© *The Journal of Risk and Insurance*, 2007, Vol. 74, No. 1, 141-173

Household Life Cycle Protection: Life Insurance Holdings, Financial Vulnerability, and Portfolio Implications

Yijia Lin
Martin F. Grace

Abstract

Using the Survey of Consumer Finances, we examine the life cycle demand for different types of life insurance. Specifically, we test for the consumer's aversion to income volatility resulting from the death of a household's wage-earner through the purchase of life insurance. We first develop a financial vulnerability index to control for the risk to the household. We then examine the life cycle demand for life insurance using several definitions of life insurance. We find, in contrast to previous research, that there is a relationship between financial vulnerability and the amount of term life or total life insurance purchased. In addition, we find older consumers use less life insurance to protect a certain level of financial vulnerability than younger consumers. Secondly, our study provides evidence that life insurance demand is jointly determined as part of a household's portfolio. Finally, we consider the impact of family members' nonmonetary contribution on the household's life cycle protection decision. Our results provide some evidence that households take into account the value of nonmonetary contribution in their insurance purchase.

Introduction

A household's demand for life insurance depends on its economic and demographic structure. We use the Survey of Consumer Finances (SCF) to examine the life cycle demand for different types of life insurance. First, we propose a financial vulnerability index to capture a household's financial insecurity. We define financial vulnerability as the household's living standard volatility resulting from the death of a wage-earning

Yijia Lin is at the Department of Accounting & Finance, Youngstown State University, OH, USA and Martin F. Grace is at the Department of Risk Management & Insurance, Georgia State University, USA. The authors can be contacted via e-mail: ylin@ysu.edu and mgrace@gsu.edu, respectively. A very early version of this article was presented at the 2004 annual meeting of the American Risk and Insurance Association in Chicago. We appreciate the helpful comments and suggestions from participants at those meetings. We are especially grateful to two anonymous referees. They provided us with considerable help, correcting some errors and providing very useful comments.

household member. The index is determined by the labor and nonlabor income, the death probability of each adult household member, the consumption to income ratio, and the effect of age on future consumption needs. We examine the demand for life insurance using several types of life insurance. Secondly, we examine household financial portfolios to see the relationship between insurance and other assets. Finally, we consider the impact of family members' nonmonetary contribution (e.g., housework) on the household's life cycle protection decision.

Merton (1975) indicated that the usual sources of consumer uncertainty include uncertainty about future capital income, future labor income (human capital), age at death, investment opportunities, and relative prices of consumer goods. Holden, Burkhauser, and Myers (1986) and Hurd and Wise (1989) document sharp declines in living standards and increases in poverty rates among women whose husbands passed away. Analyzing data gathered during the 1960s from households in middle-age through early retirement, Auerbach and Kotlikoff (1987); Auerbach and Kotlikoff (1991a); Auerbach and Kotlikoff (1991b) found that roughly one-third of wives and secondary earners would have seen their living standards decline by 25 percent or more had their spouses actually died. While we know that life insurance can be demanded for a number of reasons, we look in particular at the life cycle income protection rationale for life insurance demand.

Our article studies the relationship between a household's financial vulnerability and its total life insurance held on the lives of both spouses. We focus explicitly on those households with a married couple, with both spouses between 20 and 64 years of age, and at least one of spouses having regular earnings as an employee. The key determinant of the demand for life insurance is the effect of the insured's death on the future consumption of the other household members. Our financial vulnerability index measures the financial vulnerability by the volatility of a household's living standard as a whole. It fits into the SCF data nicely because the SCF reports the total amount of life insurance held by each household, and not on the individual demand for life insurance by each spouse. Our financial vulnerability index does a good job in explaining the financial vulnerability of a household because it is transparent, easy to implement and based on weaker assumptions than other indices. In contrast to previous research, e.g., Bernheim et al. (2001), we find a relationship between financial vulnerability and purchases of term life insurance and a relationship between vulnerability and total (sum of term life and whole life) purchases. Moreover, our life cycle empirical results show that the sensitivity of total life insurance to financial vulnerability decreases for older households. It suggests younger households are likely to use more life insurance to manage their financial vulnerability but the household substitutes away from higher priced life insurance towards other assets as it ages.

Our analysis of consumer portfolios suggests that individual retirement accounts are complements to total life insurance for the young- and middle-aged and real estate is a complement to total life insurance only for the youngest. However, bonds are a substitute for term life insurance for older households.

Finally, we examine whether the household's life cycle protection decision takes into account nonmonetary contribution of family members. We use Heckman (1979)'s two-step method to impute the value of housework. Our results provide some evidence households take into account the value of nonmonetary contributions in their insurance purchase. Households are slightly less sensitive to financial vulnerability as measured by lower insurance demand in this case because the "imputed" housework value increases their wealth and makes them appear less risk averse.

The article is organized as follows: A Different Strategy for Measuring Financial Vulnerability provides our method for measuring financial vulnerability, and Data, Hypotheses, and Methodology describes the data, hypotheses and methodology. Life Cycle Protection Analysis shows the results of the life cycle relationship between households' life insurance holdings and financial vulnerability. We then examine the household's financial portfolio to see the life cycle relationship between life insurance and other assets. We impute the value of the nonmonetary contribution and retest the household's life cycle protection decision in Robustness Check: Valuing Nonmonetary Contribution. The final section summarizes the study.

A DIFFERENT STRATEGY FOR MEASURING FINANCIAL VULNERABILITY

Bernheim et al. (2001) adopt a yardstick to measure a household's financial vulnerability: the percentage decline in an individual's sustainable living standard that would result from a spouse's death. To calculate this decline, they make use of a relatively sophisticated, but proprietary life cycle consumption model embodied in the financial planning software, Economic Security Planner (or ESPlanner).[1] They do not find a relationship between a household's life insurance holdings and its financial vulnerability.

Our financial vulnerability index is also a life cycle measure, as it reflects different living standards among households, different living standards for households before and after a spouse dies, absolute consumption needs of a surviving spouse (and other members of the family), and age effects. However, our financial vulnerability index is different from that of Bernheim et al. (2001). It has several advantages: our index is more transparent and easier to implement. We can directly use it to study households' life cycle protection by using different types of life insurance. Moreover, our index is based on weaker assumptions.

Our Financial Vulnerability Index

One of the primary assumptions regarding a couple's standard of living involves determining the relative cost savings from living together versus separately. There are fixed costs of operating a household which can be "shared" between spouses. We use the value 0.678 which was suggested by Bernheim et al. (2001) to indicate the household scale economies.[2] It implies that a two-adult household must spend 1.5999 ($=2^{0.678}$) times as much as a one-adult household to achieve the same living standard. In other words, the two-adult household spends 0.4001 ($= 2 - 1.5999$) less than that if they live separately. Bernheim et al. (2001) further considered the effects of the number of the children and use OECD child-adult equivalency factor 0.5. We also use this equivalency factor.

[1] Economic Security Planner, Inc. provides free copies of the software for academic research: www.ESPlanner.com.

[2] The OECD uses a value of 0.7 for the exponent (see Ringen, 1991).

Moreover, households with different income levels consume different proportions of their income. The U.S. Department of Labor provides the annual income and expenditures survey report, the *Consumer Expenditures Survey* (CES), based on approximately 7,500 sample households (5,000 prior to 1999) every year.[3] We observe, in general, low-income people spend all of their income while high-income households are able to save. That is, the ratio of consumption to labor and non-labor income-before-taxes and deductions varies for each household. The relationship between a household's overall consumption ($\hat{C}_i$) and labor and nonlabor income before taxes and deductions (Tincome$_i$) for household i is shown as

$$\hat{C}_i = \alpha_i \times \text{Tincome}_i, \tag{1}$$

where α_i is so-called consumption-to-income ratio. Based on Table 2 in the CES each year,[4] we calculate the annual consumption-to-income ratios in Equation (1) for households at different levels of income before taxes. That is, household i's consumption-to-income ratio α_i may be different from household j's ratio α_j. For example, in 1998, if the households earn income before taxes in the range of \$40,000 – \$49,999, their annual consumption-to-income-before-taxes ratio is 0.90. It suggests that these households save 10 percent of their income before tax. This ratio decreases to 0.84 for the households with income before taxes in the range \$50,000 – \$69,999. Thus higher income households save more. However, the households with income less than \$30,000 consume all of their income and save nothing. In our model, it implies that their consumption-to-income ratio is 1.

Moreover, the consumption-to-total income ratio is also not constant before and after a spouse dies. That is, a wife's consumption-to-total income ratio if her husband dies $\beta_{\text{wife},i}$ and that for a husband if his wife dies $\beta_{\text{hus},i}$ vary with reduced total income if one spouse dies. Suppose a household's total income before taxes in 1998 is \$55,000. It includes the husband's labor income of \$40,000, the wife's labor income of \$10,000, and the household's overall non-labor income of \$5,000. If both of the spouses survive, $\alpha_i = 0.84$. If the husband dies, the household income falls to \$15,000 (= \$55,000 − \$40,000). So $\beta_{\text{wife},i} = 1$. If the wife dies, the household income falls to \$45,000 (= \$55,000 − \$10,000) and $\beta_{\text{hus},i} = 0.90$. If household j has a different total income before taxes, its α_j, $\beta_{\text{wife},j}$ and $\beta_{\text{hus},j}$ may be different from α_i, $\beta_{\text{wife},i}$ and $\beta_{\text{hus},i}$ of household i.

[3] From http://www.bls.gov/cex/home.htm. Annual income and expenditures integrated from the *Interview and Diary* surveys in varying detail, classified by income, age, consumer unit size, and other demographic characteristics of consumer units, since 1984. Annual income and expenditures from the *Interview and Diary* surveys by selected consumer unit characteristics, since 1980.

[4] Before 2003, the *Consumer Expenditures Survey* reported the detailed annual consumption and income information for the households with complete reporting income up to \$70,000. From 2003, the U.S. Department of Labor began to report detailed annual consumption and income for higher income households. We notice that the consumption-to-income-before-taxes ratios of households in the same income levels do not vary between years. In order to get a more complete picture of households' consumption and income, we assume that the consumption-to-income ratios for households with income before taxes higher than \$70,000 per year in 1992, 1995, 1998, and 2001 follows that in 2003 after we adjust all consumption and income in 2001 dollars.

When both of spouses are alive, the living standard of the household i is

$$C_i = \alpha_i \frac{\text{Tincome}_i}{\left(2 + \dfrac{N}{2}\right)^{0.678}}. \tag{2}$$

The variable Tincome_i is the labor and nonlabor income before taxes and deductions of household i in \$100,000s and C_i is the living standard of household i when both of spouses are alive. N is the number of the dependent children, and $2^{0.678}$ measures the household scale economies.

When the husband dies, the living standard of the wife $C_{\text{wife},i}$ becomes

$$C_{\text{wife},i} = \beta_{\text{wife},i} \frac{\text{Tincome}_i - Y_{\text{hus},i}}{\left(1 + \dfrac{N}{2}\right)^{0.678}}. \tag{3}$$

The variable $Y_{\text{hus},i}$ is the husband's total employment income of the household i in \$100,000s and $\beta_{\text{wife},i}$ is the wife's (and other family members') consumption-to-total income ratio if the husband dies. The reason why we only deduct the husband's labor income $Y_{\text{hus},i}$ from the household's total income, Tincome_i, is that although the wife (and other members of the family) loses the husband's labor income, $Y_{\text{hus},i}$, she inherits her husband's nonlabor income, e.g., from financial assets.

The impact on the household i if the husband dies ($\text{IMPACT}_{\text{wife},i}$) can be expressed as the percentage decline in its living standard:

$$\text{IMPACT}_{\text{wife},i} = \frac{C_{\text{wife},i}}{C_i} - 1 = \frac{\beta_{\text{wife},i}(\text{Tincome}_i - Y_{\text{hus},i})\left(2 + \dfrac{N}{2}\right)^{0.678}}{\alpha_i \text{Tincome}_i \left(1 + \dfrac{N}{2}\right)^{0.678}} - 1. \tag{4}$$

Correspondingly, when the wife dies, the living standard of the husband $C_{\text{hus},i}$ is

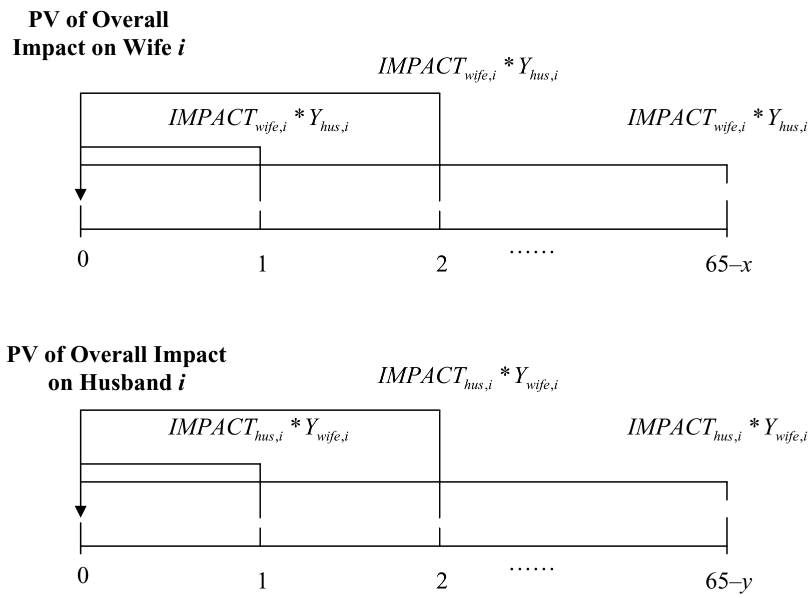
$$C_{\text{hus},i} = \beta_{\text{hus},i} \frac{\text{Tincome}_i - Y_{\text{wife},i}}{\left(1 + \dfrac{N}{2}\right)^{0.678}}, \tag{5}$$

where the variable $Y_{\text{wife},i}$ is the wife's employment income of the household i in \$100,000s and $\beta_{\text{hus},i}$ is the husband's (and other family members') consumption-to-total income ratio if the wife dies.

The impact on the household i if the wife dies ($\text{IMPACT}_{\text{hus},i}$) is given by

$$\text{IMPACT}_{\text{hus},i} = \frac{C_{\text{hus},i}}{C_i} - 1 = \frac{\beta_{\text{hus},i}(\text{Tincome}_i - Y_{\text{wife},i})\left(2 + \dfrac{N}{2}\right)^{0.678}}{\alpha_i \text{Tincome}_i \left(1 + \dfrac{N}{2}\right)^{0.678}} - 1. \tag{6}$$

FIGURE 1
The Age Effect of Spouses on Future Consumption Needs of Other Family Members



The variables $\text{IMPACT}_{\text{wife},i}$ and $\text{IMPACT}_{\text{hus},i}$ defined in Equations (4) and (6), respectively, only reflect the *relative* household living standard decline if one of the spouses dies. However, the surviving spouse (and other members of the family) cares about *absolute* consumption. The lost absolute labor income of the dead spouse causes an *absolute* living standard decline for the surviving spouse (and other members of the family). All else equal, the wife with the higher labor income from her husband will incur a higher absolute consumption decline than the other wife with lower husband's labor income. To see how this matters, assume that two wives in households i and j, respectively, will incur the same *relative* living standard decline if their husbands die, that is,

$$\text{IMPACT}_{\text{wife},i} = \text{IMPACT}_{\text{wife},j} \Rightarrow \frac{C_{\text{wife},i}}{C_i} - 1 = \frac{C_{\text{wife},j}}{C_j} - 1. \tag{7}$$

However, each wife's *absolute* living standard decline may be different and determined by the lost labor income from her husband. To account for this possibility, we multiply the relative living standard decline measure of the wife $\text{IMPACT}_{\text{wife},i}$ by the husband's labor income $Y_{\text{hus},i}$ to capture the *absolute* living standard decline of the wife. The *absolute* living standard decline of the husband is similarly defined.

We also consider an age effect. The effect of age on future consumption needs is not the same for the older or the younger household. An older family may be much less vulnerable than a younger family to the death of its more important wage-earner because of the smaller expected number of surviving years left for the survivor. The idea is shown in Figure 1. The upper graph in Figure 1 shows the effect of husband's age x on the household's future consumption needs. Assume that the husband, age x, plans to retire at age 65. If the husband dies at age x, the household will incur annual absolute living standard decline ($\text{IMPACT}_{\text{wife},i} \cdot Y_{\text{hus},i}$) for (65 $-$ x years. Assuming a flat interest rate 5 percent,[5] an annuity factor, $a_{\overline{65-x}|}$ captures the age effect of the husband's death at age x. The higher $a_{\overline{65-x}|}$ implies a larger effect of his age on future consumption needs of other family members. Similarly, $a_{\overline{65-y}|}$ represents the wife's age effect and is illustrated in the lower graph in Figure 1.

Taking into account all of the above factors, our index of financial vulnerability (IMPACT_i) of the household i is then defined as

$$\begin{aligned}&\text{IMPACT}_i\\&= \sqrt{q_{x,i}^{\text{hus}}(\text{IMPACT}_{\text{wife},i} \cdot Y_{\text{hus},i} \cdot a_{\bullet[\text{roof}]65-x})^2 + q_{y,i}^{\text{wife}}(\text{IMPACT}_{\text{hus},i} \cdot Y_{\text{wife},i} \cdot a_{\overline{65-y}|})^2}.\end{aligned} \tag{8}$$

The index we defined is similar to the definition of standard deviation. The variable $q_{x,i}^{\text{hus}}$ is the one-year death probability of the husband aged x of the household i in the survey year and $q_{y,i}^{\text{wife}}$ the one-year death probability of the wife aged y of the household i in the survey year. We use the 1990–1995 U.S. SOA Life Insurance Basic Mortality Table to capture the mortality experience of the observed household. The reason why we use a one-year death probability is that the current life insurance holding reflects the household's expectation of its potential risks if one of the spouses dies in the foreseeable future, e.g., one year. The variables $Y_{\text{hus},i}$ and $Y_{\text{wife},i}$ are the husband's and wife's total employment income of the household i in \$100,000s, respectively. The variable $\text{IMPACT}_{\text{wife},i}(\text{IMPACT}_{\text{hus},i})$ accounts for the relative living standard decline of household i if the husband (the wife) dies. The product in the first pair of brackets in Equation (8) reflects the overall impact of husband's death at age x on the household. It equals the annual absolute living standard decline (or deviation from current absolute living standard) $\text{IMPACT}_{\text{wife},i} \cdot Y_{\text{hus},i}$ times the age effect, $a_{\overline{65-x}|}$. The overall effect of wife's death at age y is similarly defined and is the product in the second pair of brackets in equation (8). Moreover, our index solves one of the main problems of using the Survey of Consumer Finances as it reports the results of the survey based on a household instead of an individual. Our index measures the financial vulnerability by the volatility of a couple's living standard as a whole. Thus, IMPACT_i captures the volatility of a household's financial situation if one spouse dies.

Advantages of Our Financial Vulnerability Index

Based on the 1995 SCF, Bernheim et al. (2001) also study households' financial vulnerabilities by comparing an individual's highest sustainable living standard when both spouses survive, C^*, with C_s^n, which represents the living standard the husband (when s = husband) or the wife (when s = wife) would enjoy without life insurance. They define their financial vulnerability index as follows:

$$\text{IMPACT}_{\text{Bernheim}} = \frac{C_s^n}{C^*} - 1. \tag{9}$$

[5] Our results are robust to other interest rate assumptions.

Bernheim et al. (2001) estimate the regression of the households' actual life insurance holdings on their benchmark life insurance (or benchmark life insurance to household income) rather than on their financial vulnerability measure in Equation (9). Their benchmark life insurance quantity is obtained from Economic Security Planner (or ESPlanner). Different financial planning software often gives us very different life insurance purchase suggestions. An important issue is that if the ESPlanner is inaccurate, it will come up with an incorrect benchmark life insurance and thus will lead to incorrect conclusions. While we do not suggest ESP is inaccurate, we cannot estimate the model underlying their conclusions. Our financial vulnerability index is different and can complement their method. Compared with Bernheim et al. (2001)'s financial vulnerability measure, our index has the following advantages:

- *Transparency:* Bernheim et al. (2001) use ESPlanner to determine the benchmark life insurance demand. It is impossible to tell how ESPlanner works and what its underlying assumptions are. The key determinant of the demand for life insurance is the effect of the insured's death on the future consumption of the other household members because they will lose the insured's labor income forever. Our financial vulnerability index transparently measures this effect by including the lost absolute consumption, the consumption to labor earnings ratios α_i, and the life cycle effects.
- *Implementation:* The cost associated with compiling data and modeling households' financial vulnerabilities is a substantial obstacle in investigating the relationship between households' life insurance holdings and financial insecurity. A complete description of Bernheim et al. (2001)'s model would be "prohibitively lengthy" (p. 7 in Bernheim et al., 2001). We present a method of estimating financial vulnerabilities that is easily implemented using data from the SCF and the CES and is easily understood.
- *Broader product comparison possible:* There are differences between term life insurance and whole life insurance which are overlooked in Bernheim et al. (2001). First, whole life insurance has a cash value while term life insurance has no cash value. Second, the duration of whole life insurance is generally much longer than term insurance. Third, term life insurance is naturally suited for ensuring that mortgages and other loans are paid on the debtor/insured's death and as a vehicle for ensuring that education or other needs are available if death were to cut short the period needed for the provider/insured to earn the needed funds. Further, whole life insurance can serve as a quasi-forced savings plan (Black and Skipper, 2000). The differences between the two types of insurance may lead to differences in the household's insurance purchasing behavior. Bernheim et al. (2001) failed to make distinctions between term life insurance and whole life insurance demand in their analysis. However, our financial vulnerability index is able to do so.
- *Weaker assumptions:* Bernheim et al. (2001) state that, "[T]his is a measure of the percent by which the survivor's living standard would, with no insurance protection, fall short of or exceed the couple's *highest* sustainable living standard (p. 6)." If we understand their "highest sustainable living standard" correctly, our concern is whether it is appropriate to use the highest sustainable living standard to obtain the benchmark. In reality, people normally lead a lifestyle below their highest living standard. If consumers are prudent, they will set aside some money for a "rainy day" (Kimball, 1990). Our measure is based on a more typical consumption level.

DATA, HYPOTHESES, AND METHODOLOGY

We now turn to an empirical examination of a household's life cycle protection. First, we investigate the effects of financial vulnerability on the households' demand for net amount at risk, term life insurance and total life insurance. Net amount at risk is our measure of households' long-term pure life insurance demand. Term life insurance measures the quantity of short-term life insurance demanded. And total life insurance is our measure of households' total life insurance demand. Second, households hold various asset items including life insurance in a portfolio. Life insurance demand is determined, in part, by households' financial asset allocation decisions. We empirically test how each asset item may influence life insurance holdings. Finally, a family member who has zero earnings may make nonmonetary contributions to the family. For instance, the one spouse who stays at home and cleans, cooks, and cares for children contributes to household income. The family would suffer a serious financial setback if this spouse dies. Therefore, we retest the household life cycle protection by imputing a value for uncompensated housework in section Robustness Check: Valuing Nonmonetary Contribution.

Data Description

The sample for our study consists of the 1992, 1995, 1998, and 2001 years of the Survey of Consumer Finances. In each of these four years, the survey covered over 4,000 households. The data includes demographic, income, wealth, debt and credit, pensions, attitudes about financial matters, the nature of transactions with various types of financial institutions, housing, real estate, business, vehicles, health and life insurance, current and past employment, current social security benefits, inheritances, charitable contributions, education, and retirement plans. The architects of the SCF data files imputed missing information, supplying five "implicates" for each household. [6] Bernheim et al. (2001) use the first implicate. We also use the first implicate in this study to compare our results and theirs. [7]

[6] Kennickell (1994) provides a description of the imputation procedure.

[7] The results shown in this article are based on the first implication of the SCF. Our results are robust no matter whether we (1) use only the first implication or (2) use all five imputed data sets and adjust standard errors for the imputation and sampling variance inherent in the data. When we use all five imputations, we use two different methods to adjust our variance estimates. Both methods obtain similar estimates and standard errors as those with the first implicate by itself. Following Bernheim, Lemke, and Scholz (2004) and the 1998 SCF codebook (http://www.federalreserve.gov/pubs/oss/oss2/98/codebk98.txt), the first variance adjustment method estimates the mean 999 times and computes the standard error of that estimate by using bootstrapping techniques. Following Rubin (1976) and Rubin (1987)'s multiple imputation strategy, the second method calculates the variance estimate v from five implicates ($m = 5$) by using the following equation:

$$v = \frac{1}{m}\sum_{i=1}^{m}\hat{v}_i + \frac{m+1}{m}\left[\frac{1}{m-1}\sum_{i=1}^{m}\left(\hat{Q}_i - \bar{Q}\right)^2\right] = \frac{1}{5}\sum_{i=1}^{5}\hat{v}_i + \frac{3}{10}\sum_{i=1}^{5}\left(\hat{Q}_i - \bar{Q}\right)^2,. \quad \bullet$$

where $\hat{v}_i$ is the variance estimate from analyzing the ith implicate. The point estimate from the multiple imputations $\bar{Q}$ is the average of the estimate from each analysis $\hat{Q}_i$, that is, $\bar{Q} = \frac{1}{5}\sum_{i=1}^{5}\hat{Q}_i$.

We focus on households with married couples. Because we are looking at those who potentially have a need for life insurance, we restrict the ages of both spouses to a range from 20 to 64. Following Bernheim et al. (2001), we exclude those observations where neither spouse had regular labor earnings. Accurate measurement of life insurance holdings is particularly critical for our analysis. Fortunately, the SCF data match up reasonably well with other sources of information concerning this life insurance.[8] Moreover, including consistent labor income measures is also important because they are two major variables determining our financial vulnerability index. We delete those observations with labor income paid by lump sum, one payment only/in total, by the piece/job and if the pay varies. The SCF reports the husband's labor income and the wife's labor income, respectively. It also reports the household's total labor income. We double check to make sure that the sum of the husband's labor income and that of the wife is the same (or almost the same) as the household's total labor income. In all, we identify around one percent of our sample as outliers.

An important characteristic and limitation of the SCF is that it contains information only on the total amount of term life insurance and total amount of whole life insurance held by each household, and not on the division of this insurance between spouses. Bernheim et al. (2001) estimate a regression model explaining the fraction of a couple's total life insurance held on the life of husband as a function of the age of each spouse, the husband's earnings, the husband's share of the couple's total nonasset income, family size, and the husband's share of the couple's total benchmark life insurance. Due to the nature of the data, this type of estimation may be biased because it does not look at "household" purchases of insurance (Lewis, 1989). It could lead to the conclusion that there is no correlation between life insurance demand and a household's financial vulnerability. Thus, we explore the relation between different types of life insurance demand and financial vulnerability directly based on the structure and characteristics of the household.

Dependent Variables and Hypotheses

The face value of life insurance is the amount an insurer will pay to the beneficiary when the insured dies. The face value reflects the amount a household perceives is appropriate to manage its financial vulnerability. However, there is a problem with face value of whole life insurance because the actual amount of pure whole life insurance protection at any point is the difference between the policy cash value (saving component) at that point and the face amount. This difference is called the "net amount at risk" (Black and Skipper, 2000). Therefore, the net amount at risk is a more appropriate proxy of the quantity of whole life insurance demanded than the whole life insurance face value. From the perspective of consumers, we consider the "net amount at risk" of whole life insurance as the proxy of whole life insurance quantity

[8] Bernheim et al. (2001) made some comparisons between statistics on life insurance coverage (including all individual and group policies) drawn from the SCF and from a survey fielded by the Life Insurance Marketing Research Association (LIMRA). Furthermore, they computed the aggregate amount of in-force life insurance implied by the SCF survey responses, and compared this with total in-force life insurance reported by the industry (obtained from the ACLI, 1999). They concluded that there is no indication that the SCF understates life insurance coverage.

demanded and the face value of term life insurance as the proxy of term life insurance quantity demanded. Because of the skewness of the face value of term life insurance or the net amount at risk, we use a logarithmic transformation. Since Bernheim et al. (2001) explore the relationship based on the total insurance demand, we also study this relationship by using the sum of term life insurance face value and the net amount at risk of whole life insurance.

According to Ando and Modigliani (1963)'s life cycle theory, an individual's income will be low in the beginning and end stages of life and high during the middle income-earning years of life. Term insurance can be useful for persons with low incomes and high insurance needs because of its relatively low price (Black and Skipper, 2000). Since younger families have lower income and less wealth accumulation, they may desire lower-cost insurance protection. On the other hand, older households may be less vulnerable than younger families to the death of the more important wage-earner because of the smaller expected number of surviving years left for the survivor. Moreover, older households may be less risk averse because they have already accumulated a certain amount of wealth. In addition, Chen, Wong, and Lee (2001) find that baby boomers tend to purchase less life insurance than those in previous generations. Baby boomers are in the middle- and older-age groups in our study. We predict that there will be a more significant relationship between younger household's life insurance holdings and its financial vulnerability.

Other Explanatory Variables and Hypotheses

In addition to independent variable IMPACT_i, other differences, such as demographic characteristics, financial situation, and obligations among couples are expected to affect life insurance demand. Identifying those factors will give us a clearer picture of the relationship between life insurance demand and financial vulnerability and between life insurance holdings and other assets.

Assets. Intuitively, the wealth a person holds will influence life insurance purchases. The relation between the demand for life insurance and wealth is ambiguous as it depends upon a consumer's risk tolerance. It is possible that an individual increases his life insurance demand with increasing wealth. It is also possible that a person will mainly put the incremental wealth into savings because he thinks he can handle risks with his improved economic strength. If so, life insurance can be an inferior good. Fortune (1973) found that per capita wealth was related negatively to "net" life insurance in force. This was attributed to the fact that increases in wealth lead to decreases in aversion to risk.

Life insurance demand is determined by a household's asset allocation decisions. Fortune (1973) concludes life insurance is a substitute for financial assets such as equities or other lower risk assets. Headen and Lee (1974) propose a four-component interrelated household asset model including primary securities (corporate stocks and bonds), money (currency and demand deposits), time deposits (all savings shares and various time deposits), and life insurance sales (ordinary). However, their results on the relationship between life insurance demand and other financial assets are inconclusive. They find limited evidence that life insurance decreases with investment in stocks and bonds, and increases with saving account holdings. Individual retirement accounts are also saving accounts with tax advantages. Higher rates of net saving are assumed to be positively correlated with life insurance demand since life insurance is a primary financial asset alternative for low-asset holders (Headen and Lee, 1974). Household financial assets also include annuities. Brown (1999) finds evidence that many households simultaneously hold term life insurance and private annuities. Moreover, Bernheim et al. (2001) state that housing may also affect life insurance needs. Although they treat housing as fixed consumption, we look at real estate holdings as a part of household assets. Households often purchase term life insurance to ensure that mortgages are paid on the debtor/insured's death.

In order to identify the effect of different types of assets on the different types of life demand, we split the assets into several categories. We include cash and cash equivalents, mutual funds, stocks, bonds, annuities, individual retirement accounts, real estate, and other assets. All of the above assets are all measured based on the unit of the household using the log value.

Debts. Good risk management principles suggest the family unit should be protected against catastrophic losses. Life insurance can be a way to ensure that mortgages and other obligations are paid on the insured's death. Again, it is ambiguous whether there is a positive relationship between life insurance holdings and debts of a household.

Education. Education tends to be a good predictor of earning ability over the long term. It is also associated with wealth, financial vulnerability, and life insurance demand. Burnett and Palmer (1984) show that higher education is associated with higher life insurance demand, even allowing for the higher incomes. However, Goldsmith (1983) concludes that households with a more educated wife, *ceteris paribus*, have a lower likelihood of purchasing term insurance on the husband. Thus the overall effect of education on a household's insurance holdings is uncertain.

Inheritance, Obligations, Bequests, and Emergencies. In the SCF, there is a question concerning an expected inheritance. Thus, we are able to control for a potential substitute for life insurance. Also the survey asked whether there are any foreseeable major financial obligations expected to be met in the future such as educational expenses, health care costs, and so forth. We control for fixed obligations that life insurance may finance if one of spouses dies. Finally, we consider a household's desire to leave a bequest and also include it as one of independent variables.

Term Life Insurance. Term life insurance furnishes protection for a limited number of years at the end of which the policy expires, meaning that it terminates with no maturity value. The face amount of the policy is payable only if the insured's death occurs during the stipulated term, and nothing is paid in case of survival. Term insurance can be the basis for one's permanent insurance program through a so-called buy-term-and-invest-the-difference (BTID) arrangement. The difference between the higher-premium cash-value policy and the lower-premium term policy is to be invested separately, such as in a mutual fund, savings account, an annuity, or other investment media. The hope is that the term plus the separate investment will outperform the cash-value life insurance policy (Black and Skipper, 2000). Thus, we predict that the term life insurance is a substitute for the whole life insurance. So we use the log value of the term life face value in the net amount at risk function and the log value of the net amount at risk value in term life insurance demand function.

Age. The relationship between age and life insurance is ambiguous. Burnett and Palmer (1984) do not find a significant relationship between age and life insurance holdings. For older people, they may have a greater desire to leave a bequest. However, they may have a binding budget constraint when approaching retirement. Following Bernheim et al. (2001), we control for the effects of age by two ways. In the first way, we include linear and quadratic terms in the couple's average age. Secondly, we divide our sample into three age groups. Three age dummies are assigned to these three groups.

Income. We include household labor income in our model. Income, like wealth, may have ambiguous effects on the life insurance demand. If the consumer has decreasing absolute risk aversion, he will purchase less insurance at higher levels of income due to decreasing marginal utility of income. However, we know that as income increases, new types of risks arise. For example, consumers may buy bigger houses and may incur more expensive obligations. Thus, one could hypothesize a positive relationship between income and insurance demand. Burnett and Palmer (1984) find a significant and positive relationship between income and life insurance holdings.

Summary Statistics

Our final sample consists of 6,755 married couples for the 1992, 1995, 1998, and 2001 years of the Survey of Consumer Finances. Variables in dollars are all in year 2001 dollars. Table 1 shows the descriptive statistics for our sample. "Net amount at risk" is the difference between face value of whole life insurance and whole life cash value. "Salary and wage" refers to labor income. "Cash and cash equivalent" includes checking accounts, saving accounts, money market deposit accounts, money market mutual funds, call accounts at brokerages, and certificates of deposit. "Mutual fund" includes stock mutual funds, tax-free bond mutual funds, government bond mutual funds, other bond mutual funds, combination and other mutual funds, and total directly held mutual funds, excluding money market mutual funds. "Stock" refers to publicly traded stock. "Bond" includes tax-exempt bonds (state and local bonds) mortgage-backed bonds, U.S. government and government agency bonds and bills, corporate and foreign bonds, and savings bonds. "A household's individual retirement account" includes individual retirement account, thrift accounts, and future pensions. "Individual annuity not including job pension" refers to other managed assets such as trusts, annuities, and managed investment accounts in which a household has equity interest. "Real estate" is the sum of the value of primary residence, other residential real estate, and net equity in nonresidential real estate. If a household only owns a part of the property, the value reported should be only the household's share. "Other assets" are a household's total assets excluding whole life cash value, cash, mutual fund, stock, bond, individual annuity not including job pension, individual retirement account, and real estate. The education level of respondents and spouses reflects the number of years of schooling.

TABLE 1
Summary Statistics for the Survey of Consumer Finances 1992, 1995, 1998, and 2001 Waves

Variable Description	Mean	Standard Deviation	Minimum	Median	Maximum
Dependent Variables					
Net amount at risk (NAR)	$248,892	1,930,412	0	0	86,786,560
Face value of term life insurance	$366,263	1,995,366	0	56,700	80,000,000
Term life face value + whole life NAR	$615,155	2,871,676	0	126,000	93,746,560
Independent Variables					
Financial vulnerability index	0.2350	0.3065	0.0000	0.1229	1.9930
Salary and wage of the respondent before taxes	$79,490	134,360	0	41,737	2,261,997
Salary and wage of the spouse before taxes	$25,572	46,311	0	14,351	1,122,372
A household's total salary and wage before taxes	$105,062	144,084	5,039	64,258	2,261,997
A household's total income before taxes	$313,055	1,258,928	5,450	74,430	28,188,000
Average age of couple	42	10	20	43	64
Sizable inheritance expected	$103,740	1,514,129	0	0	112,140,000
Cash + cash equivalent	$117,729	1,027,846	0	6,496	60,152,200
Mutual fund	$95,447	830,297	0	0	44,385,080
Stock	$520,522	6,849,555	0	0	288,828,200
Bond	$163,355	2,306,561	0	0	135,465,200
Individual annuity not including job pension	$187,984	3,735,184	0	0	163,500,000
A household's individual retirement account	$129,938	508,276	0	13,000	20,390,480
Real estate	$589,868	2,798,397	0	140,000	126,633,780
Other assets	$2,215,470	15,987,826	0	24,360	500,876,000
Total debt of the household	$131,536	584,411	0	51,500	36,523,000
Education level of the respondent	14.0691	2.6268	1	14	17
Education level of the spouse	13.8343	2.6221	0	14	17
Number of dependent children	1.2762	1.2383	0	1	8
Desire to leave a bequest (1 = Yes, 0 = No)	39.14%	48.81%	0	0	1
Foreseeable major financial obligations (1 = Yes, 0 = No)	59.19%	49.15%	0	1	1
Baby boom indicator of the respondent (1 = Yes, 0 = No)	56.23%	49.61%	0	1	1
Baby boom indicator of the spouse (1 = Yes, 0 = No)	58.87%	49.20%	0	1	1

Note: Number of observations: 6,755

Estimation Methodology

The regression on the SCF data using ordinary least squares (OLS) is potentially problematical because there is about 35 percent zero term life face value, 58 percent zero whole life face value, and 16 percent zero total life insurance face value. Tobit models under this situation will give us consistent estimates. So we employ ordinary tobit estimation for the life insurance demand model. In addition to the dependent variable to measure whole life insurance demanded (log of net amount at risk of whole life), we estimate another two quantities: log of term life face value and log of sum of term life face value and whole life net amount at risk. Since there are many zero values in our dependent variables, we add a relatively small value (0.00001) to those with zero. We then test for the sensitivity with respect to adding this small value and find that the results are robust to size of the data transformation.

Moreover, the pooled results will be overstated if the inclusion of the same household for multiple years results in observations that are not independent (although the SCF data is not a panel data). Therefore, we run the regressions and report the estimates by year.[9]

LIFE CYCLE PROTECTION ANALYSIS

Financial Vulnerability

We first analyze households' life cycle life insurance holdings and financial vulnerability without including asset items. We estimate the tobit regressions by year. The dependent variables are three definitions of life insurance demanded (net amount at risk of whole life, term life face value, and sum of whole life net amount at risk and term life face value, respectively). There are two separate set of results. For the first set of regression, we include linear and quadratic terms in the couple's average age.

$$\text{Log}(\textbf{LifeIns}) = \alpha_3 + \gamma\text{IMPACT} + \beta_1\text{Age} + \beta_2\text{Age}^2 + \varepsilon_1, \tag{10}$$

where **LifeIns** stands for three different dependent variables representing quantity of insurance demanded. IMPACT is our financial vulnerability index. We expect the coefficient γ is positive, which means that a household increases its life insurance holdings with increasing financial vulnerability. The variable Age stands for the couple's average age.[10]

In the second set of regression, we adopt a more flexible functional specification proposed by Bernheim et al. (2001). That is, we divide our sample into three age groups and assign a group dummy for each group. Moreover, we interact these group dummies with our financial vulnerability index.

[9] Our results are even stronger when we pool the four waves of survey.

[10] Originally, we also include an interaction term between age and our financial vulnerability index to investigate the hypothesis that the correlation between insurance holdings and vulnerabilities changes with age. However, including this interaction term causes a serious multicollinearity problem since the Pearson's correlation between the interaction term and financial vulnerability index is as high as 0.98.

$$\begin{aligned}\text{Log}(\textbf{LifeIns}) &= \alpha_1 A_{20-34} + \alpha_2 A_{35-49} + \alpha_3 A_{50-64} \\ &\quad + \gamma_1 \text{IMPACT} \cdot A_{20-34} + \gamma_2 \text{IMPACT} \cdot A_{35-49} + \gamma_3 \text{IMPACT} \cdot A_{50-64} + \varepsilon_2, \quad (11)\end{aligned}$$

where A_{20-34}, A_{35-49} and A_{50-64} are age dummies for age group 20–34, 35–49, and 50–64, respectively.

In the first separate set of age definition, the regression results in Table 2 show that there is a significant and positive relationship between a household's financial vulnerability and net amount at risk as the marginal effects of the financial vulnerability index are all significant in most cases except year 1998. Regression results based on a more flexible functional specification suggest that the positive and significant relationship in 1992, 1995, and 2001 is driven by the middle and older age groups because the interaction terms of age group dummy and financial vulnerability index are positive and significant for those two groups but not for the younger families. It implies that younger households do not purchase whole life insurance to manage the potential financial insecurity caused by the death of the income earner(s).

An important conclusion to be drawn from Table 3 is that there is a positive and significant relationship between a household's term life insurance and its financial vulnerability in all four time periods in the first specification. Moreover, the second specification suggests that younger households tend to purchase term life insurance, in contrast to what we conclude for the whole life insurance from Table 2. It is not a surprising result. Whole life insurance is more expensive than term life insurance. Younger households have not accumulated enough wealth (or consume too much annual income) to purchase whole life insurance and therefore prefer term life insurance.

Table 4 shows the results when the dependent variable is the sum of net amount at risk and term life insurance. Both the first specification and the second specification in all four years tell us the same story: the higher volatility of potential living standard implies more total life insurance purchases. In general, households in different ages use a combination of term life and net amount at risk to reduce their potential financial vulnerability. Moreover, according to the results of the second specification, younger households are more sensitive to financial vulnerability than older households because the coefficient of interaction term of financial vulnerability index and age group 20–34 is higher than the interaction terms for the other two age groups (e.g. 6.4232 for younger group vs. 4.6381 and 4.9168 for middle and older groups in 2001) except year 1992. We conclude that there is a life cycle relationship between a household's life insurance holdings and its financial vulnerability. Our results are opposite to Bernheim et al. (2001)'s conclusion because they do not find this relationship specifically, as they only look at total life purchases in 1995.

Portfolio Implications

Headen and Lee (1974) explore the linkage between life insurance demand and household financial assets. They construct a four-component interrelated household asset estimated using primary securities, money, time deposits, and ordinary life insurance sales. They use another four variables reflecting household expectations and current

TABLE 2
Tobit Estimation of Life Cycle Relationship Between Net Amount at Risk and Financial Vulnerability Index

Independent Variables	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]
Intercept	−30.3277***	−21.5130***	−32.8487***	−32.9051***				
	(5.492)	(4.670)	(5.096)	(4.684)				
Financial vulnerability index	3.9049***	3.8339***	0.4304	2.1128***				
	(1.056)	(0.955)	(0.955)	(0.776)				
Average age of couple	0.9730***	0.4744**	1.0200***	0.9592***				
	(0.267)	(0.228)	(0.245)	(0.223)				
(Average age of couple)^2	−0.0089***	−0.0032	−0.0092***	−0.0085***				
	(0.003)	(0.003)	(0.003)	(0.003)				
Age 20–34 (group 1)					−9.4225***	−10.5669***	−11.5490***	−11.4676***
					(0.791)	(0.739)	(0.808)	(0.923)
Age 35–49 (group 2)					−5.7569***	−7.2435***	−6.5494***	−7.8256***
					(0.603)	(0.513)	(0.510)	(0.438)
Age 50–64 (group 3)					−3.7104***	−5.7704***	−5.1797***	−6.4715***
					(0.800)	(0.687)	(0.650)	(0.565)
Financial vulnerability index					4.5251	5.3720	−1.2110	−10.6069*
interacted with age group 1					(3.082)	(3.761)	(4.001)	(5.737)
Financial vulnerability index					4.2647***	3.1499**	1.0691	2.9758***
interacted with age group 2					(1.575)	(1.373)	(1.343)	(1.037)
Financial vulnerability index					4.4239**	5.3704***	0.9062	2.6526**
interacted with age group 3					(1.775)	(1.611)	(1.495)	(1.319)
Number of observations	1496	1745	1723	1791	1496	1745	1723	1791
Log-likelihood	−3693.933	−3785.846	−3652.297	−3221.883	−3708.269	−3802.642	−3654.576	−3230.931

Note: Standard errors are presented below the estimated coefficients.
[a] Marginal effects (M. E.) of tobit model are computed at the mean of Xs.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

TABLE 3
Tobit Estimation of Life Cycle Relationship Between Term Life Insurance and Financial Vulnerability Index

Independent Variables	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]
Intercept	−14.9533***	−18.4438***	−18.5555***	−18.1209***				
	(5.253)	(4.735)	(5.294)	(5.061)				
Financial vulnerability index	2.5250**	4.3390***	3.6713***	3.6349***				
	(1.099)	(1.059)	(1.065)	(0.970)				
Average age of couple	0.7836***	0.8790***	0.8536***	0.8458***				
	(0.258)	(0.233)	(0.259)	(0.247)				
(Average age of couple)^2	−0.0090***	−0.0097***	−0.0101***	−0.0096***				
	(0.003)	(0.003)	(0.003)	(0.003)				
Age 20–34 (group 1)					0.8470	−1.7531**	−2.5067***	−2.2302***
					(0.813)	(0.788)	(0.840)	(0.840)
Age 35–49 (group 2)					1.8979***	0.8305	−1.0069	0.5743
					(0.649)	(0.595)	(0.618)	(0.587)
Age 50–64 (group 3)					0.3561	0.8075	−1.8601**	−1.2543*
					(0.840)	(0.779)	(0.783)	(0.745)
Financial vulnerability index interacted with age group 1					−2.4789	9.0140**	8.4143**	8.3099**
					(3.155)	(3.895)	(3.731)	(3.539)
Financial vulnerability index interacted with age group 2					2.9755*	5.8447***	5.1016***	2.6590**
					(1.584)	(1.451)	(1.466)	(1.288)
Financial vulnerability index interacted with age group 3					3.7313**	2.3670	1.5483	4.5605***
					(1.850)	(1.809)	(1.745)	(1.689)
Number of observations	1496	1745	1723	1791	1496	1745	1723	1791
Log-likelihood	−4752.68	−5468.79	−5195.57	−5515.63	−4754.95	−5471.28	−5196.43	−5518.27

Note: Standard errors are presented below the estimated coefficients.
[a] Marginal effects (M. E.) of tobit model are computed at the mean of Xs.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

TABLE 4
Tobit Estimation of Life Cycle Relationship Between Sum of Net Amount at Risk and Term Life Insurance and Financial Vulnerability Index

Independent Variables	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]
Intercept	−9.3876***	−17.3661***	−17.7839***	−21.0985***				
	(3.634)	(3.591)	(4.314)	(4.260)				
Financial vulnerability index	3.8054***	4.1257***	3.3367***	4.5764***				
	(0.764)	(0.810)	(0.876)	(0.822)				
Average age of couple	0.7425***	1.0218***	0.9949***	1.0963***				
	(0.178)	(0.177)	(0.210)	(0.207)				
(Average age of couple)^2	−0.0075***	−0.0102***	−0.0100***	−0.0110***				
	(0.002)	(0.002)	(0.002)	(0.002)				
Age 20–34 (group 1)					6.0398***	3.1984***	2.1818***	1.1595
					(0.573)	(0.615)	(0.707)	(0.721)
Age 35–49 (group 2)					8.1361***	7.2227***	5.6995***	5.5611***
					(0.460)	(0.463)	(0.522)	(0.504)
Age 50–64 (group 3)					8.4217***	7.7514***	6.5674***	5.4848***
					(0.595)	(0.602)	(0.650)	(0.635)
Financial vulnerability index					3.6393*	8.6704***	5.8590*	6.4232**
interacted with age group 1					(2.172)	(3.046)	(3.148)	(3.043)
Financial vulnerability index					3.7645***	4.2955***	4.7469***	4.6381***
interacted with age group 2					(1.143)	(1.141)	(1.226)	(1.096)
Financial vulnerability index					4.6485***	4.2867***	2.1757	4.9168***
interacted with age group 3					(1.315)	(1.394)	(1.418)	(1.432)
Number of observations	1496	1745	1723	1791	1496	1745	1723	1791
Log-likelihood	−4976.52	−5793.68	−5755.23	−5940.21	−5014.79	−5471.28	−5196.43	−5952.79

Note: Standard errors are presented below the estimated coefficients.
[a] Marginal effects (M. E.) of tobit model are computed at the mean of Xs.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

economic conditions in financial markets: net savings, the consumer sentiment index (reflecting household expectations of future prices, income, and general economic conditions), interest rates (on high grade bonds), and index of security prices. Given the low *t*-ratios for lagged alternative assets, they conclude that the evidence concerning the relation of life insurance demand and other alternative financial assets is not certain. The variables Headen and Lee (1974) define are macroeconomic oriented. For example, they use ordinary life insurance sales as life insurance demand and they investigate stocks and bonds quarterly flowing to the household sector. However, they do not explore the life cycle effects and do not study term insurance and whole life insurance separately.

We, on the other hand, investigate a household's life insurance purchasing behavior from a microeconomic perspective and treat each household as a unit. Although we have found a life cycle relationship between life insurance and financial vulnerability, it may be interesting to further determine the life cycle relationship between a household's life insurance holdings and other assets. Our regression is shown as follows:

$$\begin{aligned} \text{Log}(\textbf{LifeIns}) &= \gamma_4\text{IMPACT} + \alpha_4\text{A}_{20-34} + \alpha_5\text{A}_{35-49} + \alpha_6\text{A}_{50-64} \\ &+ \sum_i^n \delta_{1i}\text{Asset}_i \cdot \text{A}_{20-34} + \sum_i^n \delta_{2i}\text{Asset}_i \cdot \text{A}_{35-49} + \sum_i^n \delta_{3i}\text{Asset}_i \cdot \text{A}_{50-64} + \beta X' + \varepsilon_3, \end{aligned} \tag{12}$$

where the variable Asset_i stands for asset item i including cash, stocks, bonds, mutual fund, annuities, individual retirement accounts, and real estate. The vector X includes other control variables.

We focus on the relationship of a household's life insurance holdings with its different kinds of financial assets: cash, stocks, bonds, mutual fund, annuities, individual retirement accounts, and real estate. We run the tobit regressions by year and get similar results as those for year 2001, shown in Table 5. Our results in Table 5 suggest that most of the life cycle relationships between life insurance holdings and different asset items are insignificant because the interaction terms of different assets and age group dummies are not significant. We find limited positive (negative) relationship between individual retirement accounts, annuities, and real estate (bonds), respectively, with life insurance holdings, which is consistent with the existing literature (Fortune, 1973; Headen and Lee, 1974; Brown, 1999; Bernheim et al., 2001).

For some financial assets (i.e., cash, stock, individual retirement accounts, and real estate) and the age groups, the interaction terms of financial vulnerability index and age group dummies are highly correlated with the interaction terms of financial assets and the same age group dummies. To solve the multicollinearity problem, we include the financial vulnerability index rather than financial vulnerability index and age group dummy interaction terms in Equation (12). It dramatically reduces the multicollinearity problem. The coefficients of financial vulnerability index in Table 5 are positive and significant at around 6 percent for term life insurance, and total life insurance, respectively, but not for net amount at risk. It is not surprising that the coefficients of financial vulnerability index are less significant and have smaller magnitude than those shown in Tables 2–4. The household will be less vulnerable to the

TABLE 5
Life Cycle Relationship Between Life Insurance and Household's Portfolio with Imputed Housework Value in 2001

	Net Amount at Risk		Term Life		NAR + Term Life	
Independent Variables	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M. E.[a]
Financial vulnerability index	−0.1171	−0.1869	1.8974**	1.9318*	1.5160**	1.5686*
	(0.838)	(0.213)	(0.871)	(1.021)	(0.713)	(0.838)
Age 20–34 (group 1)	−2.4542***	−4.1447***	−16.5513***	−24.6087***	−10.2308***	−15.9931***
	(0.914)	(0.951)	(2.213)	(2.755)	(1.808)	(2.247)
Age 35–49 (group 2)	−2.3969***	−3.0802***	−13.5899***	−20.2894***	−7.7396***	−12.1368***
	(0.879)	(0.721)	(2.138)	(2.625)	(1.747)	(2.137)
Age 50–64 (group 3)	−3.5604***	−3.9223***	−9.8748***	−15.4132***	−5.1059**	−8.4841***
	(1.055)	(0.831)	(2.587)	(3.152)	(2.111)	(2.541)
Log(cash+cash equivalent) interacted	−0.0518	−0.0012	0.3025	0.4593*	0.3036*	0.4541**
with age group 1	(0.090)	(0.112)	(0.222)	(0.275)	(0.181)	(0.225)
Log(cash+cash equivalent) interacted	0.0232	−0.0146	−0.0271	−0.0299	0.2140	0.2718
with age group 2	(0.075)	(0.053)	(0.183)	(0.225)	(0.150)	(0.182)
Log(cash+cash equivalent) interacted	0.0932	0.0412	−0.1606	−0.2139	0.1469	0.1696
with age group 3	(0.098)	(0.071)	(0.241)	(0.294)	(0.197)	(0.237)
Log(stock) interacted with age group 1	0.1103*	0.1232**	0.1282	0.1286	0.1790	0.2088
	(0.065)	(0.052)	(0.159)	(0.186)	(0.130)	(0.153)
Log(stock) interacted with age group 2	−0.0380	−0.0208	−0.0645	−0.0846	−0.1049	−0.1298*
	(0.033)	(0.021)	(0.082)	(0.096)	(0.067)	(0.079)
Log(stock) interacted with age group 3	0.0652*	0.0281	0.1148	0.1288	0.0513	0.0501
	(0.039)	(0.024)	(0.096)	(0.114)	(0.079)	(0.093)
Log(bond) interacted with age group 1	−0.0291	−0.0161	0.0081	0.0054	0.1209	0.1462
	(0.088)	(0.063)	(0.217)	(0.256)	(0.178)	(0.209)
Log(bond) interacted with age group 2	0.0411	0.0393	−0.0361	−0.0392	−0.0133	−0.0142
	(0.039)	(0.024)	(0.097)	(0.114)	(0.079)	(0.093)
Log(bond) interacted with age group 3	−0.0136	−0.0126	−0.3304***	−0.3883***	−0.1378	−0.1529
	(0.044)	(0.026)	(0.107)	(0.128)	(0.088)	(0.103)

(continued)

TABLE 5
(Continued)

	Net Amount at Risk		Term Life		NAR + Term Life	
Independent Variables	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M. E.[a]
Log(mutual fund) interacted with age group 1	−0.0623	−0.0218	0.1359	0.1165	0.1395	0.1432
	(0.077)	(0.064)	(0.189)	(0.220)	(0.154)	(0.182)
Log(mutual fund) interacted with age group 2	−0.0096	−0.0121	0.0881	0.0819	0.0105	0.0020
	(0.033)	(0.020)	(0.081)	(0.096)	(0.067)	(0.078)
Log(mutual fund) interacted with age group 3	−0.0229	−0.0193	0.0338	0.0328	0.0018	−0.0018
	(0.037)	(0.021)	(0.090)	(0.107)	(0.073)	(0.086)
Log(annuity) interacted with age group 1	0.1131	0.0485	−0.1840	−0.2370	−0.0553	−0.0873
	(0.110)	(0.074)	(0.271)	(0.324)	(0.222)	(0.263)
Log(annuity) interacted with age group 2	0.0949**	0.0229	−0.0580	−0.0662	−0.0930	−0.1204
	(0.045)	(0.024)	(0.112)	(0.132)	(0.091)	(0.107)
Log(annuity) interacted with age group 3	0.0433	0.0152	−0.0166	−0.0202	0.0821	0.0878
	(0.040)	(0.023)	(0.099)	(0.117)	(0.081)	(0.095)
Log(a household's individual retirement account)	0.0116	0.0649	0.5083***	0.6265***	0.5499***	0.6975***
interacted with age group 1	(0.054)	(0.052)	(0.131)	(0.157)	(0.107)	(0.130)
Log(a household's individual retirement account)	−0.0272	−0.0290	0.4236***	0.5023***	0.2769***	0.3236***
interacted with age group 2	(0.038)	(0.026)	(0.092)	(0.110)	(0.075)	(0.090)
Log(a household's individual retirement account)	−0.0607	−0.0389	0.2997**	0.3527**	0.1524	0.1770
interacted with age group 3	(0.048)	(0.030)	(0.117)	(0.140)	(0.095)	(0.113)
Log(real estate) interacted with age group 1	−0.0277	−0.0596	0.1665	0.2027	0.0911	0.1095
	(0.043)	(0.040)	(0.104)	(0.126)	(0.086)	(0.104)
Log(real estate) interacted with age group 2	0.0071	0.0026	0.2118**	0.2596**	0.2030**	0.2474**
	(0.041)	(0.029)	(0.101)	(0.122)	(0.082)	(0.099)
Log(real estate) interacted with age group 3	0.0125	0.0067	0.0571	0.0613	0.0222	0.0134
	(0.070)	(0.056)	(0.171)	(0.207)	(0.140)	(0.168)
Log(sizable inheritance expected)	0.0076	0.0124	−0.0008	0.0030	−0.0082	−0.0056
	(0.022)	(0.014)	(0.055)	(0.065)	(0.045)	(0.053)

(continued)

TABLE 5
(Continued)

	Net Amount at Risk		Term Life		NAR + Term Life	
Independent Variables	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M. E.[a]
Log(total debt of the household)	0.0116	0.0141	0.2128***	0.2565***	0.1797***	0.2251***
	(0.029)	(0.019)	(0.071)	(0.086)	(0.058)	(0.069)
Log(other assets)	0.0424	0.0101	−0.1096	−0.1340	0.0738	0.0935
	(0.043)	(0.032)	(0.106)	(0.128)	(0.087)	(0.105)
Log(salary and wage of the respondent)	0.0547*	0.0396*	0.1442*	0.1692*	0.1415**	0.1634**
	(0.032)	(0.022)	(0.079)	(0.095)	(0.065)	(0.077)
Log(salary and wage of the spouse)	−0.0066	0.0119	0.1105*	0.1315*	0.0775	0.0972*
	(0.024)	(0.016)	(0.060)	(0.071)	(0.049)	(0.058)
Education level of the respondent	0.0918*	0.0635*	0.3190	0.3627**	0.3152***	0.3687***
	(0.051)	(0.037)	(0.124)	(0.150)	(0.101)	(0.122)
Education level of the spouse	−0.0375	−0.0214	0.1669	0.2199	0.0198	0.0276
	(0.049)	(0.035)	(0.121)	(0.147)	(0.099)	(0.119)
Desire to leave a bequest	0.0557	−0.1172	0.7805	0.8786	0.3750	0.3552
	(0.229)	(0.158)	(0.563)	(0.667)	(0.461)	(0.547)
Foreseeable major financial obligations	0.5854***	0.4081***	1.2215**	1.4633**	1.3311***	1.5945***
	(0.217)	(0.153)	(0.533)	(0.637)	(0.435)	(0.519)
Log(cash value)	0.9512***	0.4028***	−0.2262***	−0.2714***	0.1986***	0.2284***
	(0.011)	(0.039)	(0.061)	(0.075)	(0.021)	(0.025)
Log(face value of term life insurance)	−0.0066	0.0007				
	(0.010)	(0.006)				
Log(Net Amount at Risk)			−0.0397	−0.0410		
			(0.059)	(0.072)		
Adjusted R-square	0.8425		0.1450		0.2234	
Log-likelihood		−2064.82		−5387.18		−5769.86

Number of observations: 1,791.
Standard errors are presented below the estimated coefficients.
[a] Marginal effects (M.E.) of tobit model are computed at the mean of Xs.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

death of the breadwinner if it has more financial assets. Therefore, it will buy less life insurance.

The education levels of the respondent in the three tobit models in Table 5 are all positive and statistically significant, consistent with Burnett and Palmer (1984). It suggests that a more educated household has a greater likelihood of understanding the need for insurance. The results also provide some evidence that life insurance demand is related to the bequest motive for the term life insurance regression and the sum of term life and net amount at risk regression. If a couple desires to leave an estate, the evidence suggests a positive relationship between a bequest and the demand for total life insurance, although its coefficient is not statistically significant.

We also note the negative relationship between term and whole life insurance in the demand equation. Term life insurance is negatively related to cash value and net amount at risk, respectively, of whole life insurance, which means that whole life insurance is a substitute for term life insurance. Another finding is that labor income of both spouses in most cases is positively related to the net amount at risk, the term life, and the total insurance demand in our tobit models. Foreseeable major financial obligations expected to be met in the near future such as educational expenses, health care costs, and so forth are also positively and significantly related to the net amount at risk, the term life, and the total life insurance demand. In this sense, people tend to use life insurance to manage their current or short-term obligations.[11]

ROBUSTNESS CHECK: VALUING NONMONETARY CONTRIBUTION

One may argue that the nonmonetary contribution of a spouse who stays at home should be considered as income, as a family will also suffer a financial loss if the spouse were to die. To impute the value of household services we divide the sample into two parts. It is interesting to examine whether the positive and significant relationship between financial vulnerability index and insurance holdings we find in section Life Cycle Protection Analysis is driven by families' different choices between earning two incomes and earning one income.

Valuing in monetary terms the time spent on productive household activities by using shadow and/or market prices and then adding this value to money income measure allows us to examine whether the households take into account this housework value when they purchase life insurance. We impute a housework value by using the selectivity correction method of Heckman (1979). Heckman (1979)'s two-step estimation

[11] We also explore the impact of the baby-boom cohort on the life insurance demand. The baby-boom generation refers to the cohort born between 1946 and 1964. Contrary to the finding of Chen, Wong, and Lee (2001), we do not find a significant difference between the baby-boom cohort's life insurance purchasing behavior and earlier or later counterparts. Since controlling for whether a householder belongs to the baby-boom cohort does not improve our regression results, we do not include it in our regression model.

procedure includes both a selection equation and regression equation:

$$\begin{aligned}
&\textit{Selection equation:}\\
&z_s^* = \gamma_s' w_s + u_s, \quad z_s = 1 \quad \text{if } z_s^* > 0\\
&\qquad\qquad\qquad\quad\; z_s = 0 \quad \text{otherwise}\\
&\qquad\qquad\qquad\quad\; \text{Prob}(z_s = 1) = \Phi(\gamma_s' w_s) \text{ and } \text{Prob}(z_s = 0) = 1 - \Phi(\gamma_s' w_s)\\
&\qquad\qquad\qquad\quad\; \text{where } s = \text{wife or hus.}
\end{aligned} \tag{13}$$

$$\begin{aligned}
&\textit{Regression equation:}\\
&\text{Log}(Y_s) = \beta_s' X_s + \varepsilon_s \text{ observed only if } z_s = 1\\
&\qquad\quad (u_s, \varepsilon_s) \sim \text{ bivariate normal } [0, 0, 1, \sigma_{s,\varepsilon}, \rho_s].
\end{aligned} \tag{14}$$

The selection variable z_s^* is not observed. We only observe only whether a spouse is working or not. If the spouse is working, labor income Y_s is observed and we assign a working indicator $z_s = 1$. We first estimate the probit selection equation to obtain estimates of γ_s. Then we calculate $\hat{\lambda}_s = \phi(\hat{\gamma}_s' w_s)/\Phi(\hat{\gamma}_s' w_s)$ for each observation in the selected sample. Next we estimate β_s and $\beta_{s,\lambda} = \rho_s \sigma_{s,\varepsilon}$ by least squares regression of log of Y_s on X_s and $\hat{\lambda}_s$.

Log of labor income is the dependent variable in the regression equation, which is determined by the number of children, education, and age. The results of the Heckman two-step estimation are shown in Table A1 in Appendix A. As the number of children increases, the probability of the respondent[12] working outside increases while that of the spouse decreases. Higher education is associated with the higher probability of working outside and the higher salary for both respondents and spouses.

If the observed labor income is less than the imputed value $\hat{Y}_s$, we set the labor income equal to the imputed value $\hat{Y}_s$ and then reestimate the tobit regressions on life insurance demand shown in Equations (10), (11), and (12). Table A2 shows the results of life cycle relationship between the sum of net amount at risk and term life insurance and financial vulnerability index with imputed housework value. The regression results with the net amount at risk or the term life insurance as the dependent variable adjusting for imputed housework value have the same sign and significance as those in Tables 2 and 3, but are not reported here. Based on Equation (12), Table A3 shows the life cycle relationship between life insurance and a household's portfolio with imputed housework value in 2001.

In general, our results are robust with and without imputation of housework value since we obtain similar estimates and significance. In addition, we notice an interesting pattern. Compared with Tables 4 and 5, our regression results in Tables A2 and A3 show that life insurance demand is consistently slightly less sensitive to financial vulnerability in both magnitude and statistical significance when we impute the housework value in monetary terms.[13] For example, the coefficient of financial

[12] In most cases the respondent is the husband.

[13] We reach the same conclusion with the net amount at risk or the term life insurance as the dependent variable in different years.

vulnerability index in 2001 in Table 4 is 4.5764 while it decreases by 18 percent to 3.7363 in Table A2 with imputed housework value. Similarly, in the portfolio implication regression, the coefficient of financial vulnerability index in 2001 in Table 5 is 1.5686 while it decreases to 1.5159 in Table A3 with imputed housework value. Moreover, the coefficient of financial vulnerability index in Table A3 is slightly less significant at 8 percent compared to 6 percent in Table 5. It is not a surprising result. There are two possible explanations: first, the households do not buy life insurance on the housekeepers. The economic justification for life insurance purchase, we learn from the textbook, is that the insured earns an income, and others are dependent on that earning capacity for at least part of their financial support (Rejda, 2005). If the households follow this suggestion, no life insurance will be purchased on the housekeepers' lives because other family members do not depend on their earning capacity to sustain current living standards. Second, if the one-income households (or so-called traditional families) recognize the economic value of housework and impute the monetary terms to it, they will treat themselves as two-income families because the housekeepers also create "income" at home. In theory, two-income households are less vulnerable to the death of an earner than one-income households in which only one parent is in the labor force. So the life insurance demand of two-income families is less sensitive to the households' financial vulnerabilities. Although the above two explanations are alternative, they are not mutually exclusive explanations for our findings. It is possible that the households realize the housework value but do not purchase life insurance on the housekeepers. The first explanation seems to support the reduced significance in the coefficients of financial vulnerability index and the second explanation provides a support for their reduced magnitude.

CONCLUSION

We find a relationship between a household's financial vulnerability and the demand for life insurance. Unlike Bernheim et al. (2001), we decompose the demand for life insurance into the demand for term life and whole life insurance and take into account the vulnerability to loss of labor income to both spouses. Further, we employ an index of financial vulnerability that has several important features. First, it is transparent in the sense that we do not rely upon a proprietary model to construct it. Second, it is easy to implement since it dramatically reduces the cost associated with compiling data and modeling households' financial vulnerabilities. Third, our index can study households' life cycle protection by using different types of life insurance, respectively. Fourth, it is close to the reality in the sense that the consumption-to-income ratio for each household in the index is obtained from the annual survey, *Consumer Expenditures Survey*.

Bernheim et al. (2001) found that the correlation between life insurance demand and financial vulnerability is essentially zero throughout the entire life cycle (they did not distinguish between whole life insurance and term life insurance and they used a financial planning model to decide the benchmark life insurance). While our result also does not consistently apply to whole life insurance, we do see a strong relationship between term and total insurance and financial vulnerability in our life cycle analysis. Our finding of a positive relationship between a household's financial vulnerability and the term life insurance and total life insurance holdings, respectively, seems reasonable in the light of the theory. Our empirical analysis shows that the more volatile the living standard in a household will be, the more term or total life insurance it will purchase.

Another conclusion from our life cycle regression results is that older households tend to use less life insurance to protect a certain level of financial vulnerability than younger households. This may arise from the elders' avoidance of the higher price of life insurance or decreasing absolute risk aversion since a household generally accumulates more wealth as it gets older. We also present evidence of how individual households change their portfolio over the life cycle and how this relates to the demand for life insurance. We find limited positive (negative) relationship between individual retirement accounts, annuities, and real estate (bonds), respectively, with life insurance holdings for some age groups. Finally, we take into account the nonmonetary contribution of family members. Our results are robust no matter whether we impute the value of the housework or not.

APPENDIX ESTIMATION RESULTS OF ROBUSTNESS CHECK: VALUING NONMONETARY CONTRIBUTION

TABLE A1

Estimation Results of the Heckman Model

	Log(Labor Income)	
Regression Equation Independent Variables	Respondent Estimate	Spouse Estimate
Intercept	8.1039***	9.2257***
	(0.274)	(0.396)
Number of dependent children	0.0527	−0.0034
	(0.034)	(0.049)
Education level of the respondent	0.1245***	
	(0.016)	
Age of the respondent	0.0282***	
	(0.004)	
Education level of the spouse		0.0527**
		(0.023)
Age of the spouse		0.0118**
		(0.006)
Adjusted R-square	0.1279	0.1183
	Working Indicator	
Selection Equation Independent Variables	Respondent Estimate	Spouse Estimate
Intercept	6.2064	5.6874
	(43.358)	(31.847)
Number of Dependent Children	0.0356*	−0.1243***
	(0.020)	(0.014)

(*continued*)

TABLE A1
(Continued)

	Working Indicator	
Selection Equation Independent Variables	Respondent Estimate	Spouse Estimate
Education level of the respondent	0.0427***	
	(0.009)	
Age of the respondent	−0.0224***	
	(0.002)	
Spouse working indicator	−4.8848	
	(43.358)	
Education level of the spouse		0.0629***
		(0.006)
Age of the spouse		−0.0207***
		(0.002)
Respondent working indicator		−5.1709
		(31.846)
λ	−7.5471***	−6.8699***
	(0.274)	(0.282)
Log-likelihood	−1990.90	−3777.74

Note: Number of observations: 6,755.
Standard errors are presented below the estimated coefficients.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

REFERENCES

ACLI, 1999, *1999 Life Insurance Fact Book*. (Washington, D.C.: American Council of Life Insurance).

Ando, A., and F. Modigliani, 1963, The 'Life Cycle' Hypothesis of Savings: Aggregate Implications and Tests, *American Economic Review*, 53(1): 55-84.

Auerbach, A. J., and L. J. Kotlikoff, 1987, *Work, Health, and Income Among the Elderly, Chapter Life Insurance of the Elderly: Its Adequacy and Determinants* (Washington, D.C.: The Brookings Institute).

Auerbach, A. J. and L. J. Kotlikoff, 1991a, The Adequacy of Life Insurance Purchases, *Journal of Financial Intermediation*, 1(3): 215-241.

Auerbach, A. J., and L. J. Kotlikoff, 1991b, Life Insurance Inadequacy–Evidence From a Sample of Older Widows, National Bureau of Economic Research, Working paper no. 3765.

Bernheim, B. D., K. G. Carman, J. Gokhale, and L. J. Kotlikoff, 2001, The Mismatch Between Life Insurance Holdings and Financial Vulnerabilities: Evidence From the Survey of Consumer Finances, NBER Working paper no. 8544.

Bernheim, B. D., R. J. Lemke, and J. K. Scholz, 2004, Do Estate and Gift Taxes Affect the Timing of Private Transfer? *Journal of Public Economics*, 88(12), 2617-2634.

TABLE A2
Tobit Estimation of Life Cycle Relationship Between Sum of Net Amount at Risk and Term Life Insurance and Financial Vulnerability Index with Imputed Housework Value

Independent Variables	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]	1992 M. E.[a]	1995 M. E.[a]	1998 M. E.[a]	2001 M. E.[a]
Intercept	−9.6187***	−17.8304***	−18.5630***	−21.2981***				
	(3.629)	(3.606)	(4.321)	(4.268)				
Financial vulnerability index	3.1922***	2.8853***	2.1633**	3.7363***				
	(0.766)	(0.814)	(0.882)	(0.837)				
Average age of couple	0.7602***	1.0510***	1.0410***	1.1101***				
	(0.178)	(0.178)	(0.211)	(0.208)				
(Average age of couple)^2	−0.0077***	−0.0105***	−0.0105***	−0.0111***				
	(0.002)	(0.002)	(0.002)	(0.002)				
Age 20–34 (group 1)					6.1796***	3.4059***	2.8955***	1.5551**
					(0.573)	(0.624)	(0.727)	(0.744)
Age 35–49 (group 2)					8.2635***	7.4391***	6.0169***	5.4533***
					(0.447)	(0.466)	(0.525)	(0.512)
Age 50–64 (group 3)					8.4660***	8.0610***	6.9104***	5.5919***
					(0.601)	(0.596)	(0.661)	(0.652)
Financial vulnerability index interacted with age group 1					2.9745	6.9387**	0.7795	3.5704
					(2.137)	(2.999)	(3.153)	(3.207)
Financial vulnerability index interacted with age group 2					3.1308***	2.9981***	3.5255***	4.2377***
					(1.092)	(1.111)	(1.207)	(1.095)
Financial vulnerability index interacted with age group 3					4.2402***	3.2338**	1.4510	4.0418***
					(1.244)	(1.312)	(1.409)	(1.416)
Number of observations	1496	1745	1723	1791	1496	1745	1723	1791
Log-likelihood	−4990.17	−5826.87	−5766.41	−5959.13	−4997.60	−5841.29	−5772.63	−5969.44

Note: Standard errors are presented below the estimated coefficients.
[a] Marginal effects (M. E.) of tobit model are computed at the mean of Xs.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

TABLE A3
Life Cycle Relationship Between Life Insurance and Household's Portfolio with Imputed Housework Value in 2001

	Net Amount at Risk		Term Life		NAR + Term Life	
Independent Variables	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M.E.[a]	OLS Estimate	TOBIT M.E.[a]
Financial vulnerability index	−0.0846	−0.1700	1.8661**	1.8791*	1.4853**	1.5159*
	(0.873)	(0.220)	(0.908)	(1.064)	(0.743)	(0.873)
Age 20–34 (group 1)	−2.4519***	−4.1389***	−16.6269***	−24.6833***	−10.2903***	−16.0543***
	(0.914)	(0.951)	(2.213)	(2.756)	(1.808)	(2.248)
Age 35–49 (group 2)	−2.3877***	−3.0667***	−13.7938***	−20.4977***	−7.9014***	−12.3035***
	(0.880)	(0.721)	(2.140)	(2.626)	(1.748)	(2.138)
Age 50–64 (group 3)	−3.5456***	−3.9012***	−10.1591***	−15.7022***	−5.3316**	−8.7145***
	(1.055)	(0.830)	(2.587)	(3.152)	(2.111)	(2.541)
Log(cash+cash equivalent) interacted with age group 1	−0.0521	−0.0013	0.3034	0.4607*	0.3044*	0.4552**
	(0.090)	(0.112)	(0.222)	(0.275)	(0.181)	(0.225)
Log(cash+cash equivalent) interacted with age group 2	0.0223	−0.0151	−0.0172	−0.0195	0.2219	0.2801
	(0.075)	(0.053)	(0.183)	(0.225)	(0.150)	(0.182)
Log(cash+cash equivalent) interacted with age group 3	0.0926	0.0405	−0.1554	−0.2076	0.1511	0.1741
	(0.098)	(0.071)	(0.241)	(0.294)	(0.197)	(0.237)
Log(stock) interacted with age group 1	0.1099*	0.1229**	0.1301	0.1306	0.1806	0.2105
	(0.065)	(0.052)	(0.159)	(0.186)	(0.130)	(0.153)
Log(stock) interacted with age group 2	−0.0382	−0.0210	−0.0645	−0.0846	−0.1048	−0.1296*
	(0.033)	(0.021)	(0.082)	(0.096)	(0.067)	(0.079)
Log(stock) interacted with age group 3	0.0650*	0.0279	0.1162	0.1302	0.0524	0.0513
	(0.039)	(0.024)	(0.096)	(0.114)	(0.079)	(0.093)
Log(bond) interacted with age group 1	−0.0290	−0.0161	0.0076	0.0048	0.1205	0.1457
	(0.088)	(0.063)	(0.217)	(0.256)	(0.178)	(0.209)
Log(bond) interacted with age group 2	0.0413	0.0395	−0.0375	−0.0408	−0.0145	−0.0154
	(0.039)	(0.024)	(0.097)	(0.114)	(0.079)	(0.093)
Log(bond) interacted with age group 3	−0.0134	−0.0124	−0.3308***	−0.3885***	−0.1382	−0.1534
	(0.044)	(0.026)	(0.107)	(0.128)	(0.088)	(0.103)

(*continued*)

TABLE A3
(Continued)

Log(mutual fund) interacted with age group 1	−0.0626	−0.0220	0.1369	0.1178	0.1405	0.1444
	(0.077)	(0.064)	(0.189)	(0.220)	(0.155)	(0.182)
Log(mutual fund) interacted with age group 2	−0.0098	−0.0123	0.0892	0.0832	0.0115	0.0030
	(0.033)	(0.020)	(0.081)	(0.096)	(0.067)	(0.078)
Log(mutual fund) interacted with age group 3	−0.0229	−0.0192	0.0335	0.0324	0.0016	−0.0020
	(0.037)	(0.021)	(0.090)	(0.107)	(0.073)	(0.086)
Log(annuity) interacted with age group 1	0.1132	0.0489	−0.1837	−0.2366	−0.0551	−0.0871
	(0.110)	(0.074)	(0.271)	(0.324)	(0.222)	(0.263)
Log(annuity) interacted with age group 2	0.0947**	0.0228	−0.0572	−0.0654	−0.0924	−0.1197
	(0.045)	(0.024)	(0.112)	(0.132)	(0.091)	(0.107)
Log(annuity) interacted with age group 3	0.0433	0.0153	−0.0155	−0.0191	0.0829	0.0886
	(0.040)	(0.023)	(0.099)	(0.117)	(0.081)	(0.095)
Log(a household's individual retirement account)	0.0115	0.0646	0.5100***	0.6281***	0.5513***	0.6989***
interacted with age group 1	(0.054)	(0.052)	(0.131)	(0.157)	(0.107)	(0.130)
Log(a household's individual retirement account)	−0.0274	−0.0294	0.4255***	0.5046***	0.2784***	0.3254***
interacted with age group 2	(0.038)	(0.026)	(0.092)	(0.110)	(0.075)	(0.090)
Log(a household's individual retirement account)	−0.0609	−0.0394	0.3008***	0.3538**	0.1534	0.1780
interacted with age group 3	(0.048)	(0.030)	(0.117)	(0.140)	(0.095)	(0.113)
Log(real estate) interacted with age group 1	−0.0277	−0.0595	0.1657	0.2018	0.0905	0.1089
	(0.043)	(0.040)	(0.104)	(0.126)	(0.086)	(0.104)
Log(real estate) interacted with age group 2	0.0069	0.0023	0.2134**	0.2611**	0.2043**	0.2489**
	(0.041)	(0.029)	(0.101)	(0.122)	(0.082)	(0.099)
Log(real estate) interacted with age group 3	0.0118	0.0063	0.0673	0.0715	0.0304	0.0217
	(0.070)	(0.056)	(0.171)	(0.207)	(0.140)	(0.168)

(*continued*)

TABLE A3
(Continued)

	Net Amount at Risk		Term Life		NAR + Term Life	
Independent Variables	OLS Estimate	TOBIT M. E.[a]	OLS Estimate	TOBIT M.E.[a]	OLS Estimate	TOBIT M.E.[a]
Log(sizable inheritance expected)	0.0076	0.0122	−0.0008	0.0029	−0.0081	−0.0055
	(0.022)	(0.014)	(0.055)	(0.065)	(0.045)	(0.053)
Log(total debt of the household)	0.0116	0.0141	0.2132***	0.2572***	0.1801***	0.2255***
	(0.029)	(0.019)	(0.071)	(0.086)	(0.058)	(0.069)
Log(other assets)	0.0422	0.0096	−0.1065	−0.1308	0.0762	0.0963
	(0.043)	(0.032)	(0.106)	(0.128)	(0.087)	(0.105)
Log(salary and wage of the respondent)	0.0550*	0.0398*	0.1418*	0.1662*	0.1396**	0.1611**
	(0.032)	(0.022)	(0.079)	(0.095)	(0.065)	(0.077)
Log(salary and wage of the spouse)	−0.0065	0.0113	0.1221**	0.1425*	0.0867*	0.1060*
	(0.025)	(0.017)	(0.062)	(0.074)	(0.051)	(0.060)
Education level of the respondent	0.0918*	0.0642*	0.3131	0.3572**	0.3105***	0.3642***
	(0.051)	(0.037)	(0.124)	(0.151)	(0.102)	(0.122)
Education level of the spouse	−0.0378	−0.0219	0.1700	0.2232	0.0222	0.0303
	(0.049)	(0.035)	(0.121)	(0.147)	(0.099)	(0.119)
Desire to leave a bequest	0.0542	−0.1187	0.7914	0.8904	0.3839	0.3645
	(0.229)	(0.158)	(0.563)	(0.667)	(0.460)	(0.547)
Foreseeable major financial obligations	0.5854***	0.4084***	1.2134**	1.4558**	1.3245***	1.5886***
	(0.217)	(0.153)	(0.533)	(0.637)	(0.436)	(0.519)
Log(cash value)	0.9512***	0.4029***	−0.2256***	−0.2709***	0.1989***	0.2287***
	(0.011)	(0.039)	(0.061)	(0.075)	(0.021)	(0.025)
Log(face value of term life insurance)	−0.0066	0.0007				
	(0.010)	(0.006)				
Log(Net Amount at Risk)			−0.0400	−0.0413		
			(0.059)	(0.072)		
Adjusted R-square	0.8425		0.1448		0.2231	
Log-likelihood		−2064.90		−5387.41		−5770.10

Notes: Number of observations: 1,791. Standard errors are presented below the estimated coefficients.
[a] Marginal effects (M. E.) of tobit model are computed at the mean of Xs.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

Black, K. J., and H. J. Skipper, 2000, *Life & Health Insurance*, 13th ed. (New Jersey: Prentice-Hall, Inc).

Brown, J. R., 1999, Are The Elderly Really Over-Annuitized? New Evidence On Life Insurance and Bequests, NBER Working paper 7193.

Burnett, J. J., and B. A. Palmer, 1984, Examining Life Insurance Ownership Through Demographic and Psychographic Characteristics, *Journal of Risk and Insurance*, 51(3), 453-467.

Chen, R., K. A. Wong, and H. C. Lee, 2001, Age, Period, and Cohort Effects on Life Insurance Purchases in the U.S., *Journal of Risk and Insurance*, 68(2), 303-328.

Fortune, P., 1973, A Theory of Optimal Life Insurance: Development and Tests, *Journal of Finance*, 27(3): 587-600.

Goldsmith, A., 1983, Household Life Cycle Protection: Human Capital Versus Life Insurance, *Journal of Risk and Insurance*, 50(3): 473-486.

Headen, R. S., and J. F. Lee, 1974, Life Insurance Demand and Household Portfolio Behavior, *Journal of Risk and Insurance*, 41(4), 685-698.

Heckman, J. J., 1979, Sample Selection Bias as a Specification Error, *Econometrica*, 47(1): 153-162.

Holden, K. C., R. V. Burkhauser, and D. A. Myers, 1986, Pensioners' Annuity Choice: Is the Well–being of Their Widows Considered? University of Wisconsin Institute for Research on Poverty, Discussion Paper no. 802-86.

Hurd, M. D., and D. A. Wise, 1989, *The Economics of Aging*, Chapter The Wealth and Poverty of Widows: Assets Before and After the Husband's Death (Chicago and London: University of Chicago Press), pp. 177-199.

Kennickell, A. B., 1994, October, Multiple Imputation of the 1983 and 1989 Waves of the SCF. The American Statistical Association 1994 Annual Meeting.

Kimball, M. S., 1990, Precautionary Saving in the Small and in the Large, *Econometrica*, 58(1): 53-73.

Lewis, F. D., 1989, Dependents and the Demand for Life Insurance, *American Economic Review*, 79(3), 452-467.

Merton, R. C., 1975, Theory of Finance From the Perspective of Continuous Time, *Journal of Financial and Quantitative Analysis*, 10(4): 659-673.

Rejda, G. E., 2005, *Principles of Risk Management and Insurance*, 9th ed. (New York: Addison–Wesley Publishers).

Ringen, S., 1991, Households' Standard of Living and Inequality, *Review of Income and Wealth*, 37: 1-13.

Rubin, D. B., 1976, Inference and Missing Data, *Biometrika*, 63(3): 581-592.

Rubin, D. B., 1987, *Multiple Imputation for Nonresponse in Surveys* (New York: John Wiley & Sons, Inc).

Copyright of Journal of Risk & Insurance is the property of Blackwell Publishing Limited and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.