money; then consume the amount you would receive if you in fact owned such an annuity. The theory is simple, elegant, and rational – qualities valued by economists (Thaler, 1990). Unfortunately, as Courant, Gramlish, and Laitner observe (1986, p. 279-80), "For all its elegance and rationality, the life-cycle model has not tested out very well."

At the center of the theory of saving is a hump-shaped age-saving profile. The young, whose incomes are below their permanent income, borrow to finance consumption; the middle-aged save for retirement; and the old dissave (Thaler, 1990). In a series of papers written in the 1950s Franco Modigliani and his collaborator Albert Ando examined consumer behavior and savings. Modigliani emphasized that income varies systematically over people's lives and that savings allow consumers to move income from those times in life when income is high to those times when it is low. One important reason that income varies over a person's life is retirement. This interpretation of consumer behavior formed the basis for his life-cycle hypothesis (Mankiw, 2002).

Ando and Modigliani begin their discussion of the derivation of the aggregate consumption (savings) function as follows:

> "The Modigliani and Brumberg model starts from the utility function of the individual consumer: his utility is assumed to be a function of his own aggregate consumption in current and future periods. The individual is then assumed to maximize his utility subject to the resources available to him, his

> resources being the sum of current and discounted future earnings over his lifetime and his current net worth. As a result of this maximization the current consumption of the individual can be expressed as a function of his resources and the rate of return on capital with parameters depending on age. The individual consumption functions thus obtained are then aggregated to arrive at the aggregate consumption function for the community… the most crucial assumptions in deriving the aggregate consumption function must be those relating to the characteristics of the individual's utility function, and the age structure of the population." – Ando and Modigliani, 1963.

The assumptions Ando and Modigliani make are as follows (Ando and Modigliani, 1963):

Assumption I: The utility function is homogeneous with respect to consumption at different points in time; or, equivalently, if the individual receives an additional dollar's worth of resources, he/she will allocate it to consumption at different times in the same proportion in which he had allocated his total resources prior to the addition.

Assumption II: The individual does not expect to receive, nor desires to leave, any inheritance.

Assumption III: The consumer at any age plans to consume his total resources evenly over the remainder of his life span.

Assumption IV: (a) Every age group within the earning span has the same average income in any given year *t*. (b) In a given year *t*, the average income expected by any age group *T* for any later period *r*, within their earning span, is the same, (c) Every household has the same (expected and actual) total life and earning spans, assumed to be 50 and 40 respectively for the purpose of numerical computation.

Assumption V: The rate of return on assets is constant and is expected to remain constant.

Ando and Modigliani aggregated the relationship between consumption and total resources over all age groups to get the consumption function for the whole community:

$$C_t = \alpha'_1 Y_t + \alpha'_2 Y_t^e + \alpha'_3 A_{t-1} \quad (1)$$

where: C_t = aggregate consumption in a given year t, Y_t = aggregate non-property income in a given year t, Y_t^e = average annual expected income, and A_{t-1} = net worth in a given year t-1.

Ando and Modigliani also noted that the measurement of expected non-property income, Y^e, is not directly observable. They note a "naïve" hypothesis is to assume that expected non-property income is the same as actual current income, except for a possible scale factor. Thus, they concluded:

$$Y_t^e = ß' Y_t; \quad ß' \cong 1. \quad (2)$$

Substituting the above expression into (1), we obtain the aggregate consumption function

$$C_t = (\alpha'_1 + ß'\alpha'_2) Y_t + \alpha'_3 A_{t-1} = \alpha_1 Y_t + \alpha_3 A_{t-1}$$

$$\alpha_1 = \alpha'_1 + ß'\alpha'_2 \cong \alpha'_1 + \alpha'_2.$$

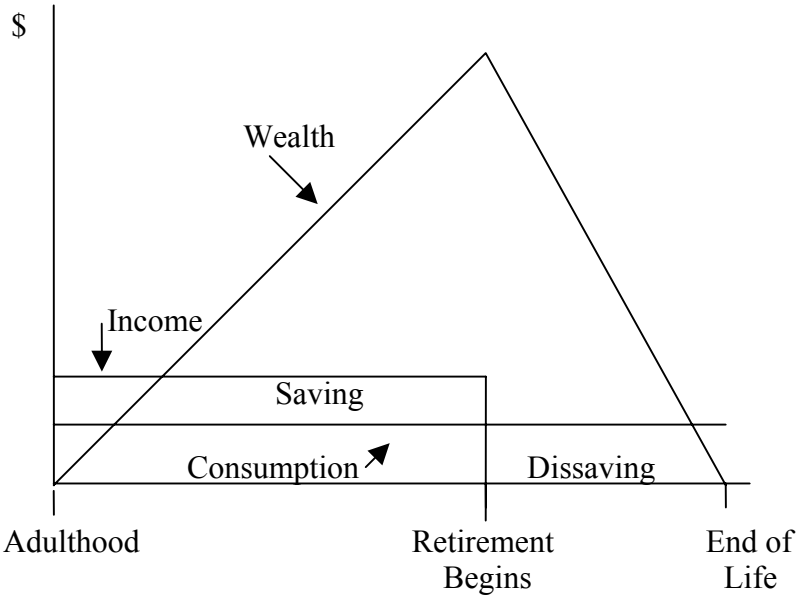
Ando and Modigliani designated this formulation as hypothesis I (Ando and Modigliani, 1963). This implies saving is equal to:

$$S_t = Y_t - (\alpha_1 Y_t + \alpha_3 A_{t-1})$$

In summary, the life-cycle model predicts that saving varies over a person's lifetime. If a person begins adulthood with no wealth, she will accumulate wealth during her working years and then run down her wealth during her retirement years. Figure 1 illustrates the consumer's income, consumption, and wealth over her adult life. According to the life-cycle hypothesis, because people want to smooth consumption over

their lives, the young who are working save, while the old who are retired dissave (Mankiw, 2002).

Figure 1



One of the key assumptions of the life-cycle hypothesis is "fungibility." Richard Thaler explained fungibility as the notion that money has no labels. In the context of the life-cycle theory, the fungibility assumption is what permits all the components of wealth to be collapsed into a single number (Thaler, 1990). According to the life-cycle hypothesis, the effect of me winning $500 from a lottery ticket should be the same as having stock in which 100 shares increase by $5 a share, or having the value of my pension increase $500. The marginal propensity to consume (MPC) for all types of wealth are supposed to be equal, assuming no transactions costs.

Thaler explained that a simple way of thinking about how people actually behave with respect to various types of wealth is to assume households have a system of mental accounts. One possibility is that a household has three broad accounts, a current income account *I*, asset account *A*, and a future income account *F*. Roughly speaking, the MPC

from *I* is close to unity, the MPC from *F* is close to zero, and the MPC from *A* is somewhere in between. Thaler believes the assumption that all three MPCs are equal is not a valid assumption.

One variation of the life-cycle hypothesis is Milton Friedman's permanent income hypothesis. Friedman's concept is that consumption depends on a long-term average of incomes -called permanent income- rather than just current income. If the change in income is temporary, then permanent income, and hence consumption, change relatively little. The marginal propensity to consume out of temporary income is small and approximately equal to the interest rate (Barrow, 1997).

It is important to note that the role of self-control strongly influences saving behavior. I think any one of my college peers who has ever received a credit card statement that was a little (a lot) more than they planned can attest that self-control influences spending. One way of estimating the importance of income-sensitive behavior is to consider the possibility that there are two types of consumers: one type satisfies the permanent income hypothesis, the other type follows the rule of thumb "spend what you make" (Thaler, 1990). Campbell and Mankiw consider such a model, and estimate the relative proportions to be about 50-50 (Campbell and Mankiw, 1989). Therefore the permanent income model does not seem rational enough to use for all consumers. I will refer to the first type of consumers as "savers," and those who spend what they make will be labeled "spenders."

If I had lived in 1963 when the life-cycle model was created, I think it would have been a lot easier to save money. But we are living in the twenty-first-century, and the world has changed. The life-cycle hypothesis assumption that the consumer at any age

plans to consume her total resources evenly over the remainder of her life span may not be realistic today. Consumers have tastes and preferences that are different from those of the 1960s.

Consumers have a plethora of goods to choose from that are high-tech, top of the line, and/or luxurious. For example, a common winter activity in 1950 would be to go ice fishing, now the popular winter activity is snowboarding. It is clear that a season of snowboarding is an expensive alternative to ice fishing. A snowboarder needs equipment, a ski pass, and then there are additional goods that are often wanted, such as: the newest .mp3 player to listen to music while he or she rides the slopes, a cellular phone for when he or she is separated from friends, and a personal Global Positioning System tracker so he or she can be easily found if lost.

It might be that this theoretical snowboarder realizes she is spending all this money while she is young, and therefore plans to spend less when she is older. But if this were true, one of the key assumptions of the life-cycle hypothesis is violated, and an anomaly has occurred.

Also, there are both expected and unexpected occurrences in life that were not as prevalent in 1960. For instance, more people go to college now than in 1960, and while college increases future expected income, it also puts an individual in greater debt. If people are not rational enough to calculate present values, how does one know if he or she should attend college? Also, there are events that affect consumption rates more now such as: divorce, single parent families, and expensive health care systems.

The next section summarizes some of the research on the life-cycle theory. This is followed by a test of the model in section three. The paper concludes with a summary and the policy implications in section four.

II. LITERATURE REVIEW

Thaler comments that economists of prior generations offered many behavioral treatments of saving behavior. For example, Irving Fisher (1930) stressed the roles of foresight, self-control, and habits. In 1957 Friedman said individual perspective affected the permanent income hypothesis. He said, "The permanent income component is not to be regarded as expected lifetime earnings. … It is to be interpreted as the mean income at any age regarded as permanent by the consumer unit in question, which in turn depends on its horizon and foresightedness."[2]

Thaler also notes that modern theories of saving make the representative consumer increasingly sophisticated. Thaler said it best when he compared Robert Barro's models to his own, Thaler said "Barro assumes the agents in his model are as smart as he is, while I portray people as being as dumb as I am" (Thaler, 1990). Barro agreed with this assessment. The problem seems to be that while economists have gotten increasingly sophisticated and clever, consumers have remained decidedly human (Thaler, 1990).

The empirical research on the life-cycle model is voluminous. Many people have used the life-cycle model to examine aspects of human behavior. I focused on the literature that empirically tested the life-cycle hypothesis, concentrating on consumption (savings), and the assumptions about the representative consumer.

One of the first articles I came across was that of Betsy Buttrill White, which was written in 1978. This article led me to see that evaluating the validity of the life-cycle hypothesis was not a new idea; ever since 1954 when the model was created it has been

[2] This point is stressed by Carroll and Summers (1989), who quote this passage.

subjected to testing. However, White noted the empirical tests that analyzed the data accepted the hypothesis that the model was true. White conducted her own empirical tests of the life-cycle hypothesis and determined that the model was lacking as an explanation of aggregate personal saving in the United States. White drew the conclusion that saving for future consumption does not account for the totality of observed personal saving (White, 1978).

There seems to be an agreement emerging among economists that consumption is too sensitive to current income to be consistent with a lifetime conception of permanent income (Thaler, 1990). The evidence for this view is widespread, despite various ways of getting there. For example, some studies examine the shape of the lifetime consumption profile while others examine the smoothing of year-to-year consumption. Numerous authors that have studied the shape of consumption profiles over the life-cycle have concluded that they resemble the income profile too much to be consistent with the life-cycle theory, unless there are important liquidity constraints (Kotlikoff and Summers, 1981; Courant, Gamlich and Laitner, 1986).

Some studies even find that with or without liquidity constraints, people seem to be inefficient in smoothing consumption over the life cycle (Conlisk, 1996). Hall and Mishkin (1982) showed that the prediction of smoothed consumption is violated. Although their result was described in terms of a modern, rational expectations model of permanent income, the empirical results were similar to those obtained by Milton Friedman (1957) in his work on the consumption function. Friedman estimated a planning horizon of three years or less, and thus a consumption function that depends strongly on current income (Thaler, 1990).

Another prediction of the life-cycle theory is that the shape of consumption profiles should be independent of the shape of income profiles (Thaler, 1990). An example that this prediction does not always hold true can be seen when looking at graduate students; even those with high-income expectations such as medical students consume much less than their permanent income. Hard data give the same impression (Thaler, 1990). Carroll and Summers look at the consumption and income profiles for various occupation and education groups in the U.S. They find that the age-consumption profile is strongly influenced by the income profile.

While the above examine the consistency of the aggregate data with the theory, an alternative is to question people about their behavior and examine individual behavior. Do subjects do well in such tests? Often not. Hundreds of studies of this type have been done, most by psychologists, but recently by experimental economists as well. "There is a mountain of experiments in which people display intransitivity, misunderstand statistical independence, mistake random data for patterned data and vice versa, fail to appreciate the law of large number effects, fail to recognize statistical dominance, make errors in updating probabilities on the basis of new information, understate the significance of given sample sizes, fail to understand covariation for even the simplest examples, make false inferences about causality, ignore relevant information, use irrelevant information (as in sunk cost fallacies), display overconfidence in judgment relative to evidence, fail to discount the future consistently, and there are more" (Conlisk, 1996). In such experiments, the mental tasks people go through are often simple, at least relative to many economic decisions; and their responses are frequently way off. Keeping in mind

the errors people are prone to make, it is easy to see why household consumption data are often at odds with the standard life-cycle theory.

Reasoning errors are typical (Conlisk, 1996). A good example of a consumer going against economic theory is that when consumers purchase large appliances they tend to buy models with low price and high energy use, even though at plausible discount rates the initial price saving does not compensate for the later energy dissaving (Jerry Hausman 1979, Dermot Gately 1980, Loewenstein and Thaler 1989). In purchasing flood and earthquake insurance, consumers also appear to make inefficient choices (Kunreuther, 1978).

Psychologists hypothesize that subjects make systematic errors by using decision "heuristics," or rules of thumb, which fail to accommodate the full logic of a decision, as when a person makes systematic forecast errors by using adaptive rather than rational expectations (Conlisk, 1996). The systematic errors are often referred to as "biases," and the general topic often carries the label "heuristics and biases." The number of experiments reporting biases is so great that a sizable number of books and long survey papers have been written just to review the evidence (Conlisk, 1996). John Kagel and Alvin Roth (1995) present an excellent set of reviews of the results of experimental economics.

Various studies report that the young and the old consume too little, that consumption is sensitive to short run income fluctuations, that individual behavior and reasoning ability affect an individual's decisions, that consumption is not sensitive enough to expected future changes in income, and that consumption is improperly

sensitive to the composition of wealth and income (Thaler (1990), Christopher Carroll (1994), John Shea (1995)).

In light of my examination of the research, there are a number of interesting hypotheses that come to mind.

i. Are various forms of wealth fungible?

ii. Do savings adhere to the form assumed within the life-cycle model?

iii. To what extent do demographic characteristics such as age, gender, and race affect savings?

In the next section I attempt to test empirically the life cycle hypothesis. Section four concludes the paper with a summary and policy implications.

III. LIFE-CYCLE MODEL TESTED

Problems arise when trying to test the life-cycle theorem. An empirical result qualifies as an anomaly if it is difficult to "rationalize," or if implausible assumptions are necessary to explain it within the paradigm (Thaler, 1990). The anomalous empirical evidence on consumption falls roughly into two categories. First, Richard H. Thaler explains that consumption appears to be excessively sensitive to income. Over the life-cycle the young appear to consume too little, and the middle-aged consume too much. Second, various forms of wealth do not appear to be close substitutes as the theory would suggest. Compared to other assets, the marginal propensities to consume either pension wealth or home equity are very low (Thaler, 1990).

Various explanations as to why the empirical evidence does not correlate with the life-cycle model have been researched. Maybe some people aren't rational enough to calculate present values and annuity payments. Or perhaps credit markets are to blame, with liquidity constraints preventing people from achieving the life-cycle plan they would otherwise choose to adopt. Or savings is dependent on innate tendencies; some people like to spend money, whereas others like to save it. These among other explanations have been researched, criticized, and supported.

I use data from the 1998 Survey of Consumer Finances (SCF). The Federal Reserve, with the assistance of other agencies and organizations, conducts the SCF every three years to obtain detailed information about households' assets, liabilities, incomes, and the use of financial institutions and instruments such as credit cards. Each survey uses a random sample of U.S. households, with an over sample of high-income and high-wealth households, to obtain a detailed, comprehensive, and representative picture. The

over sampling is necessary because income and wealth are concentrated among a small number of households, so a random sample of the population would not account adequately for assets held by U.S. households (Yoo, 1998).

The 1998 SCF interviewed 4,305 families. To deal with missing data, the survey employs the multiple imputation technique, whereby missing data are imputed five times by drawing repeatedly from an estimate of the conditional distribution of the data. (For details on the techniques, see Kennickell 1998.) The technique produces five complete data sets, or implicates. As a result, the 1998 survey data contain 21,525 observations, or five times the number of respondents (Stavins, 2000). I selected key information from the hundreds of variables in the SCF to create my data set. My data set included statistics on income, savings, debt, net worth, age, gender, race, regional location, and occupation among other factors. Table 1 summarizes the data set.

A. Basic Model

i. Are various forms of wealth fungible?

I began by testing whether or not the MPC of the current income account *I*, was equal to that of the asset account *A*. If the two MPC's are equal, Ando and Modigliani are correct, if they are not equal, income may not be fungible. The initial regression model was:

$$\text{Net Savings} = \beta_1 + \beta_2 I + \beta_3 A + \beta_4 \text{Age} + \beta_5 \text{Interest\_Rate} + \varepsilon \quad (1)$$

where:

Net Savings = personal savings (stock amount individual held when surveyed) – personal debt (stock amount individual held when surveyed);

I = temporary income, income earned in previous calendar year;

A = net worth, where net worth = asset – debt;

Age = respondent's age in years;

Interest_Rate = the interest rate on the credit card which he or she has the largest balance;
ß: are coefficients to be estimated; and
ε = the random error term.

I included age and interest rates in my regression since the life-cycle model predicts that the only factors that should affect a household's saving rate are age, lifetime wealth, and the interest rate. Thus my hypothesis is:

$$H_0: ß_2 = ß_3$$

$$H_1: ß_2 \neq ß_3$$

Note, $ß_2$ and $ß_3$ measure the marginal propensity to save out of *I* and *A* respectively. The results of the regression equation can be found in Table 2.

Before testing my null hypotheses, I tested for homoskedasticity using White's test. I found that the null hypothesis of homoskedasticity should be rejected. Because my data was not homoskedastic I ran a regression using Ordinary Least Squares (OLS) with White's heteroskedasticity-consistent covariance matrix.[3] I rejected the null hypothesis that the MPC of the current income account was equal to the MPC of the asset account.[4] Since I cannot conclude the MPC of *I* and the MPC of *A* are equal, income may not be fungible.

I decided to examine the idea that fungibility is rational in greater detail. I tested whether the MPC of financial assets, income, and home equity were equivalent. The unrestricted regression equation was then:

[3] Even though I rejected homoskedasticity via a two-variance partition, I went on to complete a Chow test. The appropriate Chi-Square Wald test is beyond the scope of this paper.
[4] I used a F-test for stability and rejected the null hypothesis because the F-statistic was 110, which is greater than the F cutoff of 3.84 using an alpha value of 5%.

$$\text{Net Savings} = \beta_1 + \beta_2 I + \beta_3 \text{Financial} + \beta_4 \text{Home\_Equity} + \beta_5 \text{Age} + \beta_6 \text{Interest\_Rate} + \varepsilon \quad (2)$$

where:

Financial = total financial assets (excluding non-financial assets);

Home_Equity = home value less amount still owed on 1st and 2nd mortgage less amount owed on home equity lines of credit;

My hypothesis is:

$$H_0: ß_2 = ß_3 = ß_4$$

$$H_1: ß_2 \neq ß_3 \neq ß_4$$

I used OLS with White's robust standard errors, and the R^2 value was .12, with degrees of freedom 21,519. The restricted equations was:

$$\text{Net Savings} = \beta_1 + \beta_2(I + \text{Financial} + \text{Home\_Equity}) + \beta_5 \text{Age} + \beta_6 \text{Interest\_Rate} + \varepsilon \quad (3)$$

The R^2 value was .104382, with degrees of freedom 2. The F-Statistic equaled 131; since 131 is larger than the cutoff of $F_{3,\,21519,\,.05}$, which equaled 2.6, I reject the null hypothesis. The MPC's of income, financial assets, and home equity are not all equal, thus income does not appear fungible.

ii. Do savings adhere to the form assumed within the life-cycle model?

The results of regression 1 also indicate income is not a significant determinant of net savings. This result is unexpected because it goes against Ando and Modigliani's results, and also the literature I reviewed. The regression showed for every additional dollar of income earned, net savings increased by .004. Ando and Modigliani were correct in assuming that age and interest rate are significant determinants of savings. For

every year older a person is, his/her savings increases by $1,268. Net savings decreases by $38 for every percentage point increase in the interest rate.

iii. To what extent do demographic characteristics such as age, gender, and race affect savings?

In the simple theory, the only factors that should affect a household's saving rate are age, lifetime wealth, and the interest rate. Ando and Modigliani do not mention other variables that may affect savings. The coefficient of determination (R^2 = .1387) indicates there may be other factors that influence savings. If Ando and Modigliani left out significant variables in their model their results could be misleading. Their results could be biased due to other variables being omitted. For example, marital status, education and occupation are all examples of variables that may be correlated with age. Most people marry when they are young, and achieve higher levels of education and business positions when they are older.

Determinants that may affect savings include: gender, marital status, children, race, location of residence, education, occupation, normal hours worked in a week, a person's outlook on the future of the economy, among others. Therefore, I created a regression model that included these characteristics along with Ando and Modigliani's factors. The regression equation was:

$$\text{Net Savings} = \beta_1 + \beta_2 I + \beta_3 A + \beta_4 \text{Age} + \beta_5 \text{Interest\_Rate} + \beta_6 \text{Male} + \beta_7 \text{Single} + \beta_8 \text{Kids} + \beta_9 \text{White} + \beta_{10} \text{East\_North\_Central} + \beta_{11} \text{East\_South\_Central} + \beta_{12} \text{Middle\_Atlantic} + \beta_{13} \text{New\_England} + \beta_{14} \text{Pacific} + \beta_{12} \text{South5\_Atlantic} + \beta_{16} \text{West\_North\_Central} + \beta_{17} \text{West\_South\_Central} + \beta_{18} \text{Education} + \beta_{19} \text{Occupation\_Agriculture} + \beta_{20} \text{Occupation\_Manufacturing} + \beta_{21} \text{Occupation\_Mining\_Construction} + \beta_{22} \text{Occupation\_Public\_PersonalServices} + \beta_{23} \text{Occupation\_PublicAdministration} +$$

$$\beta_{24}\text{Occupation\_Wholesale\_Retail\_Trade} + \beta_{25}\text{Hours\_Worked\_Week} +$$

$$\beta_{26}\text{Expectation\_Better\_in\_Five} + \varepsilon. \qquad (4)$$

where:

Male = 1 if the respondent is male;

Single = 1 if the respondent is single;

Kids = the number of children respondent has;

White = 1 if the respondent is Caucasian; (Excluded races are African-American, Hispanic, Asian, and Other)

Location variables = 1 if respondent lives in region, regions are divided into the 9 census regions, for example an individual living in Massachusetts would be given a 1 for the New_England variable, and a 0 elsewhere; (Excluded region is the Mountain region)

Education = the highest grade of school or college completed by the respondent;

Occupation = 1 if the respondent is employed in the business or industry, see equation 6 for detailed breakdown; (Excluded occupation is Financial, Insurance, Real Estate, and Business category)

Hours_Worked_Week = the number of hours respondent works in a normal week;

Expectation_Better_in_Five = 1 if respondent expects economy to be better over the next five years.

The regression results are reported in column one of Table 3. I tested for homoskedasticity, and found that I had to reject homoskedasticity. I therefore used OLS with White's robust standard errors. The overall goodness of fit (R^2) increased from .1387 to .1453. This was not a great improvement. The variables with significant t-statistics[5] for net savings were: net worth, interest rate, children, race, Pacific, South Atlantic, West North Central, education, occupation of mining and construction, and the expectation of a better economy.

Most important to note, income was not a statistically significant variable. I conducted a t-test with the null hypothesis that income had no effect on net savings

[5] Significance is based on an alpha value of 5%.

versus a two-sided alternative. I could not reject the null hypothesis that income had no effect on net savings. I also conducted a regression on net savings using normal income instead of income in the previous calendar year. The coefficient was not significant and it did not change the significance of any other variables. Normal income is the income that people expect to persist into the future rather than random and temporary changes in income one may see from year to year. Using normal income only affected some of the coefficients' values, but no change was large enough to affect significance.

Lastly, I chose to look in detail at the composition of net savings, since net savings equal savings minus debt, I wanted to see if the determinants affected savings and debt equally. The regression equations were the same as that of equation 6, with the exception that the dependent variable was changed to savings, and then debt. The results with savings as the dependent variable can be seen in column 2 of Table 3, and the results with debt as the dependent variable can be seen in column 3 of Table 3. I used OLS with White's robust standard errors in these regressions as well.

The significant determinants of total savings are: net worth, age, interest rate on card with largest balance, race, education, agriculture, manufacturing, mining and construction, public and personal services, public administration, wholesale and retail trade, hours worked in a week, and expectation of a better economy in five years. The significant determinants of debt are: net worth, interest rate on card with largest balance, kids, race, East South Central, Middle Atlantic, Pacific, South Atlantic, West North Central, education, mining and construction, public administration, wholesale and retail trade, and expectation better in five years. The goodness of fit for the regression on total

savings was $R^2 = .0158$, whereas the goodness of fit increased to $R^2 = .2001$ for the regression on debt.

Race is a statistically significant determinant of net savings, total savings, and debt. Caucasians, compared to all other races, including African Americans, Hispanics, Asians, have $40,000 less in net savings, $12,000 less in total savings, and $27,000 more in debt. This could be due to credit being more available to Caucasians; for example, mortgages for housing may be easier to obtain for Caucasians. The life-cycle theory does not take race into account when determining savings.

Gender is not a statistically significant determinant of net savings, total savings, or debt. However, the regression coefficients showed males have $27,000 less in net savings, $10,000 less in total savings, and $16,500 more in debt compared to females. These differences may be due to women having less access to credit.

Education is a statistically significant variable of net savings, total savings, and debt. While the life-cycle theory does not take education into account, my results show educational level has an impact on savings. On average, for every additional year of education a person has $12,500 less in net savings, $1,500 more in total savings, and $14,000 more in debt. A person may have more in savings because he or she is more educated and informed, but also more debt because of the costs of education.

Thus, the characteristics that were significant in determining both savings and debt were: net worth, interest rate on card with largest balance, race, education, mining and construction, public administration, wholesale and retail trade, and expectations of a better economy in five years. Some characteristics lost their significance when broken into savings and debt, whereas other characteristics changed to be significant when

regressed on savings, debt, or both. For example, age was a significant variable when regressed on savings, but age was not significant when regressed on net savings or debt. This could mean that Ando and Modigliani were correct in stating that age is a significant factor of savings. Also, children were not a significant determinant of savings, but were a significant determinant of debt. This statistic could imply that having children does not necessarily affect one's savings rate, but does in fact increase the amount of debt.

Another example of variables gaining significance is regional location. Five of the eight regional locations were found to be significant determinants of increasing debt, but not significant determinants of savings. Perhaps the cost of living is higher in these regions thus causing people to have higher amounts of debt. This is clear when looking at the Pacific region. If a person lives in the Pacific region he or she will on average be $74,500 more in debt than someone living in the Mountain region. This ends the empirical portion of the paper; a conclusion including policy implications follows.

LIFE-CYCLE HYPOTHESIS CONCLUSION

Despite the notion that the life-cycle model makes strong assumptions, such as the concept of fungibility and an individual's saving rate being dependent upon only three variables, I still find the model valuable. One model may not be able to represent all consumers since behavioral patterns of individuals are not all the same, but still could be used to represent a portion of individuals.

I do agree with Thaler that fungibility is not realistic and a consumer does not have the same MPC for all of his or her measures of wealth. I found that a consumer does not have the same MPC between income and assets. When I broke apart the variables of wealth to include income, financial assets, and home equity, not all three had the same MPC.

The life-cycle model did correctly predict that age, lifetime wealth, and interest rate effect household saving. My results also conclude that both normal income and current income are not significant determinants of savings. It is possible normal income is not a significant determinant of savings because a person may save only when he or she can "afford to" and not necessarily save a fixed percentage of income per month. However, the conjecture that current income is not a significant factor of savings seems a bit strong. It is important to note I may have had somewhat skewed results since I measure the stock amount of savings, and not the flow of the savings rate.

The life-cycle hypothesis does however leave out important determinants, which I feel devalues the model. It is hard for me to assume variables such as race, location of residence, education, occupation, and a person's own personal outlook on the economy do not affect savings. As I mentioned, children are a significant determinant, for each

additional child a person has, his or her savings decreases by about $25,800. Location and occupation also affect savings. The life-cycle model that I would endorse is one that takes into account behavioral differences, differences of MPC in measures of wealth, and personal characteristics.

When I first started researching the life-cycle model I felt it was important to sell the model to those who are spenders. I thought the model may allow them to see how their own behavior is different from and/or similar to that predicted by the model, and thus prevent them from accumulating too much debt and having to declare bankruptcy.

However, I now conclude that the presumption savings is good, as stated in the quote by J.A. Hobson (1964), and debt is bad is not necessarily the case. The second quote from *Strategic Analysis* (2002) enforces the connotation of debt has changed. Debt is no longer an attribute of the poor, but that of the affluent. Debt indicates a person has access to credit, and may be using debt to increase his or her net worth. Debt also allows a person to increase consumption to a level that may not have been attainable otherwise, and therefore higher levels of utility and satisfaction are possible. Keynes is dead, but the notion of "good debt" lives.

TABLES

Table 1:

N=21,525	West South Central	East North Central	East South Central	Income	Normal Income	Saving	Debt	Net Savings	Net Worth
Mean	9%	16%	6%	$436,254	$305,771	$17,557	$144,996	-$127,439	$5,537,369
Median				$49,662	$50,675	$10	$16,940	-$13,600	$153,710
Standard Deviation	0.3	0.4	0.2	3,854,813	1,435,655	289,563	723,297	766,878	27,385,564

N= 21,525	Age	Education	Children	Male	White	Single	Middle Atlantic	Mountain	New England	Pacific	South Atlantic	West North Central
Mean	50	14	.83	78%	81%	35%	17%	6%	5%	16%	18%	7%
Median												
Standard Deviation	16.5	2.9	1.2	0.4	0.4	0.5	0.4	0.2	0.2	0.4	0.4	0.2

Table 2*:

Variable	**Effect on Net Savings**
Intercept	-92,289 (-6.28)
Income	0.0045 (1.09)
Networth	-0.011 (-6.93)
Age	1,268 (3.81)
Interest Rate on Card with Largest Balance	-38.24 (-8.50)

R^2 = .1387
N = 21,525
* t-statistics in parentheses

Table 3*:

Variable	**Effect on Net Savings**	**Effect on Total Savings**	**Effect on Debt**
Intercept	198,086 (5.75)	-36,039 (-3.13)	-234,124 (-7.13)
Income	0.005 (1.30)	-0.002 (-1.92)	-0.007 (-1.60)
Net Worth	-0.010 (-6.73)	0.001 (3.63)	0.012 (7.39)
Age	596.94 (1.36)	737.80 (4.73)	141.02 (0.34)
Interest Rate on Card with Largest Balance	-13.00 (-2.72)	4.49 (2.12)	17.49 (4.10)
Male	-26,966 (-1.86)	-10,353 (-1.80)	16,613 (1.25)
Single	5,463 (0.41)	-5,148 (-1.11)	-10,610 (-0.84)
Kids	-25,783 (-9.09)	-1,237 (-1.35)	24,545 (9.09)
White	-39,522 (-5.19)	-12,489 (-2.15)	27,033 (5.03)
East North Central	-11,732 (-0.89)	1,658 (0.40)	13,390 (1.06)
East South Central	-22,210 (-1.08)	19,125 (1.36)	41,336 (2.92)
Middle Atlantic	-25,704 (-1.61)	10,074 (1.56)	35,778 (2.48)

Variable	Effect on Net Savings	Effect on Total Savings	Effect on Debt
New England	-38,873 (-1.43)	2,574 (0.36)	41,448 (1.55)
Pacific	-67,742 (-4.53)	6,796 (1.18)	74,539 (5.44)
South Atlantic	-30,059 (-2.24)	-961.61 (-0.20)	29,098 (2.33)
West North Central	-24,179 (-2.09)	58.44 (0.02)	24,238 (2.21)
West South Central	-25,329 (-1.20)	1,011 (0.21)	26,339 (1.26)
Education	-12,398 (-9.35)	1,467 (3.60)	13,865 (10.77)
Agriculture	-22,317 (-0.62)	-30,801 (-3.47)	-8,485 (-0.25)
Manufacturing	-32,473 (-0.92)	-22,719 (-3.75)	9,754 (0.28)
Mining and Construction	58,598 (2.94)	-18,718 (-2.64)	-77,316 (-4.12)
Public and Personal Services	4,405 (0.23)	-25,595 (-3.86)	-29,999 (-1.62)
Public Administration	35,885 (1.89)	-21,632 (-4.24)	-57,517 (-3.07)
Wholesale and Retail Trade	29,756 (1.65)	-20,053 (-3.00)	-49,810 (-2.94)
House Worked in Week	-127.85 (-0.24)	565.38 (3.35)	693.23 (1.32)
Expectation Better Five Years	-57,144 (-3.82)	-7,002 (-2.15)	50,142 (3.41)
Goodness of Fit	R^2 = .1453	R^2 = .0158	R^2 = .2001

N = 21,525

* t-statistics in parentheses

REFERENCES

Adler, Daniel, and George Loewenstein, "A Bias in the Prediction of Tastes." *The Economic Journal*, Volume 105, Issue 431 (Jul., 1995), 929-937.

Ando, Albert and Franco Modigliani, "The "Life Cycle" Hypothesis of Saving: Aggregate Implications and Tests." *The American Economic Review,* Volume 53, Issue 1 (Mar., 1963), 55-84.

Barrow, Robert J. *Macroeconomics*. Massachusetts: MIT Press, 1997.

Campell, John Y., and N. Gregory Mankiw, "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence," National Bureau of Economic Research Working Paper #2949, 1989.

Carroll, Christopher D. "How Does Future Income Affect Consumption?" *Quart. J. Econ*., Volume 109, Issue 1 (Feb., 1994), 111-147.

Carroll, Christopher D. "How Does Future Income Affect Current Consumption?" *Quart*erly *Journal of Economics*, Volume 109, Issue 1 (Feb., 1994), 111-147.

Carroll, Christopher, and Lawrence H. Summers, "Consumption Growth Parallels Income Growth: Some New Evidence," *Department of Economics, Harvard University*, 1989.

Carter, J. R., Econometrics, class notes. College of the Holy Cross, Worcester, MA, Fall 2002.

Conlisk, John, "Why Bounded Rationality?" *Journal of Economic Literature*, Volume 34, Issue 2 (Jun., 1996), 669-700.

Fisher, Irving, *The Theory of Interest*. London: MacMillian, 1930.

Friedman, Milton, *A Theory of Consumption Function*. Princeton: Princeton University Press, 1957.

Gately, Dermot, "Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables: Comment," *Bell Journal of Economics*, Volume 11, Issue 1 (Spring, 1980), 373-374.

Hall, Robert and Fredrick Mishkin, "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households," *Econometrica*, 1982, 50, 461-481.

Hausman, Jerry A, "Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables," *Bell Journal of Economics*, Volume 10, Issue 1 (Spring, 1979), 33-54.

Kennickell, Arthur B., Martha Starr-McCluer, and Brian J. Surette. "Recent changes in U.S. family finances: results from the 1998 Survey of Consumer Finances." *Federal Reserve Bulletin*, Board of Governors of the Federal Reserve System, (Jan., 2000), 1-29.

Keynes, John Maynard, *The General Theory of Employment, Interest, and Money*. New York: Hardbinger Press, 1964.

Kunreuther, Howard. ET AL. *Disaster insurance protection*. New York: Wiley, 1978.

Loewenstein, George and Thaler, Richard H. "Intertemporal Choice," *Journal of Economic Perspectives,* Volume 3, Issue 4 (Fall, 1989), 181-193.

Mankiw, Gregory N., *Macroeconomics*. New York: Worth Publishers, 2003.

Papadimitriou, Dimitri B., Anwar Shaikh, Claudio dos Santos, and Gennaro Zezza. "Is Personal Debt Sustainable?" *Stategic Analysis*, The Levy Economics Institute of Bard College, (Nov., 2002), 1.

Rabin, Matthew. "Psychology and Economics." *Journal of Economic Literature*, Volume 36, Issue 1 (Mar., 1998), 11-46.

Shea, John, "Union Contracts and the Life-Cycle/Permanent-Income Hypothesis," *American Economic Review,* Volume 85, Issue 1, (Mar., 1995), 186-200.

Stavins, Joanna, "Credit Card Borrowing, Delinquency, and Personal Bankruptcy." *New England Economic Review*, (Jul./Aug., 2000), 15-30.

Thaler, Richard H., "Anomalies: Saving, Fungibility, and Mental Accounts." *The Journal of Economic Perspectives*, Volume 4, Issue 1 (Winter, 1990), 193-205.

Yoo, Peter S. "Still Charging: The Growth of Credit Card Debt Between 1992 and 1995." *Federal Reserve Bank of St. Louis Review*, no.1, (Jan./Feb., 1998), 19-27.