FACTORS INFLUENCING HOUSEHOLDS' DEMAND FOR LIFE INSURANCE

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FACTORS INFLUENCING HOUSEHOLDS' DEMAND FOR LIFE INSURANCE

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ABSTRACT

This thesis aims to examine both the type and amount of life insurance purchased by households. To this end, comprehensive models of households' demand for life insurance were developed, which included demographic variables (age, education, employment status, health status, number of children, marital status, and race), economic and assets variables (income, homeownership, debts, as well as portfolio elements such as liquid assets, certificates of deposit, mutual funds, bonds, stocks, individual retirement accounts, annuities, other miscellaneous financial assets, and nonfinancial assets), and psychographic variables (attitude toward risk, attitude toward leaving a bequest, and one's expected life expectancy). The effects of these factors on either term or cash value life insurance purchased by households were examined separately.

The data was obtained from the 2004 Survey of Consumer Finances. The Heckman two-step selection model was used for the data analysis in order to investigate two different household life insurance purchasing behaviors: the type of life insurance purchased and the amount of life insurance purchased. The descriptive statistics indicated that, in 2004, 40% of households owned term life insurance, 14% held cash value life insurance, and 35% of households did not have any life insurance. Compared to term life

insurance holders, cash value life insurance holders were older, more educated, less risk-taking, more likely to own a home, expected to live longer, and having more positive attitude towards leaving bequest. Households who held term life insurance reported better health and were more likely to be employed than those holding cash value life insurance. Households without any life insurance, however, were relatively young, less educated, unemployed, not married, renters, expecting to die in their 70s, with low income, were not concerned on leaving bequest, and preferred not to take risks.

The results of the two-stage model showed that some variables in the likelihood of purchasing life insurance model and the amount of life insurance model differed in their significances. In addition to race, life expectancy, CDs, and annuities, all other hypothesized factors had significantly positive or negative impacts on term life insurance demand of households. Employment of head, race, and life expectancy did not significantly affect cash value life insurance demand of households, while other factors were shown to be significant contributors.

This study provides three contributions. First, the results proved that most of assets categories associate with the purchase of life insurance by households. Second, using Heckman two-stage selection model is supported in this study because factors influenced the probability of owning life insurance and the amount life insurance held were different. Finally, the fact that variables associated with the demand for term life insurance and the demand for cash value life insurance were different support the view that term life and cash value life insurance should be examined separately.

Chapter One
Introduction

1.1 An Overview

Life insurance plays an important role in individuals' and families' financial lives because it is a hedge against the loss of income following the death of an earner. In 1965, Yarri proposed the use of life insurance to insure against lifetime uncertainty resulting for the mortality risk of individuals. A study conducted by the global consulting firm Milliman, Inc. and commissioned by the Life and Health Insurance Foundation for Education (LIFE) (2007) reveals that although mortality rates in the United States have declined since the 1970s, the risk of premature death of person within the age range of 25-64 is still high. The chance of death between the age of 25 and 65 is greater than 17 percent for males and 11 percent for female. However, Americans generally underestimate this risk. For example, only 5% of Americans ages 35-44 said they think they will die before reaching age 65, while in fact a typical 35-year-old male has a 17.5% chance of death before age 65.

Premature death of a family head can bring serious financial consequences for the surviving family members because the family head's earnings are lost forever leaving unfulfilled financial obligations, such as dependents to support, children to educate, and a mortgage to repay. Life insurance allows individuals and families to share the risk of premature death with many others and to alleviate the financial loss from the premature death of the primary wage earner (Garman & Forgue, 2006). Thus, the main reason for the purchase of life insurance is to provide financial security for the family. There is more

to it, however; people also buy life insurance as a medium to long-term tax favored savings and investment vehicle.

There are two methods to provide life insurance protection: term insurance and cash value insurance (Rejda, 2004). Term life insurance provides protection for a limited period but permits the policyholder to renew the policy without evidence of insurability if the policy is guaranteed renewable. The right to renew, however, is limited to a specified age and the premiums increase with age as the probability of death increases. The benefits from term life insurance are paid only if the insured dies within the period of validity. Cash value life insurance not only pays the death benefit to the beneficiaries of the insured but also has a saving component built into the policy. In many cash value policies, the premium remains level throughout the life of the policy. The premiums paid in the early years are excessive relative to current death claims, whereas the premiums paid in the later years are inadequate relative to the probability of death. The excess premiums paid in the early years are invested by the insurance company at a compound rate of return to accumulate cash, and the accumulated funds are then used to supplement the inadequate premiums paid during the later years of the policy. The manner of investing and building up the cash value is regulated by contract and law, and is usually referred to as a legal reserve. The difference between the face amount of the policy and the legal reserve is called the net amount at risk or, literally, the insurance. Thus, a cash value life insurance policy combines an element of protection (the net amount at risk) and an element of savings (the legal reserve). The policyholder has the right to borrow the cash value or surrender the policy for the cash value without tax liability.

The purchase of life insurance is one of the most important purchasing decisions for individuals and families (Anderson & Nevin, 1975) and it is a critical component of a long-term financial plan (Devaney & Keaton, 1994). Although almost 75% of Americans agree that life insurance is the best way to protect against the premature death of a primary wage earner, the report in 2006 prepared by Life Insurance Marketing and Research Association (LIMRA) revealed that consumers consider the purchase of life insurance to be a complex process and eight in ten find it difficult to decide how much and what type of life insurance to buy. The worry about making an incorrect decision becomes an excuse for not buying life insurance. This issue creates interest in examination of the consumer demand for life insurance is aroused. It is necessary for financial planners to understand consumer life insurance purchasing behavior in order to help them buy suitable life insurance.

Most American families rely on life insurance to provide financial protection to their dependents and many of them have cash value life insurance in their financial asset portfolios. Sixty-two percent of Americans owned some type of life insurance in 2004 (LIMRA international, 2005). By the end of 2006, total life insurance coverage in the United States reached $19.1 trillion, according to American Council of Life Insurers (ACLI). LIMRA also reports that the average life insurance face value sold in 2006 was $255,861; the total face value sold was 5 percent higher in 2007, as compared to 2006.

Individual life insurance is the most widely used form of life insurance, accounting for 53 percent of all life insurance in force at the end of 2006. Of new individual life polices purchased in 2006, 41 percent were term life policies accounting for 71 percent of the total face amount issued. The purchase of permanent life occupied

59 percent of total life insurance policies issued and 29 percent of the individual life face amount issued (ACLI, 2007).

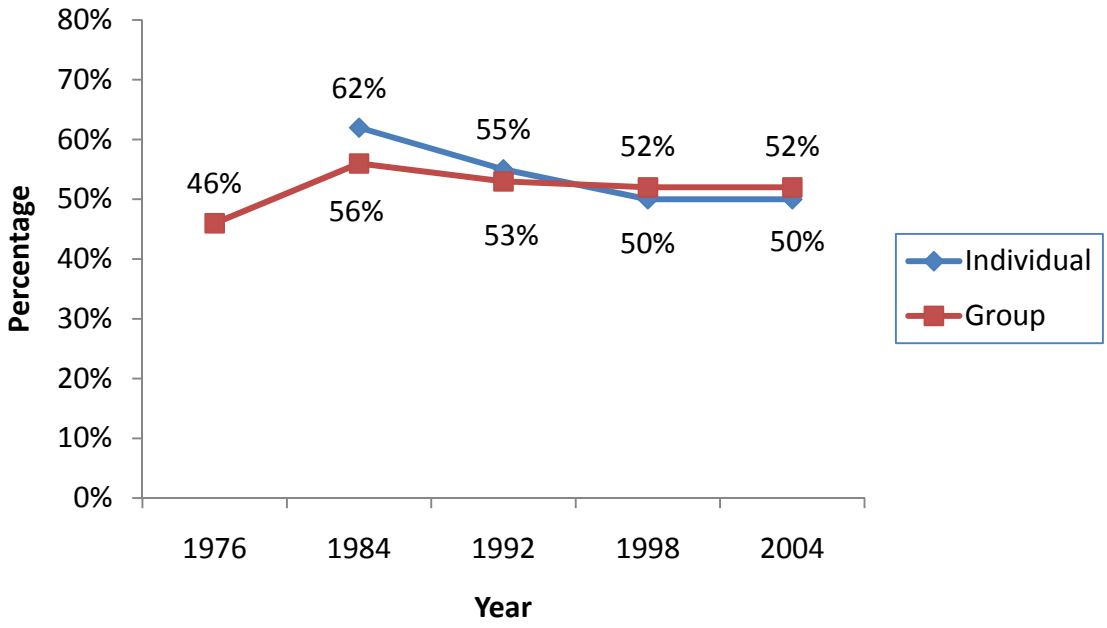
1.2 Trends in Life Insurance purchase

Until recent years, the percent of U.S. households that own life insurance has steadily declined over the past 40 years. By the end of 2004, ownership of individual life insurance, which covers a single life, held steady, with half of U.S. households owning some individual life insurance. Group life insurance, which covers the many lives that are members of the group, is often offered through employers and labor unions. Ownership of group life insurance rose notably as large numbers of married women entered the workforce during the 1970s. The percentage of group life insurance ownership by household has remained at 52 percent of the total life insurance policies, including individual life insurance, group life insurance, and several other miscellaneous forms of coverage such as veterans' and creditor's life insurance, during the past two decades (see Figure 1-1). Although the percent of U.S. households that own life insurance has finally reached its plateau, more than 2 in 10 households still carry no life insurance on anyone in the household.

According to a report by LIMRA, though the number of life insurance policies sold has declined, the face amount of insurance coverage held by households grew rapidly over the past two decades. The average amount of life insurance coverage that insured households carried grew by over $50,000 since 1998 reaching almost $270,000 in 2004. Interestingly, households held life insurance sufficient to replace household income for an average of 3.6 years in 2004, as compared with only 2.4 years in 1998.

Figure 1-1

Percentage of households owning individual or group life insurance

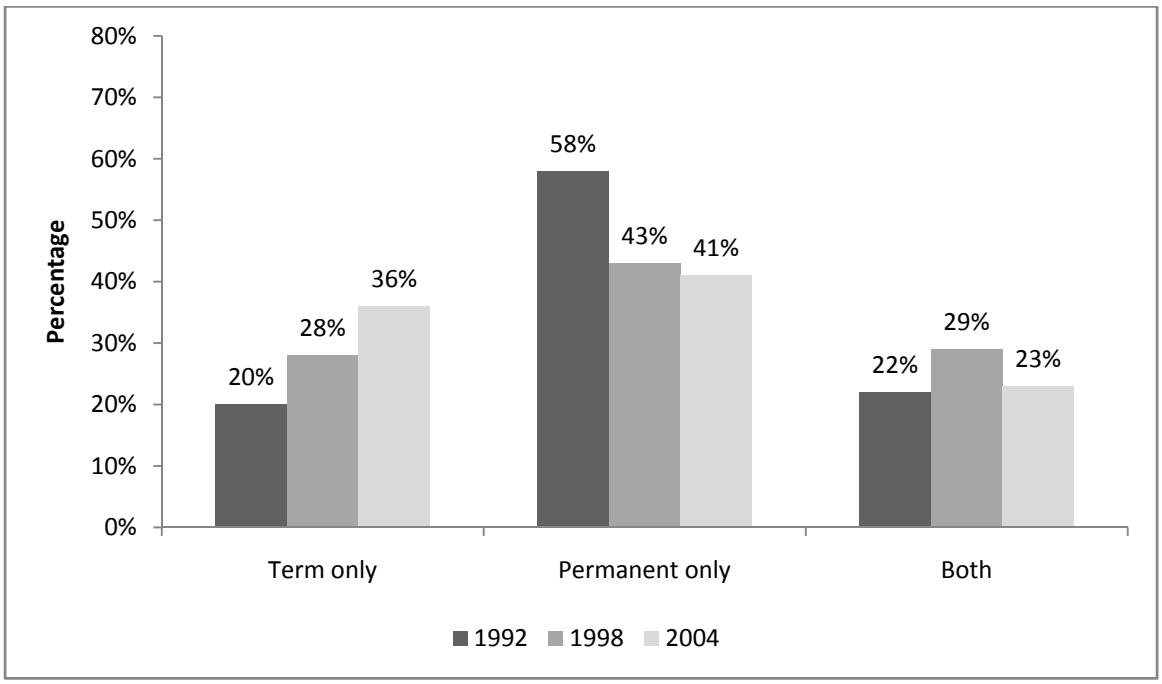


Source: Life Insurance Marketing and Research Association, 2005

Note: Individual life insurance includes policies purchased through agents and companies, fraternal organizations, and associations. Group life insurance includes life insurance obtained through an employer or labor union.

According to LIMRA's 2005 survey, ownership of term life insurance has soared during the last ten years. About 36 percent of insured households purchased only term life insurance in the 2004 survey, almost double the percentage of insured household with only term life insurance in the 1992 survey. The popularity of longer term level premium term life products, in which the premiums paid during the specified period are level, are considered to be the reason behind this increase. The percentage of insured households owning only permanent life insurance decreased during the same 1992-2004 period. Eighty percent of households with individual life insurance carried some permanent life insurance as part of their portfolio of life insurance in 1992, while only 64 percent of insured households carried permanent life insurance in 2004 (see Figure 1-2).

Figure 1-2 Percentage of households owning each type of individual life insurance by year



Source: Life Insurance Marketing and Research Association, 2005

Life insurance ownership increases with household income, as expected. In 2005, life insurance was owned by about 50 percent of households with incomes under $35,000, more than 80 percent of households with income of $35,000-$99,999, and 93 percent of households with income of $100,000 or more. This distribution remains constant with that found in 1998. During the 1998-2004 period, households with income under $35,000 had the largest increase in dollar of insurance in force, primarily due to increases in availability of group life insurance (LIMRA, 2005).

Over the 1998-2004 period, individual life insurance ownership declined for two key age groups. For the 35-44 age group, individual life insurance ownership declined from 59 percent in 1992 to 46 percent in 2004. The declines also happened among those reaching retirement age, from 63 percent in 1998 to 57 percent in 2004. LIMRA found that the youngest households are least likely to own life insurance, whereas households between ages 35 and 64 were most likely to purchase life insurance.

Results of LIMRA's 2005 survey indicated that 44 percent of U.S. households believe they do not have enough life insurance. There is a large gap between what households believe they need and what they actually own. Sixty-eight million Americans have no life insurance and those with coverage have far less than most experts recommend, in order to insure a secure financial future for their families. Today, 1 in 3 insured adults have only group life insurance they obtained at work which, on average, represents a relatively low face value of life insurance. As a result, many households are not prepared for the death of a primary wage earner. Those who are underinsured report that they expect to purchase life insurance, but most will not (only 1 in 10 U.S. households actually do buy life insurance in any given year) (LIMRA, 2007).

Family members also face financial insecurity when the family head is underinsured and dies. A recent survey by Bernheim, et al., (2006), conducted for Boston University (BU) employees, indicated that the degree of underinsurance is particularly severe. Almost 13 percent of primary earners' spouses would experience a 40 percent or greater drop in their level of living, if the primary earners died.

The Life and Health Insurance Foundation for Education (LIFE) conducted a survey in 2006 to examine the role of life insurance in safeguarding a college-funding plan. The survey found that the risk of not being able to afford college is dramatically greater for parents that have either no life insurance or insufficient coverage. For instance, among the 76 percent of parents with no life insurance coverage, 40 percent say that the death of the primary wage earner in their household would make it harder to afford college, and 36 percent stated that they could not afford college if the primary earner died. By contrast, parents with life insurance coverage equal to at least five times their annual income are confident that their children would get a college education, even in the event of a premature death.

1.3 Purposes of the Study

The research questions in this study are: (1) What are the characteristics of households who have purchased either term or cash value life insurance? (2) What is the nature of the relationship between either the type of life insurance or the amount of life insurance purchased by the household and the household's demographic, economic, and psychographic characteritics? (3) What is the nature of the relationship between life insurance and other assets in households' financial portfolios?

The main purpose of this study is to examine the factors that influence the household's demand for life insurance. From previous statements regarding the trends in life insurance ownership, it is clear that many households have no life insurance. According to LIMRA's survey, one of the main reasons that Americans delay buying life insurance is that they cannot decide how much and which type of life insurance they should carry. The purpose of this research is to contribute to the understanding of the household life insurance purchase decision; using known demographic characteristics, in an effort to improve the efficiency of that decision. Moreover, results of this research will enable life insurers to better understand consumer life insurance behavior and thus be better equipped to motivate consumers to purchase needed and appropriate life insurance products.

The work is structured as follows. The next section is a literature review over the following: suitability of different type of life insurance, investment in cash value life insurance, and empirical studies on the life insurance purchase decision. Section three discusses the theoretical foundations of the demand for life insurance. In the fourth section the data used for the empirical analyses are described, and the results of the analyses are presented in the following section. The last section presents a summary and conclusions from the research.

Chapter Two

Literature Review

This section reviews prior research related to both life insurance purchase demand and investments. This chapter includes 1) studies on the suitability of different life insurance policies; 2) studies on household investment through cash value policies; and 3) empirical studies on the life insurance purchase decision.

2.1 Suitability of Different Life Insurance

From a generic viewpoint, life insurance policies can be categorized as either term life insurance or cash value life insurance (Rejda, 2004). Term life insurance provides temporary and pure protection, whereas cash value life insurance policies not only provide protection for the whole life of the insured but also builds a source of saving/wealth, which is called; the cash value. A number of cash value life insurance policies are available to consumers. This section will review term life insurance and the primary cash value life insurance policies: whole life insurance (WL), universal life insurance (UL), variable life insurance (VL), and variable universal life insurance (VUL).

2.1.1 Term Life Insurance

Term life insurance provides insurance protection for a limited time and pays a death benefit only if the insured dies during that period. If death does not happen during that period, the policy can be renewed for additional periods without evidence of

insurability, if it has a guaranteed renewable feature. Term life insurance is pure protection. It does not have a cash value. Initially, when the insured is younger, premiums are lower than the premiums of cash value life insurance. Term life insurance premiums, however, increase with the insured's age because the probability of death increases with each year of life. Eventually, they reach unaffordable levels later in life, often when life insurance is no longer needed.

Based on the features of term life insurance, people have drawn consistent conclusions on when it is appropriate to use term life insurance. As Rejeda (2004) and Trubey (1999) suggest term life insurance is suitable in the following situations: if the insured has limited income that can be spent on life insurance, such as young people who are just beginning their careers or families; or if the need for protection is temporary, such as saving for children's education or paying off a mortgage or other debts if the family head dies prematurely. Angell (1981) stated that term life insurance is an ideal plan to carry if the insured has the necessary self-discipline to regularly invest the difference in term and cash value life premiums. He readily admitted, however, that many people do not have this self-control.

2.1.2 Whole life insurance

In contrast to term life insurance, which provides temporary protection, whole life insurance (WL) is the most basic cash value life insurance offering lifetime protection. Premiums remain level and fixed throughout the policy's life; they will not increase with the age of the insured. The death benefit is guaranteed and remains constant. Under a whole life insurance policy, the insured is overcharged for the insurance protection

during the early years and undercharged during the later years. Whole life insurance has an investment or saving element called the policy's cash value which is built by the greater premiums required in the early years of the policy's life. With whole life insurance, the cash value is guaranteed to grow at a fixed rate of interest that is not known to the owner of the policy. As the cash value increases as a proportion of the face value, the amount of pure protection decreases. At any given age, the sum of the protection element and the cash value element will always equal the face amount of the policy. To secure the guaranteed growth rate of WL, the insurer chooses relatively conservative financial vehicles in order to assure that their assets meet their liabilities. This, in turn, causes a relatively low rate of return. A key feature of WL is that the increases in cash value are not subject to income tax if the policy is held until the insured's death. The death benefit, paid to the beneficiary, is received free of income-tax. The cash value can be taken in cash by surrendering the policy or borrowing against the policy requiring interest to be paid by the owner of the policy on the loan in order to offset the loss of interest to the insurer. This interest is relatively low and the loan principal need not be repaid, however, the death benefit is reduced by the amount of any outstanding balance on the loan.

Though cash value life insurance has a saving element, the insured should keep in mind that the fundamental purpose of life insurance is to provide financial protection for the family. The saving and investment purpose of cash value life insurance is usually a secondary concern (Angell, 1981). Angell suggested that when families have sufficient money left over, cash value life insurance can be purchased as an investment, after all other tax advantaged saving vehicles have been exhausted. Trubey (1999) advocated that

whole life insurance is the proper choice when the insured wants both lifetime protection and cash accumulation; wants additional income during retirement; wants to leave an estate to their heirs; needs money for estate settlement costs and taxes; or to save money for children's college funding. For many individuals, whole life insurance may be a suitable, competitive choice, but the cost of the premiums makes WL unaffordable. In this case, an ideal insurance plan may be a combination of whole life and term life insurance.

2.1.3 Universal Life Insurance

Universal life insurance (UL), introduced in 1979, has been the most popular type of cash value insurance sold in recent years. According to LIMRA's report, UL accounted for 41% of total premiums in 2007 and the sale of UL outperformed that of other cash value life insurance policy types. Universal life insurance is different from whole life insurance on a number of factors (Shaw, 1985). First, the protection and saving elements are separated and unbundled in UL. Thus, in contrast to whole life insurance, the death benefit and cash value accumulation are not being guaranteed but the rate of return and cost of insurance are explicitly known. Second, unlike whole life insurance, UL does not require a fixed schedule of premium payments; instead, the premium payment schedule is flexible. Flexibility allows policy owners to skip scheduled premium payments occasionally without causing the policy to lapse. Third, under WL, the policy owner captures cash value by surrendering the policy or borrowing against the policy. A UL policy holder, in contrast, can access his or her cash value by making partial withdrawals in addition to the two options offered with WL. Finally, though UL does not guarantee a fixed growth rate, it assures a minimum rate of interest, and it

credits a current interest rate to the policy. The same income tax treatment applies to UL as to WL.

As Shaw (1985) indicated, universal life offers flexibility and adaptability in several areas making it a more appealing alternative to most households as compared with whole life insurance. The insured that is willing to give up certain contractual guarantees in exchange for potentially greater cash value growth will be attracted to universal life (Trubey, 1999).

2.1.4 Variable Life Insurance

Variable life insurance (VL) can be defined as a fixed premium policy in which the death benefit and cash values vary as a result of the investment performance of a separate account (Rejeda, 2004). Variable life insurance is the other form of cash value life insurance that performs like traditional whole life insurance in some ways: fixed premiums, guaranteed death benefit equal to the original face value, and no partial withdrawal. The main differences between WL and VL are regarding how the cash values are invested and with respect to who assume the risk of the underlying investment. Under WL, cash value growth is generated by investing in fixed-interest vehicles and the insurer assumes the risk of investment performance. In contrast, the owner of the policy under a VL has a right to choose various financial vehicles to invest premiums, such as mutual funds of stocks, bonds, or money market securities. Investment options can be changed after original purchase, thus making the decision one that is more close to an investment decision as opposed to an insurance decision. When changing account investment choices, an account transfer fee could apply. If the investment performance is favorable, the face

amount of life insurance is increased. If the investment performance is poor, the face amount of life insurance is reduced, but it will typically not fall below the original face amount. Thus, the owner of the policy bears the risk of investment results, as opposed to the insurer.

Since premiums can be invested in a variety of favorable investments, the VL policy has the opportunity to provide potentially greater cash value growth than that available in WL. Hence, those who need long-term insurance protection and a fixed predictable premium payment, but are not satisfied with the conservative rate of return associated with whole life and prefer potentially greater tax free cash value growth, a VL policy may be a suitable option (Trubey, 1999). Of course, VL policy owners must be knowledgeable about investments and willing to accept the greater risk of poor investment results.

2.1.5 Variable Universal Life Insurance

Variable universal life insurance (VUL), introduced in 1984, is a popular type of cash value insurance that has been widely sold in recent years. It combines the features of universal life with variable life. These features include flexible premiums, adjustable death benefits, more methods of accessing cash value, more investment choices, and the potentially higher rate of return and that comes with accepting greater risk. Most VUL are sold as investments or tax shelters (Rejeda, 2004).

Like UL, VUL allows the policy owner to adjust the amount and frequency of premium payments and death benefits to meet his or her needs. The policy owner determines how to invest the premiums under a VUL policy. The premiums are held in

separate accounts which are not subject to creditor claims of the insurer (Freeman, 1995). The types of investments are the same as those of VL, ranging from very conservative guaranteed fixed accounts, to bonds, to common stocks and highly aggressive sector funds. The policy owner can also choose how much of their premiums will be allocated into the various accounts, allowing for a potentially greater rate of return. Internal transfers between the different accounts are free of income tax. Like VL, VUL has no guaranteed minimum cash value since the cash value depends on the performance of the underlying investments.

Variable universal life insurance policies have substantial investment risk. The policy owner totally bears the risk of investment. Investment returns rely on how the premiums are invested. If the investment performance is poor, cash values can drop to zero. Therefore, the policy owner should be familiar with investing and be able to choose his investment well (Trubey, 1999). The VUL policy has significant expense charges including investment, management and mortality costs. According to a study by the Consumer Federation of America (CFA) in 2003, these various costs can more than offset the tax benefits of VUL policies. Thus, CFA advised purchasing a VUL only when the policy owner has made maximum annual contributions to his or her employer's 401(k) plan or individual retirement account (IRA) because they provide favorable income tax treatment at a much lower cost. This advice also applies to other cash value life insurance purchase since the expense loading of cash value life insurance is relatively high when compared to competing investments.

2.2 Studies on Cash Value Policies as Investment

Most cash value insurance policies are sold as investments and tax shelters. This trend has occurred in recent years because of the favorable tax treatment currently granted to them by the Internal Revenue Service and easy access to cash value. Cash value life insurance has two major defects as an investment vehicle, however. These defects include relatively high expenses and relatively low rates of return as compared with competing investments. Therefore, the topic about whether cash value insurance is an appealing investment is controversial among those in the financial planning academic world. This chapter presents a number of points view on this topic.

Using utility theory, Fortune (1973) built a model to examine the determinants of the optimal amount of life insurance. Fortune attempted to link life insurance demand analysis to the wealth of households. He recognized that life insurance may be a substitute for financial assets such as lower risk assets in the household portfolio. Subsequently, Headen and Lee (1974) advocated that ordinary life insurance (whole life insurance) can be considered as an indirect investment in securities that could be competitive in the short-run with alternatives in the household financial asset portfolio. They used data from 1957-1971 provided by both the Federal Reserve's flow of funds and A.M. Best Company. Using these data, they built a cost model to estimate the effect of the household portfolio on ordinary life insurance demand. They did not find strong evidence of a relationship between ordinary life insurance demand and other alternative financial assets. The result indicated that low-asset households tend to view ordinary life insurance as an alternative investment asset.

In a recent paper, Lin and Grace (2007) provided further support that the life insurance demand is jointly determined in the context of other elements within the household's portfolio. Using the data from the 1992, 1995, 1998, and 2001 years of the Survey of Consumer Finances, they found limited positive (negative) relationships between individual retirement accounts, annuities, and real estate (bonds), respectively, with life insurance holdings for some age groups.

Myers and Pritchett (1983) studied the rate of return on differential premiums between those paid on participating policies (an insurance contract that pays dividends to the policy holder) and nonparticipating policies (no dividends are paid to the policy holder) issued in 1959. He noted that the length of time the policy was kept in force is a key important factor affecting the rate of return. In his study, returns were estimated for various holding periods, up to 20 years. The results showed that for policies kept in force for the full 20 year period, higher returns were achieved for participating policies than if the policy owners had purchased nonparticipation policies and invested the premium difference in other investments.

To evaluate the performance of whole life insurance, Kamath (1982) studied 73 whole life insurance policies issued in 1959. He calculated the Linton Yields of the sample of policies (the comparable return you would have received if instead of investing in the variable life insurance policy) based on their actual performance. The results showed that the average yield on the savings portion of the sampled policies, over 20 years, was equal to or better than the average rate of return of eight sets of alternative investments including the Dow Jones 30 industrial stock portfolio and S&P's AA bonds for the same period after taking transaction costs and taxes into account. Kamath

concluded that whole life insurance policies are good long-term investment vehicle by considering the comparative merits of whole life insurance.

D'Arcy and Lee (1986) believed that despite expense loadings and surrender charges on variable universal life policies, the tax treatment within these policies often produced a greater after tax return than alternative investment strategies. The longer the policy is kept in force, the more significant the tax advantage of life insurance policies, as compared with other investments. They compared variable universal life insurance with other alternative investments including purchasing term insurance and investing the difference in money market funds, bond funds, equity funds, deferred annuities, municipal bond funds, or through an individual retirement account. They concluded that VUL policy is a preferred choice, if used after maximum amounts had been invested in an IRA or similar tax sheltered investment and if the policy is held long enough by the policy owner. A method was provided to calculate the necessary holding period for the VUL policy to dominate other investments. They found that a holding period of at least eight years appeared to be optimal, based on some typical values, such as age of the policy holder, cost of insurance, investor's marginal tax rate, expense loadings, and the rate of return of both policies and comparable investments.

In another paper, Baldwin (1995) considered VUL as a "Swiss Army Knife" of financial products because of its flexibility and adaptability for many consumer needs. But Baldwin also noted in his other article (1996) that although VUL has significant tax advantages as an investment medium, it will not work well when underfunded and mismanaged by investing too little into the policy and by not diversifying the choice of investments within the policy.

Cherin and Hutchins (1987) draw an opposite conclusion. They computed the internal rate of return for 60 UL policies. For all cases, the internal rate of return fell below the rate of return advertised by the insurers. Using a present value model, they found high mortality charges and expense charges explained the difference between the computed rate of return and the current quoted interest rate. Cherin and Hutchins concluded that despite the tax advantages of UL, the investor would be better off buying term insurance and investing the balance in an alternative investment with no or low expense loads.

A contrary argument was also presented in Carney and Graham's paper (1998). They compared the after-tax wealth accumulation at age 65 generated by a VUL policy with that achieved from buying term life insurance and investing the difference in alternative investments. Their results indicated that the cash growth of the latter considerably outperformed that of the former, especially when one buys term life insurance and invests in a Roth IRA savings vehicle.

Cunningham (1995) considered that variable universal life insurance performed like a variable annuity because of the tax deferred benefits of a variable annuity. The substantial investment, management and mortality expenses, however, made the return on the VUL policy lower than that of variable annuity. To examine the effect of such expenses on a VUL policy's performance, Cunningham used a model calculating the cash value increase rate of policies under assumptions of both 6 and 12 percent gross rates of return (the rates of return taking account of expenses). He found at a gross rate of return of 12 percent, the net cash growth rate was significant higher over a 20 year period than that over the first 10 years. At a gross rate of return of 6 percent, ten-year net cash growth

rate was significantly less than 0 percent, and twenty-year net cash growth rate was about 0 percent.

In another paper, whole life insurance was compared with an annuity by Adelmann (1990). An annuity is the opposite of life insurance. Life insurance protects against the risk of dying too soon. In contrast, an annuity protects against the risk of living too long and provides a lifetime income. Adelmann pointed out that the tax treatment of withdrawal is different between variable annuities and variable life insurance. Those who borrow from a variable annuity are subject to income tax and a 10 percent penalty before age 59.5, whereas borrowing from VL is free of tax. Adelmann suggested that a young investor with more debts and responsibilities should buy the VL because of the higher death benefit feature. An older investor with more assets can get a higher return by purchasing an annuity.

2.3 Empirical Studies on Life Insurance Purchase Decisions

In previous empirical studies, the amount of life insurance purchased is viewed as a function of numerous variables. These variables, explored through a variety of different approaches and data, explained the significant factors that influence the life insurance purchase decisions. However, previous studies have provided some conflicting results. Most research on life insurance demand determinants is based on empirical data. The demographic, economic and psychographic factors found to be the most robust in predicting life insurance demand will be the focus of this review. Some key findings of selected empirical studies are given in Table 2.1.

Table 2.1 Empirical Results of Selected Literatures on Demand for Life Insurance

Author	Hammond, et al. (1968)	Mantis and Farmer (1968)	Duker (1969)	Anderson and Nevin (1975)		Burnett and Palmer (1984)
Data	The Survey Research Center of University of Michigan 1952-1961	Life insurance fact book 1929-1964	The Survey Research Center of University of Michigan 1959	The Panel on Consumer Decision Processes 1968-1971		A consumer panel in a middle-sized southwestern city Early 1980s
Method	Multi-linear regression model	Multi-linear regression model	Multi-linear regression model	Multiple Classification Analysis		Multiple Classification Analysis
Dependent Variable:	Premium expenditures	Amount of life insurance	Premium expenditures	Amount of life insurance	Type of life insurance	Amount of life insurance
Independent Variables:						
Age	+/-		NS			
Income	+	+	+	+	+	+
Net worth	+		+	+	+	
Family size		-	NS			
Marital Status	-	-				NS
Education						+
children						+
Social security						
Employment(h)	+	+		-		
Employment(w)			-			
Home Ownership						
Race	NS					

Note: The independent variables in each paper may not be limited by the listed above; NS means that the variable is not statistically significant in the model; + means positive and significant in the model; - means negative and significant in the model; +/- means that the significance is different in the data set from different year.

Table 2.1 Empirical Results of Selected Literatures on Demand for Life Insurance (continued)

Author	Fitzgerald (1987)	Bernheim (1991)	Showers and Shotick (1994)	Gandolfi and Miners (1996)	Baek and DeVaney (2005)	
Data	The Wisconsin Assets and Income Survey 1946-1964	The Longitudinal Retirement History Survey 1975	The Consumer Expenditure Survey 1987	The life Insurance Marketing Research Association Survey 1984	The Survey of Consumer Finances 2001	
Method	One period model	Probit , Tobit, and heckman model	Tobit model	Tobit model	Double-hurdle model	
Dependent Variable:	Amount of life insurance	Amount of life insurance	Premium expenditures	Amount of life insurance	The ownership	The amount
Independent Variables:						
Age			+		+	+
Income		+	+	+		+
Net worth	NS					
Family size		-	+	+/-		
Marital Status		-			+	+
Education				+		
children						
Social security	-					
Employment(h)	+	+			+	+
Employment(w)			-	-		
Home Ownership				+	+	
Race	NS				NS	NS

Note: The independent variables in each paper may not be limited by the listed above; NS means that the variable is not statistically significant in the model; + means positive and significant in the model; - means negative and significant in the model; +/- means that the significance is vary in the different models.

2.3.1 Demographic Factors

2.3.1.1 Age

There are contradictory conclusions about the effect of age on the demand for life insurance. For example, Berekson (1972), Showers and Shotick (1994), Baek and DeVaney (2005) found that the effect of age was positive and significant, but Ferber and Lee (1980), Bernheim (1991) and Chen et al. (2001) found a negative significant relationship between age and life insurance demand, whereas Hammond et al. (1967), Duker (1969), Anderson and Nevin (1975), Burnett and Palmer (1984), Gandolfi and Miners (1996) argued that age was not a significant factor in purchase of life insurance.

Bernheim (1991) used a probit, a Tobit and a Heckman model, respectively to investigate the impact of bequest motives on savings based on the estimates of the demand for life insurance, using the 1975 Longitudinal Retirement History Survey data. The youngest respondent was 64 years old and the oldest respondent was 69 years old in the 1975 survey. The effect of age on life insurance holding was also examined in the models. The results of all three models showed that the probability of life insurance holdings fall with age. Bernheim pointed out that this negative relationship could reflect dissaving behavior after retirement of the respondent. Using the 1984 LIMRA data, Gandolfi and Miners (1996) found that age was negatively associated with the demand for life insurance for husbands, while the age variable was not significant in the model when studying life insurance demand for wives.

2.3.1.2 Education

Most researchers such as Hammond et al. (1967), Ferber and Lee (1980), Burnett and Palmer (1984), Gandolfi and Miners (1996), and Baek and DeVaney (2005), agreed in their research that there is a positive relationship between education and life insurance demand. They recognized that those who have a better education will purchase more life insurance, potentially due to the fact that households with greater education can expect their incomes to continue to increase at a faster rate and for a longer period of time.

Using the 2001 Survey of Consumer Finance data, Baek and DeVaney (2005) examined the effect of human capital, bequest motives, and risk on term and cash value life insurance purchased by households. They explained this positive relationship was due to a greater loss of human capital when the household head dies. Households with a head with greater education have potentially higher incomes. The death of such a household head will bring more financial loss to the family as compared with those with lower education. Hence, the purchase of life insurance for those with greater education increases as the value of the lost human capital increases. Anderson and Nevin (1975), however, found a negative association between education and the amount of life insurance purchased. The authors explained that higher educated people may believe that inflation often decreases the cash value of life insurance from a savings standpoint and hence declines their need for life insurance.

2.3.1.3 Family size or number of children

Family size and number of children were found to be significant explanatory variables for determining the demand for life insurance in many studies (Hammond et al.,

1967; Ferber and Lee, 1980; Burnett and Palmer, 1991; Showers and Shotick, 1994). Burnett and Palmer (1991) employed a dollar amount of total individual life insurance including term, whole life and endowment as a dependent variable. Using Multiple Classification Analysis (MCA), three demographic variables were found to be statistically significant in their association with the amount of life insurance. Number of children was one of positive significant variables. Burnett and Palmer noted that as the number of children increased, the amount of insurance purchased also increased. This is as expected with households with more children having a greater demand for financial resources if the household head dies.

Showers and Shotick (1994) examined the positive relationship between family size and life insurance purchased in their 1994 study. They found that when household size is added by one person, on average, the need for life insurance will have a corresponding increase in insurance premiums of $28.58. In contrast, Anderson and Nevin (1975) obtained the result that there is no significant association between family size and the purchase of life insurance using the data of Consumer Decision Processes 1968-1971.

2.3.1.4 Employment

Previous studies have consistently conclusion that, if household heads or husbands are employed, more life insurance will be purchased by individuals or households. These studies' authors include Hammond et al. (1967), Mantis and Farmer (1968), Duker (1969), Ferber and Lee (1980), and Fitzgerald (1987).

Fitzgerald (1987) developed a one period model of the amount of life insurance purchased by a married couple with data from the Wisconsin Assets and Income Survey (1946-1964). The dependent variable in this study was the face amount of life insurance held by the husband. The results showed that occupation of husband had a positive impact on the amount of life insurance purchased. Gandolfi and Miners (1996) found that the wife's employment status has a negative impact on the husband's life insurance ownership. They argued that full-time labor force participation by the wife reduces the husband's life insurance demand. The analysis of Baek and DeVaney (2005), however, indicated that labor force participation by the wife enhanced the purchase of both cash value and term life insurance of the household.

2.3.1.5 Other demographic factors

Just two research articles have examined the influence of health status or life expectancy on the life insurance purchase. Zhu (2007) studied an individual's choices on the purchase of life insurance and the purchase of stocks using one-period and two-period models. Zhu argued that when an individual decided the purchase of life insurance and stocks, he or she would consider his or her personal circumstances, such as wealth, future income, health status and survival probability, attitudes toward risk and bequest. Zhu found that an increased survivor probability encouraged the individual to hold more life insurance. Similarly, Baek and DeVaney (2005) showed that a household with a healthy head spends more on life insurance expenditures.

Marital status has also been found to strongly affect both household and individual life insurance demand in previous studies (Hammond et al., 1967; Mantis and

Farmer, 1968). Mantis and Farmer (1968) were among the first to examine how marital status influences life insurance demand of households. Multiple linear regression analysis was used on data obtained from the Life Insurance Fact Book (1929-1964). Premium expenditures were used as the dependent variable to see if there was an association with six demographic independent variables. They expected that married men would spend more money on life insurance than single men. But the analysis showed a negative association between marriage and life insurance premium expenditures.

Hammond et al. (1967) also investigated the relationship between life insurance premium expenditures and various demographic characteristics of households. Marital status and race were included among the independent variables. The authors believed that race mirrored some cultural differences, such as attitudes toward death, family, individualism, and risk aversion. These differences may explain some variation in premium expenditures among households. Using the cross-sectional data, they found that marital status was negative and significant and race was not significant in the multiple linear regression analysis where premium expenditure was the dependent variable.

2.3.2 Economic Factors

2.3.2.1 Income

Income is commonly found to be positively related to the demand for life insurance, holding other factors constant. The effect of current income on life insurance demand is examined in numerous studies (Duker 1969; Ferber and Lee, 1980; Truett and Truett, 1990; Showers and Shotick, 1994; Gandolfi and Miners, 1996). Showers and Shotick (1994) used a Tobit analysis to analyze the effect of household characteristics on

the demand for total life insurance with data from the Consumer Expenditure Survey in 1987. The dependent variable used was premium expenditures on life insurance products. They assumed that life insurance was a normal good. The Tobit analysis indicated that a positive relationship existed between income and expenditures on life insurance premiums. They explained that as income increased the household has a motive to buy more life insurance because life insurance is bought as a function of the income replacement needed, in the event of an unexpected death of the major wage earner.

2.3.2.2 Net worth or wealth

There are inconsistent conclusions in previous research regarding how net worth or wealth affects life insurance purchase decisions. Some authors believed there is a positive relationship between net worth or wealth and the demand for life insurance (Duker, 1969; Anderson and Nevin (1975); Hau, 2000) since life insurance might provide protection for households' wealth. Using the data from the Panel on Consumer Decision Processes (1968-1971), Anderson and Nevin investigated the variables associated with the amount and type of life insurance purchased by a sample of young newly-married couples. The data were analyzed through Multiple Classification Analysis (MCA). There were two dependent variables in their study. One was the amount of life insurance purchased which was a continuous dependent variable measured in dollars. The other dependent variable was the type of life insurance purchased which is a dummy dependent variable, with "0" indicating cash value insurance and "1" indicating term insurance. The results of MCA showed that net worth was a positive and significant factor in explaining both the amount of life insurance purchased and the purchase of term life insurance.

Conversely, some studies support the conclusion of negative association between net worth and the purchase of life insurance arguing that the households with higher net worth or wealth have greater capability to hedge against the financial loss that may follow the primary earner's premature death (Fortune, 1973; Lewis, 1989). Lewis viewed household demand for life insurance from the perspective of the beneficiaries. He thought that life insurance was chosen to maximize the beneficiaries' expected lifetime utility. Using the data from LIMRA survey in 1976, Lewis found that net worth of the household was negatively associated with the demand for life insurance, when premiums for life insurance were the dependent variable.

2.3.2.3 The rate of interest and inflation

Several researchers have examined whether consumers are sensitive to market rates of interest when making life insurance purchases. Headen and Lee (1974) indicated that the interest rate has a different effect on the demand of insurance depending on whether it is in a short or a long run situation. In the short run, the demand increases with higher interest rates, whereas in the long run, the interest rate has no obvious influence on the demand for life insurance. In another paper, Pliska and Ye (2007) found that a wage earner buys less life insurance as the interest rate increased. They reasoned this result was due to the wage earner tending to spend less on consumption including buying life insurance and saving more money for the future as interest rates increase. Inflation has also been studied as a factor in the life insurance purchase decision and has been found to not be significant factor in the demand for life insurance (Neumann, 1969; Chang, 1995).

2.3.2.4 Homeownership

It is widely believed that homeownership is positively related to the amount of life insurance held (Anderson & Nevin, 1975; Ferber and Lee, 1980; Gandolfi and Miners, 1996). Gandolfi and Miners estimated the influence of income and the value of household production on the amount of life insurance purchased for both husbands and wives and investigated whether the influence differed by gender. The data in their study was collected by the American Council of Life Insurance (ACLI) and the Life Insurance Marketing and Research Association (LIMRA) in 1984. Husbands and wives were examined separately and total, group, and individual life insurance were used as three separate dependent variables in the Tobit model. They did not separate term policies from cash value policies due to the data limitations. The analysis indicated that home ownership was strongly positive in all the equations for both husbands and wives.

2.3.3 Psychographic Factors

2.3.3.1 Risk aversion

The research on how risk aversion relates to the demand for life insurance is varied. It is expected that the greater a household's risk aversion, the greater their incentive to buy life insurance. This point is supported in the studies of Burnett & Palmer (1984), Baek and DeVaney (2005), and Zhu (2007). In Baek and DeVaney's study, attitude toward risk was measured by the question: "Which of these statements comes closest to the amount of financial risk that you are willing to take when you save or make an investment?" The analysis of Baek and DeVaney showed that above-average risk takers were more likely buy term life insurance than those who preferred taking average

risk. Also, those who take average risk hold 10% more cash value life insurance than those who take no risk. However, Greene (1963) measured the attitude toward risk by twenty questions and used the index for these questions. He found no significant relationship between risk attitude and insurance purchase behavior.

2.3.3.2 Other psychographic factors

Using consumer panel data from a mid-sized southwestern city, Burnett and Palmer (1984) explored 14 psychographic factors, such as work ethic, self esteem, community involvement, fatalism, socialization preference, religious salience, and so on, as influential in determining life insurance demand. They found that life insurance is related with personality traits of individuals. The results showed that if people are self-sufficient and believe that they are in control of their own well being, they will buy more life insurance. Other interesting results include: people who are more likely to own life insurance purchase are individuals who are not opinion leaders, are not price conscious, are not information seekers, and are low in self esteem.

2.3 Summary

Most previous studies have focused on how independent variables influence the amount of life insurance purchased or the face value of total premium expenditures. The relationship of variables to specific life insurance products is limited. Term and cash value life insurance are two major types of life insurance. They have distinctive characteristics. Many studies, however, have considered only one type of life insurance or combined these two types as one entity.

Previous studies do not produce a comprehensive picture of life insurance demand by household in respect to the ownership and the amount owned. Some factors influencing the demand for life insurance have been extensively studied, while some have not; such as health status, bequest motive, interest rates, inflation, other investment and race. Many studies reach conflicting conclusions on how various factors affect the demand for life insurance such as age, education, family size, and employment. Those contradictory conclusions may result from different data sets, variable measurement and methodology used. Thus, the relationships between a comprehensive list of factors and the demand for life insurance still need to be examined further.

Chapter Three

Conceptual Framework

This chapter will present a theoretical background for studying household demand for life insurance. The basic consumption theory, that is, the permanent income hypothesis and the life cycle income hypothesis will be presented first. Then the expected utility theory and several theories regarding the life insurance purchase decision will be described. Testable hypotheses based on this background, are presented in the latter part of this chapter.

3.1 Permanent and life cycle income hypothesis

The permanent income hypothesis was developed by Milton Friedman. The hypothesis states that the consumption patterns of consumers are determined not by current income but by their long-run income expectations (Friedman, 1957). For example, young people at the beginning of their work lives, or before completing their education, expect low incomes. When they obtain education and work experience, their incomes are expected to rise until their income eventually levels out or decreases at their retirement. The theory posits that people make consumption and saving decisions based on their long-run expectations of future flows of income. Although people expect current income to vary during their lifetime, their consumption patterns remain constant as a proportion of their expected permanent income. Therefore, they shift income from high income periods to low income periods in order to keep consumption patterns constant (Bryant,

2006). To accomplish this, they borrow from the future for current consumption in low income periods and save in high income periods to pay off past debts and to provide for future consumption.

According to the permanent income hypothesis, the consumption pattern of consumers is expected to fluctuate over their lifetime, and income is expected to drop substantially during retirement. The consumer needs to both borrow from the future and to save money before retirement to provide for a stable level of consumption. Thus, people have the motivation to buy life insurance to protect dependents against the financial hardship in the event of a premature death. The life insurance benefit that the beneficiaries receive can be a very important financial resource. It can cover daily living expenses, pay the mortgage, or other outstanding debts. Obviously, life insurance can guard against large changes in the household's consumption pattern. Moreover, cash value life insurance has a saving element that allows people to access their cash value by borrowing from the policy or surrendering the policy to provide a continuous income during their retirement years.

In Friedman's permanent income hypothesis model, permanent income is determined by a consumer's assets including both the present value of non-human net-wealth (bonds, stocks, real estate, and other property less debts) and human capital returns in the form of future income as a result of education and experience. The consumer is believed to make an estimate of expected lifetime income based on these assets and to annuitize this present value over their lifetime. This present value of wage earner human capital can be replaced by a lump sum that might be obtained by purchasing life insurance. If the primary wage earner dies prematurely, the insurer pays a

lump sum (the death benefit) representing the present value of the human capital of the primary wage earner to the beneficiaries. Thus, it is reasonable to assume that the human capital of the individual, such as their education and employment status, would influence the demand for life insurance.

Ando and Modigliani (1963) developed the life cycle hypothesis which presents a linkage between consumption and current income and future expected income of the consumer over his or her lifetime. Like the permanent income hypothesis, the life cycle hypothesis is based on the idea that the saving and consumption decisions of the consumer are driven by present and future income. The main prediction of the life cycle hypothesis is that an individual starts with a low income during the early years of one's working life, then income increases until it reaches its highest point before retirement, and income during retirement is substantially lower. To compensate for the lower income and to avoid a sharp drop in utility during retirement, individuals will save some proportion of the income during their working life and dissave during their retirement and their early years as a household.

The life cycle hypothesis states that an individual's income will be low at the beginning and end stages of life and high during the middle years of life. Because term life insurance has relatively low cost, it can be suitable for persons with low incomes and high insurance needs. Therefore, young households with lower income may desire lower cost term life insurance. To the contrary, older households may be less risk averse and want less life insurance because they have already accumulated a certain amount of wealth. Moreover, they have a shorter period of time to need the income prior to their expected end of life.

3.2 Expected Utility Theory

Expected utility theory (EUT) is a theory of decision making under risk, formalized by John von Neumann and Oskar Morgenstern (Varian, 1993). Expected utility theory states, when faced with some type of uncertain choice, consumers make decisions based on two factors - the utility of the outcomes and their respective probability. Expected utility EU is the average utility associated with a decision, calculated by multiplying each of the possible outcomes of the decision x_i by its probability π and then summing the resulting products.

$$EU(X) = \sum_{i=1}^{n} \pi(x_i) u(x_i) \text{ , subject to } \sum_{i=1}^{n} \pi(x_i) = 1 \qquad (3.1)$$

In a simple case, utility is a weighted sum of utility derived from two different consumer goods, $U(c_1)$ with the probability π_1, and $U(c_2)$ with the probability π_2.

$$U(c_1, c_2, \pi_1, \pi_2) = \pi_1 U(c_1) + \pi_2 U(c_2) \qquad (3.2)$$

If c_1 and c_2 are the only two bundles or sets of bundles available for consumption choices, the sum of the two probability values (π_1 and π_2) is equal to 1. This formula is referred to as an expected utility function, or a von Neumann-Morgenstern utility function.

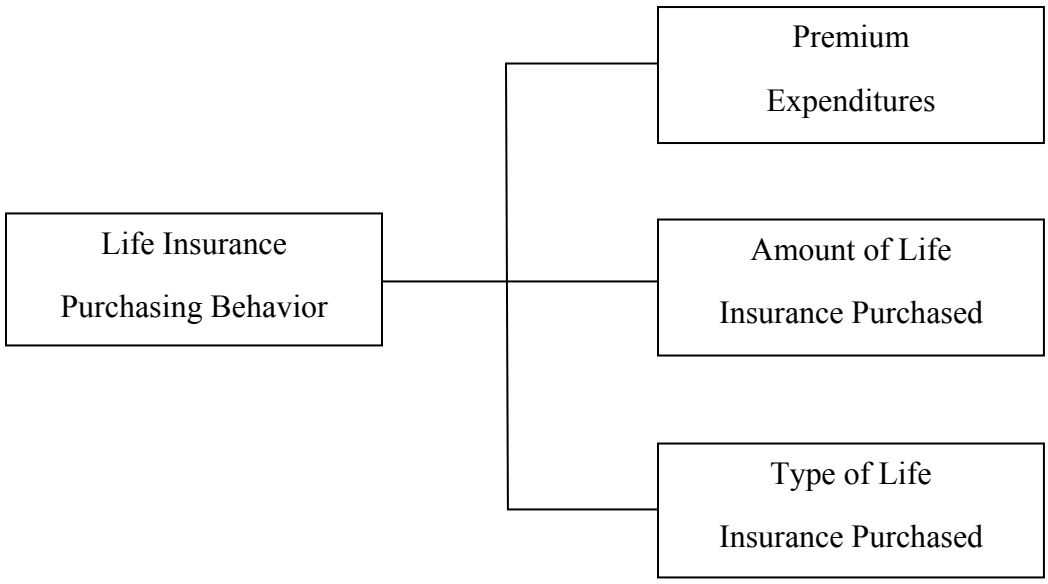
Under EUT, a decision maker chooses actions or strategies that maximize his or her expected utility. However, utilities are also determined by the decision marker's preferences. Individuals have different preferences toward different risk levels. Households with different characteristics may have different acceptable levels of risk, resulting in different decisions on whether to buy life insurance, as well as the amount of

life insurance needed. The more risk-averse a household is, the more it is willing to buy life insurance or buy more life insurance to eliminate the risk of premature death of the primary wage earner in the household.

3.3 Life Insurance Purchasing Decisions

Yarri (1965) stated that an individual increases expected utility by purchasing life insurance. Lewis (1989) noted that life insurance is chosen to maximize the beneficiaries' expected lifetime utility. But before households consider purchasing life insurance to increase their expected utility, they must make decisions on how much and what type of life insurance they need. Anderson and Nevin (1975) stated that life insurance purchasing behavior includes three parts (see figure 3-1). These three parts have been used as three dependent variables in previous studies.

Figure 3.1 Measures of Life Insurance Purchasing Behavior



Cost is one of the important factors in the life insurance purchasing decision. If all other factors are equal, low-cost insurance undoubtedly is preferable. If the other factors are unequal, the purchaser needs to weigh price differences against differences in other factors which are important to him or her. The other factors that determine the cost of life insurance include the existence of a cash value, dividends, and the time value of money (Rejda, 2004). Therefore, useful and adequate cost information is a critical element to intelligent decision-making.

Once one determines to buy life insurance, the next step is to calculate the appropriate amount of life insurance to purchase. The financial needs analysis approach is commonly used to determine how much life insurance a person should carry (Beam, et al., 2003). The financial needs analysis approach considers the various family financial needs, in the event the family head dies. These needs not only include the lump-sum needs of the family at the death of the head such as burial expense, uninsured medical bills, and estate taxes but also include ongoing income needs. For example, the surviving spouse needs income to care for the children, pay their educational fees, and to pay off the mortgage. In addition, because the insured may survive to retirement, a family should consider the need for sufficient retirement income provide by cash value life insurance.

After the needed amount of life insurance has been determined, there is a question about the most suitable type of life insurance for the insured. “The best policy is the one that best meets your financial needs.” Rejda (2004) stated. An individual has a life insurance need if he or she has a spouse, dependent children, a mortgage or has a large estate subject to taxes. The specific financial needs of each individual or household may be long-term tax favored savings, low cost loans, education funding, or

supplemental retirement income. Additionally, the individual's situation will have an effect on the choice of the type of life insurance. Factors such as age, marital status, education, the ability to pay the premium, risk tolerance, and so forth, all play a role in this decision. For instance, some people just have a temporary need for life insurance, or the amount of money they can spend on life insurance premium is limited. As such, term life insurance may be the best life insurance option. If some people believe that their retirement savings are not adequate, or they cannot save money without a mandatory monthly payment, cash value life insurance as a saving vehicle should be considered.

It is not enough to make the purchase decision if the individual does not understand the policy or its provisions. Numerous life insurance policies with particular features are available in the market. For example, cash value life insurance provides accumulation elements, but they are more expensive than term life insurance. The insured should understand the rate of return on different cash value policies may vary enormously and the rate of return may be below his or her expectations if some types of cash value life insurance. Today, life insurance products are more abundant and complicated than in the past. The requirement of knowing the features, benefits and limitations of a product is the prerequisite to purchasing an appropriate type of life insurance for individuals or households.

3.4 Dependent Variables

This study attempts to show how factors affect the demand for each of two types of life insurance, term and cash-value, as well as the amount of life insurance purchased

by households. This study uses a two-stage model (Heckman, 1976). In the first stage, the model examines whether households own term insurance, or not, and also if they own cash value life insurance, or not. Therefore, the dependent variable is a binary variable in the first stage of the model. When the decision of purchasing term life insurance is tested, the dependent variable is measured 1 if yes and 0 if no. Similarly, the decision to own cash value life insurance is defined 1 if a household has purchased cash value life insurance, and 0 if otherwise.

The SCF data provides two variables to estimate life insurance owned by households: the face value of term life insurance and the face value of cash value life insurance. The face value of life insurance, or the amount paid by insurers to the beneficiary when the policyholder dies, reflects how much life insurance households decide to purchase. This value indicates all life insurance on all family members by insurance type[1]. Therefore, the face values of term and cash value life insurance are the dependent variables in the second stage model. However, after testing for the normality of the distribution for the dependent variables, it was found that there is a right skewness in the distribution for the face value of both term and cash value life insurance, representing the nonnormality of the model. To linearize a nonlinear regression relation, the face value of term and cash value life insurance were transformed to their natural logarithm form. A log transformation on the response variable can remedy the unequal error variances and the nonnormality of the error terms which are the proxy of linear regression model analysis. (Wooldridge, 2000).

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[1] Such a limitation of data results in this study cannot examine life insurance owned by husbands and spouses separately.

3.5 Independent Variables and Hypothesis

There are three groups of independent variables which are expected to affect the purchase of life insurance by households. These variables include demographic characteristics (age, education, employment status, health status, number of children, marital status, and race); economic and financial characteristics (income, homeownership, debts, nonfinancial assets, as well as portfolio elements such as liquid assets, certificates of deposit, mutual funds, bonds, stocks, individual retirement accounts, annuities, and other miscellaneous financial assets); and psychographic factors (attitude toward risk, attitude toward leaving a bequest, and one's expected life expectancy).

3.5.1 Demographic factors

3.5.1.1 Age

Some previous studies such as Duker (1969) suggested a curvilinear relationship between the demand for life insurance and age. As age increases, household heads have a greater awareness of the need of life insurance due to increased earning power and a greater number of dependents that result in increased life insurance need to protect against financial loss following the death of household heads. Beyond a certain age, however, the needs of life insurance declines as children grow up and become self-supporting and the household accumulates wealth that can be used to support the level of living of the family. Considering this curvilinear relationship, age and age squared are included in the model.

3.5.1.2 Education

Education, as an index of the stock of human capital within a household, is associated with life insurance demand. Normally, people with higher education, which would implies that they have greater expectations of income growth, have more awareness of the necessity of life insurance purchase. Burnett and Palmer (1984) indicated that higher education is related to greater life insurance demand. Thus, the education level of the household head is hypothesized to be positively associated with life insurance consumption. In this study, education is categorized into four dichotomous variables: less than high school (control group), high school, some college, and college degree or more.

3.5.1.3 Employment

Employment of the household head is often hypothesized to have a positive influence on household life insurance holdings. This hypothesis has been confirmed in previous studies. However, the effect of the wife‘s employment on life insurance ownership is uncertain. With the wife participating in the labor market, the income of the household is enhanced. This may lead to the household having more income available to purchase life insurance. On the other hand, the income of the wife enables her to take care of herself in the event her husband dies prematurely, leading to less need for life insurance.

3.5.1.4 Number of children

As one of the main purposes of life insurance is to protect dependents against financial loss if the primary wage earner dies prematurely, one would expect that the

more children a household, has the more life insurance the household needs. Hence, this study proposes that there is a positive relationship between the number of children and life insurance purchase.

3.5.1.5 Health status, marital status, and race

Health status and marital status are two other important demographic variables that should be included in the model for the demand for life insurance. If the household head has a better health condition, he has a lower likelihood of premature death. The decreased risk of death may reduce the demand for life insurance. In the SCF, health status is classified into four groups: excellent, good, fair, and poor. This study combines the fair and poor health group as the control group, the excellent health group is one categorical (dummy) variable, and the good health group is the other category in the model.

Married households are predicted to have a greater probability to own life insurance and to have a relatively higher amount purchased since there are one or more persons depending on the earnings of married household.

Race is sometimes suggested as a factor in determining consumer life insurance purchasing behavior since race can mirror the culture difference among household and this culture difference may explain the variance of households' decision on life insurance purchase, but no evidence of race predicting life insurance purchasing behavior has been found in previous studies.

3.5.2 Economic factors

3.5.2.1 Income

Previous empirical studies have consistently found that income has a strong positive effect on the demand for life insurance. Intuitively, as income increases, life insurance purchases become more affordable, however and most importantly, as a person's income increases, so does the opportunity cost of that person's death. Thus, to maintain the level of living of one's dependents, the household with higher income would be expected to buy more life insurance.

The income in this study was measured by family income from wages and salaries (earned income). The income of the household was found does not have a normal distribution. To address this problem, a natural logarithm transformation for income is used to linearize the model and to avoid the unequal error variances and nonnormality of the error terms.

3.5.2.2 Debts and homeownership

When the household head has a greater level of debt, it generates a motive to buy more life insurance, since the face value of life insurance can protect the dependents against the burden of debts if the head dies. Similarly, homeownership could reflect the financial burden of a mortgage on the household, providing an incentive to buy more life insurance to repay the balance in the event of death. Therefore, both debts and homeownership are likely to positively influence household life insurance demand and to increase the amount purchased. The debts variable is transformed to log form in the

model. The homeownership variable is coded 1 if the head owns his home and 0 if he does not.

3.5.3 Assets

Previous researchers have demonstrated that life insurance purchasing behavior is determined by a household's asset allocation decisions. Headen and Lee (1974) found limited evidence that investment in stocks and bonds lessen life insurance purchase, while savings account holdings increase the purchase of life insurance. Liquid assets are expected to have a negative effect on life insurance holdings because, if a household has more liquid assets to prevent unexpected financial risk, the household would buy less life insurance. Other investments such as stocks, bonds, mutual funds, retirement accounts, and annuities are expected to enhance life insurance purchases since household heads with more financial experience and knowledge might be more likely to include cash value life insurance as an investment vehicle and demand life insurance to protect their financial assets from estate taxes.

To identify the impact of different types of assets on the different types of life insurance demand, this study follows the categories of assets classified by the SCF. Total financial assets include liquid assets, certificates of deposit, mutual funds, bonds, stocks, annuities, retirement accounts, and other miscellaneous financial assets. Nonfinancial assets include vehicles, residence, net equity in non-residential real estate, businesses and other miscellaneous nonfinancial assets. Liquid assets refer to money market accounts, checking accounts, saving accounts and call accounts. Mutual funds include stock mutual funds, tax-free bond mutual funds, government bond mutual funds, other bond mutual

funds, combination and other mutual funds, but exclude money market mutual funds. Bonds include tax-exempt bonds, mortgage-backed bonds, U.S. government and government agency bonds and bills, corporate and foreign bonds, and U.S. saving bonds. Retirement accounts refer to individual retirement accounts, thrift accounts, and the present value of future pensions. The values of all assets are measured as their log transformations. Since there are many zero values in different types of financial asset, a log transformation cannot be taken directly. A common method to solve this problem is to add a constant to all zero values (Turkey, 1964). Therefor a relatively small value (0.00001) has been added to cases with zero value before computing the logarithm.

3.5.4 Psychographic factors

3.5.4.1 Attitude toward risk

In the SCF, respondents' attitudes toward risk are measured by the question: "Which of these statements comes closest to the amount of financial risk that you are willing to take when you save or make an investment?" The answers include above average, average, and no risk. The household with greater risk aversion is expected to own more life insurance a protection against future financial risk. The average risk group is the control group in the model and the other two groups are measured as categorical variables.

3.5.3.2 Attitude toward leaving a bequest and life expectancy

Attitude toward leaving a bequest is measured from 1 to 5 representing very important to not important in the SCF. If household heads prefer to leave a bequest to their dependents, they have to consider potential estate taxes. Sometimes the tax may be

too large for payment using their existing liquid assets. The heirs may use the death benefits of the insured's life insurance to pay the estate tax bill. Hence, households' positive attitude toward leaving a bequest is expected to be positively associated with the dependent variables. Browne and Kim (1993) did not find a significant relationship between life expectancy and life insurance purchase, although they expected that life expectancy would be negatively associated with life insurance purchase, which is also the assumption in this study.

See Table 3-1 for the coding and definition of dependent and independent variables and Table 3-2 for a summary of hypotheses related to the set of independent variables.

Table 3-1 Measurement of Variable

Variables	Definition	Measurement
Dependent Variables		
First stage model		
TERM1	Ownership of term life insurance	1 if own a term life policy, 0 if otherwise
CASH1	Ownership of cash value life insurance	1 if own a cash value life policy, 0 if otherwise
Second stage model		
TERM2 (log)	Face value of term life insurance	Continuous
CASH2 (log)	Face value of cash value life insurance	Continuous
Independent variables		
Demographic factors		
AGE	Head's age	Continuous
AGESQU	Head's age square	Continuous
EDU1	Less than high school	Reference group
EDU2	High school	1 if yes, 0 if otherwise
EDU3	Some college	1 if yes, 0 if otherwise
EDU4	College degree or more	1 if yes, 0 if otherwise
HJOB	Head's employment status	1 if employed, 0 if otherwise
WJOB	Spouse's employment status	1 if employed, 0 if otherwise
HEAL1	Health status: excellent	1 if yes, 0 if otherwise
HEAL2	Health status: good	1 if yes, 0 if otherwise
HEAL3	Health status: fair and poor	Reference group
KIDS	Number of children	Continuous
MARI	Marital status	1 if married, 0 if otherwise
RACE	White race	1 if whites, 0 if otherwise

Table 3-1Measurement of Variable (continued)

Psychographic factors		
RISK1	Attitude toward risk: above average	1 if take risk above average, 0 if otherwise
RISK2	Attitude toward risk: average	Reference group
RISK3	Attitude toward risk: no risk taking	1 if take no risk, 0 if otherwise
BEQUEST	Attitude toward leaving a bequest	1=very important to 5=not important
LIFE	Life expectancy	Continuous
Economic factors		
INCOME (log)	Household income from wages and salaries	Continuous
DEBT (log)	Debts	Continuous
HOME	Homeownership	1 if owner, 0 if otherwise
Assets (log)		
LIQ	Liquid assets	Continuous
CDS	Certificates of deposit (CDs)	Continuous
MUTUAL	Mutual funds	Continuous
BOND	Bonds	Continuous
STOCK	Stocks	Continuous
RETIRE	Retirement accounts	Continuous
ANNU	Annuities	Continuous
OTHFIN	Other miscellaneous financial assets	Continuous
NFIN	Total nonfinancial assets	Continuous

Table 3-2 Summary of Independent Variable Hypotheses

Independent Variables	Term life insurance		Cash value life insurance	
	Ownership	Amount	Ownership	Amount
Demographic factors				
Age	+	+	+	+
Age square	-	-	-	-
Education				
High school	+	+	+	+
Some college	+	+	+	+
College degree or more	+	+	+	+
(Less than high school)				
Head's employment status				
Employed (Unemployed)	+	+	+	+
Spouse's employment status				
Employed (Unemployed)	+/-	+/-	+/-	+/-
Health status				
Excellent or good	-	-	-	-
Fair	-	-	-	-
(Poor)				
Number of children	+	+	+	+
Marital status				
Married (Non-married)	+	+	+	+
Race				
White (Non-white)	+/-	+/-	+/-	+/-
Economic factors				
Income	+	+	+	+
Debts	+	+	+	+
Home ownership				
Owner (Renter)	+	+	+	+
Assets factors				
Liquid assets	-	-	-	-
Certificates of deposit	+	+	+	+
Mutual funds	+	+	+	+
Bonds	+	+	+	+
Stocks	+	+	+	+
Retirement accounts	+	+	+	+
Annuities	+	+	+	+
Other misc. nonfinancial assets	+	+	+	+
Nonfinancial assets	+	+	+	+
Psychographic factors				
Attitude toward risk				
Above average	+	+	+	+
No risk taking	-	-	-	-
(Average)				
Attitude toward leaving bequest	-	-	-	-
Life expectancy	+	+	+	+

Note: Variables with "+" have positive effect on life insurance purchase; "-" means negative effect; "+/-" the relationship is uncertain.

Chapter Four

Methodology

4.1 Data Source

The data used in this study are from the 2004 Survey of Consumer Finances (SCF). The SCF, sponsored by the Board of Governors of the Federal Reserve System, has been conducted every three years since 1983. The SCF provides detailed information on U.S. household finances, including various types of assets and debts, as well as demographic information. The survey also collects information on the face value of the household's term and cash value life insurance, the focus in this research.

In 2004, 4,522 families were interviewed. The SCF uses weights to combine information from the two samples to mirror the characteristics of the full population. One is geographically random selected sample. The other oversampled high income families. Hence, the 2004 survey represents 112.1 million families (Bucks, Kennickell and Moore, 2006). Missing data is common in the SCF data because of respondents' unwillingness to provide information and/or mistakes in data processing. The missing data may lead to statistical problems, reducing the reliability of conclusions that may be derived from the data. Analyses conducted by researchers using incomplete data are less efficient and biased.

The multiple imputation technique provides a useful and efficient strategy for dealing with data sets with missing values. The multiple imputation method replaces each

missing value with a set of plausible values (Rubin, 1987). It provides information that can be used to estimate extra variability resulting from missing values. This method produces statistically valid inferences that properly reflect the uncertainty due to missing values.

Starting with the 1989 survey, the SCF has imputed missing values using the multiple imputation method with a goal of providing data that are the best possible estimate of the missing data. The missing data are replaced with five values which results in five different complete data sets. The SCF refers to these five data sets as implicates. For example, the 2004 SCF data has 4,522 respondents, but with the five imputations it contains 22,610 observations. The SCF suggests using all five implicates when calculating simple statistics and regression estimates because the true variance would be underestimated and the result could be biased when doing an analysis with just one implicate (Kennickell and McManus, 1994).

However, empirical researchers face a question of how to generate the best point estimates and variance of parameters from all five implicates. In general, this is achieved by combining estimates of parameters and covariance matrices from five complete data sets, referred to as the "repeated-imputation inference" (RII) (Rubin 1987). The RII method integrates the variability of the data that is due to missing data into the estimate of the standard error of the mean. The use of RII results in estimated variances that are closer to the true variances than those obtained by using just one implicate.

Montalto and Sung (1996) demonstrated that significance tests of ordinary least squares (OLS) regression coefficients might yield different results when using just one implicate instead of the suggested RII method. In the examples of Montalto and Sung, the

coefficients of some variables were significant in some implicates; however, they were not significant in the result using the RII method. Inferences based on the results from a single implicate ignore the extra variability due to missing values, leading to overestimation of the significance of the parameters. Therefore, the RII method can produce more accurate estimates and more valid inferences than using separate implicates. The RII is not only applicable to linear regressions but also to nonlinear regressions, including logit, probit and Tobit models (Montalto and Yuh, 1998). Following Montalto and Sung (1996), this study uses the RII technique to analyze data from the 2004 SCF. The details of the procedure are given in Appendix A.

The SCF employs a complex sample design in which two sampling units have different probabilities of being selected. Sampling weights must generally be used to derive unbiased estimates of simple statistics; however, the decision about their use in regression analysis is more complicated for a complex sample design. When sampling weights are a function of independent variables included in the model, unweighted OLS estimates are preferred because they are unbiased, consistent, and have smaller standard errors than weighted OLS estimates (Winship and Radbill, 1994). This point is supported by Montalto and Sung (1996) when they used the 1992 SCF data. The regressions were unweighted in their study, as they believed that when weighted regression is used, inference would be inefficient in the complex sample design. Hence, the multivariate regressions in this study are also not weighted to obtain valid results. The weighted descriptive statistics for continuous variables are presented in Table 4-1. All dollars in this study are adjusted to 2004 dollars using the consumer price index.

Table 4-1 Weighted Descriptive Statistics for Continuous Variables

Variables	Mean	Median	Minimum	Maximum
TERM2	$128915.61	$3700	$0	$150,000,000
CASH2	$40914.55	$0	$0	$100,000,000
AGE	59.56	48	18	95
KIDS	0.81	0	0	8
INCOME	$70656.77	$43128.78	$0	$1.051E+08
ASSET	$527093.6	$167001	$0	$7.447E+08
DEBT	$79083.13	$22480	$0	$4.31E+07
LIFE	82.34	80	40	100
LIQ	$24816.51	$3000	$0	$4.70E+07
CDS	$6961	$0	$0	$1.6E+07
MUTUAL	$27557.56	$0	$0	$7.50E+07
BOND	$9939.83	$0	$0	$4.050E+08
STOCK	$33012.57	$0	$0	$2.0E+08
RETIRE	$60264.16	$0	$0	$3.85E+07
ANNU	$15017.47	$0	$0	$2.0E+08

4.2 Design of Analysis

Many previous researchers have used ordinary least squares regression (OLS) or Tobit regression models to study the determinants of the amount of life insurance purchase. Using OLS regression produces biased parameter estimates when the dependent variables contain a great number of zeros. Tobit analysis can provide valid estimates when the dependent variable is censored. However, the Tobit model has a notable limitation. In the Tobit model the same set of variables and the same coefficients determine both the probability that an observation will be censored and the value of the dependent variable. That is, the Tobit model does not allow for the differences between the decision of whether to purchase life insurance and the decision about the amount of purchase. Thus, the Heckman selection model with two steps, developed by James Heckman in 1976, is appropriate to examine the demand for life insurance in this study.

In the first step, a probit regression is computed in order to estimate the probability that a given household purchases either term or cash value life insurance. The estimated parameters are used to calculate the inverse Mills' ratio, which is then included as an additional explanatory variable in the OLS estimation. In the second stage, the amount of life insurance purchase is estimated.

Heckman's sample selection model is based on the following two models:

Selection model: $Y_1 = \beta' X + U_1$ (4.1)

Outcome model: $Y_2 = \gamma' Z + U_2$ (4.2)

Where X and Z are a k-vector of independent variables, and the error terms U_1 and U_2 are jointly normally distributed, independently of X and Z. The second model is the model we are interested in. However, the latent variable Y_2 is only observed if $Y_1 > 0$. Thus, the actual dependent variable is: $Y = Y_2$ if $Y_1 > 0$, Y is a missing value if $Y_1 \leq 0$.

In this study, the selection equation (4.2) and the outcome equation (4.4) are given as follows (the definition of each variable is showed in Table 3-1 in the chapter three):

Selection model:

$$\begin{aligned} Y_1 &= \beta' X + \mu_1 = \beta_0 + \beta_1 AGE + \beta_2 AGESQU + \beta_3 EDU2 + \beta_4 EDU3 \\ &+ \beta_5 EDU4 + \beta_6 HJOB + \beta_7 WJOB + \beta_8 HEAL1 + \beta_9 HEAL2 + \beta_{10} KIDS \\ &+ \beta_{11} MARI + \beta_{12} RACE + \beta_{13} \log(INCOME) + \beta_{14} \log(DEBT) \\ &+ \beta_{15} HOME + \beta_{16} RISK1 + \beta_{17} RISK3 + \beta_{18} BEQUEST + \beta_{19} LIFE \\ &+ \beta_{20} \log(LIQ) + \beta_{21} \log(CDS) + \beta_{22} \log(MUTUAL) + \beta_{23} \log(BOND) \\ &+ \beta_{24} \log(STOCK) + \beta_{25} \log(RETIRE) + \beta_{26} \log(ANNU) \\ &+ \beta_{27} \log(OTHFIN) + \beta_{28} \log(NFIN) + \mu_1 \end{aligned} \tag{4.3}$$

Outcome model:

$$\begin{aligned} Y_2 &= \gamma' Z + \mu_2 = \gamma_0 + \gamma_1 AGE + \gamma_2 AGESQU + \gamma_3 EDU2 + \gamma_4 EDU3 \\ &+ \gamma_5 EDU4 + \gamma_6 HJOB + \gamma_7 WJOB + \gamma_8 HEAL1 + \gamma_9 HEAL2 + \gamma_{10} KIDS \\ &+ \gamma_{11} MARI + \gamma_{12} RACE + \gamma_{13} \log(INCOME) + \gamma_{14} \log(DEBT) \\ &+ \gamma_{15} HOME + \gamma_{16} RISK1 + \gamma_{17} RISK3 + \gamma_{18} BEQUEST + \gamma_{19} LIFE \\ &+ \gamma_{20} \log(LIQ) + \gamma_{21} \log(CDS) + \gamma_{22} \log(MUTUAL) + \gamma_{23} \log(BOND) \\ &+ \gamma_{24} \log(STOCK) + \gamma_{25} \log(RETIRE) + \gamma_{26} \log(ANNU) \\ &+ \gamma_{27} \log(OTHFIN) + \gamma_{28} \log(NFIN) + \mu_2 \end{aligned} \tag{4.4}$$

Where Y_1 is equal to 1, if a household purchases term or cash value life insurance, and zero if it does not. Y_2, the log amount of term or cash value life insurance the household purchased, is observable only if Y_1 is equal 1. In order to avoid the sample selection bias, maximum likelihood is used to estimate the model.

Chapter Five

Empirical Result

5.1 Characteristics of Life Insurance Holders

To outline the characteristics of holders who owned some type of life insurance, this study divided the sample into four groups in this study. The groups include term life insurance holders, cash value life insurance holders, both types of life insurance holders, and households with no life insurance. In 2004, 40% of households surveyed by the SCF owned term life insurance, 14% owned cash value life insurance, 11% held both types of life insurance and 35% of households had no life insurance policies in force. The four groups differed by age, education, head and spouse's employment status, health status, number of children, marital status, race, risk tolerance, life expectancy, homeownership, and income. The profiles of the four groups are shown in Table 5-1.

The result for age showed that household heads between 35 and 54 were about 50% of those that only owned term life insurance, while those aged 65 or older were the least likely to only own term life insurance (14.32%). The group aged 65 or older accounted for the largest proportion (38.37%) that was holding only cash value life insurance, while those under 35 represented the lowest proportion (10.84%). More than one-fourth of households with both types of life insurance were those whose head of household was aged between 45 and 54, and 31.24% of those without any life insurance were younger than 35, followed by those aged 65 or older (23.04%).

Table 5-1 Characteristics of Life Insurance Holders (weighted)

Variables	Term	Cash Value	Both	None	P-value of Chi-square
	40%	14%	11%	35%	
Age					<0.0001
<35	21.58%	10.84%	10.89%	**31.24**%	
35-44	**25.33**%	14.28%	20.90%	17.7%	
45-54	24.26%	17.95%	**27.56**%	15.64%	
55-64	14.51%	18.56%	22.34%	12.38%	
>=65	14.32%	**38.37**%	18.31%	23.04%	
Education					<0.0001
< high school	8.76%	12.64%	3.76%	25.22%	
High School	30.79%	30.90%	26.10%	**31.74**%	
Some College	19.22%	17.99%	17.55%	17.81%	
>=College degree	**41.24%**	**38.47%**	**52.59**%	25.24%	
Head's employment status					<0.0001
Employed	81.82%	60.45%	79.76%	62.55%	
Spouse's employment status					<0.0001
Employed	43.93%	28.24%	55.24%	21.71%	
Health status					<0.0001
Excellent and good	80.82%	72.14%	85.8%	65.68%	
Fair	14.09%	18.34%	10.79%	24.94%	
Poor	5.09%	9.52%	3.42%	9.37%	
Kids					<0.0001
Have children	48.86%	32.89%	52.56%	39.44%	
Marital status					<0.0001
Married	65.38%	55.3%	77.54%	44.06%	
Race					<0.0001
Whites	73.77%	75.71%	84.86%	64.82%	
Risk					<0.0001
Above average	20.88%	17.97%	31.78%	13.76%	
Average	**45.54%**	40.78%	**47.01**%	26.49%	
No risk taking	33.58%	**41.25%**	21.21%	**59.75**%	
Homeownership					<0.0001
Owner	75.67%	82.17%	89.25%	49.43%	
Life expectancy					<0.0001
<65	7.78%	4.61%	4.91%	11.69%	
65-79	**44.77%**	36.83%	**45.06%**	**40.88%**	
80-89	31.27%	**41.25**%	33.67%	27.88%	
>90	16.18%	17.32%	16.35%	19.55%	
Income percentile groups					<0.0001
0-20	9.99%	17.10%	4.51%	**37.79%**	
20-39.9	16.19%	20.72%	9.47%	27.57%	
40-59.9	23.02%	**21.43%**	19.29%	16.18%	
60-79.9	**24.13%**	20.01%	**31.11%**	11.58%	
80-100	26.67%	20.75%	35.62%	6.87%	

The results for education showed that the greater the education level of the household head, the more likely the household held some type of life insurance. For example, 41.24% of households that held only term insurance, 38.47% of households that held only cash value life insurance and 52.59% of households that owned both types of life insurance had a college degree or advanced education. All these proportions are higher than the proportion of households that had lower education level.

Of those with only term life insurance, 81.82% of household heads were employed, while of those with only cash life insurance, 60.45% of household heads were employed. This, perhaps, mirrors the fact that many employees receive term insurance as a form of the employee benefits. About 55% of households that owned both types of life insurance had an employed spouse and 21.71% of households with no life insurance had an employed spouse.

Households with a healthy head were more likely to hold life insurance. The proportion of households with a healthy head accounted for 80.82%, 72.14%, and 85.8% of the group that owned only term, only cash, and both types of life insurance, respectively. More than one-third of the heads of households that had not any life insurance reported their health status as fair or poor.

Households that had a child showed the highest percentage of owning both types of life insurance. The result for marital status indicated that 77.54% of households that held only term, 65.38% of those that owned only term, and 55.3% of those that had only cash value life insurance are married households.

In terms of risk tolerance, those who held life insurance had an average risk tolerance while about 60% of households with no insurance would not take any financial risk. When considering life expectancy, the highest proportion of heads that owned only term or both types of life insurance were those that expected they might live to an age between 65 and 80. In contrast, among those with cash value life insurance, the percentage of households whose head predicted they would live to between 80 and 90 years was the highest.

An examination of the relationship between income and insurance ownership showed that the largest proportion of only term life insurance holders were in the 60-79.9 percentile groups. The largest proportion of cash value life insurance holders were in the 40-59.9 percentile income groups. About 40% of households without life insurance fell into the lowest income group.

In the following sections, the regression results for both term and cash value life insurance are presented and interpreted separately and in that order. In the Heckman selection model, the probability of purchasing either term or cash value life insurance is first regressed. Then the amount of life insurance of each type is estimated based on the probability of holding the focus type of life insurance for only those with a positive value, while controlling for selection bias. These two-stage models produced five different estimates based on five implicates, respectively. Finally, the RII technique (See the Appendix A) is employed to derive the final result by combining the five regression results.

5.2 The Regression Results for Term Life Insurance

5.2.1 The ownership model: term insurance

The factors that influence the ownership of term life insurance are age, education, head's health status, head's and spouse's employment status, marital status, risk tolerance, home ownership, income, debts, liquid assets, stocks, and retirement accounts (see Table 5-2).

The results showed that the age of the household head had a significant effect on term life insurance holdings. The significance of the age squared term indicated that there is curvilinear relationship between the age of household head and the probability of purchasing term life insurance. That is, the probability of purchasing term life insurance rises as the age of the household head increases till it reaches a maximum value and then it decreases as age increases. The maximum age at which the likelihood of purchasing life insurance begins to decline is 56.7. Typically, as the age of the head increases, there may be the dependents that need the head to support. Thus, the household is likely to raise the demand for term life insurance to avoid the risk. However, as the household head reaches midlife (age 56.7), usually more wealth has been accumulated and dependents have become self-supporting, so the demand for term life insurance is likely to decrease in later years. The finding is consistent with those of DeVaney and Baek (2005).

The coefficients for household heads with a high school degree or above indicated a significantly effect on term life insurance ownership, as compared with household heads with less than high school education. This expected result supported the hypothesis

Table 5-2 Regression Results for Term Life Insurance

Variables	Decision to Own Insurance			Amounts of Insurance		
	Coefficient	Standard Error		Coefficient	Standard Error	
Intercept	-1.527	0.285	***	7.552	0.619	***
Demographic factors						
Age	0.034	0.008	***	0.097	0.015	***
Age^2	-0.0003	0.00008	***	-0.001	0.0001	***
Education						
High school	0.273	0.078	***	-0.024	0.150	
Some college	0.255	0.086	**	0.132	0.156	
College degree or more	0.273	0.083	**	0.607	0.152	***
(Less than high school)						
Head's employment status						
Employed (Unemployed)	0.109	0.063	*	0.616	0.114	***
Spouse's employment status						
Employed (Unemployed)	0.123	0.052	*	-0.316	0.078	***
Health status						
Excellent	-0.088	0.101		0.078	0.177	
Good	-0.238	0.107	*	-0.224	0.189	
(Fair and Poor)						
Number of children	0.036	0.019		0.142	0.029	***
Marital status						
Married (Non-married)	0.117	0.055	*	0.811	0.092	***
Race						
White (Non-white)	0.006	0.053		-0.106	0.085	
Economic factors						
Income	0.008	0.003	**	-0.00004	0.005	
Debts	0.017	0.002	***	0.010	0.005	*
Home ownership						
Owner (Renter)	0.199	0.063	**	-0.119	0.105	
Assets factors						
Liquid assets	0.018	0.005	***	0.062	0.010	*
Certificates of deposit	-0.002	0.003		0.002	0.004	
Mutual funds	-0.004	0.002		0.010	0.003	*
Bonds	0.002	0.002		0.008	0.004	*
Stocks	0.008	0.002	**	0.012	0.003	***
Retirement accounts	0.014	0.002	***	0.011	0.004	**
Annuities	-0.004	0.003		0.008	0.004	
Other misc. financial assets	-0.002	0.003		0.016	0.004	***
Nonfinancial assets	-0.009	0.005		0.060	0.009	***
Psychographic factors						
Attitude toward risk						
Above average	-0.045	0.051		0.214	0.071	**
No risk taking	-0.183	0.053	***	-0.221	0.085	**
(Average)						
Attitude toward leaving bequest	0.009	0.013		-0.074	0.020	***
Life expectancy	0.0004	0.002		0.004	0.003	
F value 36.996 ***						

Note: Reference groups are in parentheses.

**** Significant at 0.001 level; ** Significant at 0.01 level; * Significant at 0.05 level.*

that the higher the education level of the household head, the greater the household's expectation of future earnings and gains, indicating a growing need for insurance and the more likely the household is to buy life insurance. The explanation may be that the higher-educated household head needs more income replacement, such as term life insurance, for his potential earnings are greater as a result of human capital investments. Consider that, when the head dies, the present value of loss to the household will be higher than that of a lesser-educated head. Households with a head who was employed were found to be more likely to hold term life insurance than those with an unemployed head. An employed spouse also increased the likelihood of having term life insurance, which is contrary to the hypothesis. However, this may be explained by Gandolfi and Miners (1996). They argued that as the spouse joined the labor market, his or her ownership of life insurance increased the household's life insurance holdings since employers often provide group term life insurance for each employee.

Married households were also more likely to purchase term life insurance than non-married households. Because there are one or more dependents in married households, they have the motivation to purchase life insurance to avoid the financial risk to the dependents, if the head were to prematurely die. Household heads with good health status had a negative relationship with the demand of term life insurance, as compared with those with a poor health status. This result is consistent with the hypothesis that lower risk of premature death decreases the demand for life insurance. Home owners were more likely to buy term life insurance than renters. The reason might be that the ownership of a home is often accompanied by home mortgage debt which increases the need for term life insurance over the length of the life of the mortgage. The result was

consistent with that of previous researchers such as Anderson & Nevin (1975), Ferber and Lee (1980), and Gandolfi and Miners (1996).

It is not surprising to find that as income increased, the probability of purchasing term life insurance also increased. With greater earned income, the greater loss the household experiences if the head dies. Therefore, an increase in income encourages the household to purchase additional life insurance to offset the potential loss. The coefficient results indicated that increased household debts increased the probability of purchasing term life insurance. The need for term life insurance due to increased debts is not surprising because term life insurance can provide temporary protection such as paying off the debts should death occur during the life of the loan.

Households with greater risk aversion were more likely to hold term life insurance. This unexpected result may result from the measurement of risk aversion which is measured by the question regarding their attitude toward risk when households save or invest in the SCF. This measurement of risk in the SCF may not reflect the real risk aversion of households correctly.

We found that liquid assets, stocks and retirement accounts had a positive effect on the probability of buying term life insurance. The positive effect of liquid assets is contrary to the hypothesis in which liquid assets were anticipated to decline the demand for life insurance since they can be viewed as emergency funds to hedge against the unexpected financial risks. The reason might be liquid assets provide funds that can be spent on purchasing term life insurance, or they indicate financial behaviors consistent with sound personal financial management.

5.2.2 The amount of insurance model: term insurance

The results of the outcome model showed that there were differences between the factors that predicted the probability of purchasing term life insurance and the amount purchased. For example, number of children, attitudes toward leaving bequest, and mutual funds were not influential upon the probability of term life insurance purchased, but they were significant in predicting the amount of term life insurance purchased. Also, health status, homeownership, income and retirement accounts showed significant effects in the ownership regression model but they were not significant in the amount regression model. Other factors in predicting the amount of term life insurance purchased had the same significant or non-significant results with factors in predicting the probability of purchases.

Age also had a curvilinear relationship in the model for amount of life insurance since the need of protection against dependents' financial risk changes as age increased. The maximum age from which the amount of term life insurance held by households began to decrease at 48.5 years. Likely reason for this result is the fact that the length of time where income replacement is required is measurably shorter as one age. Those with college degrees or advanced degrees had more term insurance than those with less than a high school education. This result supports the hypothesis that better educated household heads would be more likely to purchase more term life insurance than those with lower education level due to rising income growth expectations. The number of children increased the need for term life insurance in households, as expected. It is clear that when the number of dependents increases, while holding over other factors constant, the need for life insurance also increases to avoid financial hardship befalling the dependents if the

head dies is greater. This effect was consistent with previous studies (Ferber and Lee, 1980; Bernheim, 1991; Showers and Shotick, 1994).

Unlike the term life insurance ownership model, in which having an employed spouse increased the likelihood of having term life insurance, having an employed spouse decreased the amount of term life insurance purchased. One possible explanation would be that the salary of the employed spouse enhanced the expected earned income of the household by decreasing the possibility of negative transitory income of the household, decreasing the financial risk of the premature death of the head. Thus, the household with an employed spouse was found, on average, to purchase less term life insurance. Like the effect in the ownership model, debts variable was positive and significant in the amount of term life insurance model. Households increased the amount of term life insurance because the additional term life insurance alleviates the burden of debts to the dependents if the household head dies.

If households had a positive attitude toward leaving a bequest, they bought more term life insurance. This finding is consistent with the result of Bernheim's study (1991) in which he found that a bequest motive can help drive an individual's life insurance decision. Above-average risk-takers had a positive and significant effect while below-average risk-takers had a negative and significant effect on the amount of term life insurance that households owned as compared with average risk takers. This result is contrast with the hypothesis. The possible reason may be result from the measurement of risk aversion of households, like the explanation of the result in the ownership model of term life insurance. Most assets categories were positively associated with the amount of term life insurance purchased by households expect for mutual funds and annuities,

suggesting that more life insurance was needed by household to protect their wealth or, alternatively, as a proxy for the financial acumen of the respondents.

In summary, the results of Heckman two-stage selection models for the purchase of term life insurance support the hypotheses that demographic factors (age, education, employment status of heads and spouses, and marital status), economic factors (debts), psychographic factors (attitude toward risk), and other financial assets (liquid assets, retirement accounts and stocks) would significantly influence the household's term life insurance purchase behavior.

5.3 The Regression Results for Cash Value Life Insurance

5.3.1 The ownership model: cash value life insurance

The probability of owning cash value life insurance was found to be significantly influenced by the following variables: age, education, marital status, debts, home ownership, risk tolerance, attitude toward leaving a bequest, and owning liquid assets, CDs, mutual funds, bonds, retirement accounts, and annuities (see Table 5-3). The summary of the regression results of term and cash value life insurance is showed in Table 5-4.

Unlike the age square term in the ownership model of term life insurance, the age square in the selection model of cash value life insurance was not significant, indicating a linear relationship exists between age and the probability of cash value life insurance ownership. Perhaps it is the case that the premiums of term life insurance become unaffordable for the household head in the later years or the whole-life return of cash

value policies encourages continuous coverage. Cash value life insurance with level premiums might be chosen to be continued to be held, as the age of the household head increased in the later years.

As seen in Table 5-3, some independent variables demonstrated the same effect on the demand of cash value life insurance as on term life insurance. Household heads with high school or advanced education level more likely buy cash value life insurance than those with less than a high school degree because more potential future income encouraged these households increased the need for cash value life insurance to avoid the future financial risk. A home owner had a significantly positive probability of carrying cash value life insurance than a renter. Married heads and heads that desire to leave a bequest preferred buying cash value life insurance to protect against potential risk. Debts had a positive effect on the likelihood of holding cash value life insurance. Like the effect of risk tolerance on term life insurance selection model, households unwilling to take financial risks were less likely to have cash value life insurance, when compared to those with average risk tolerance.

Employment status of heads and spouses, health status, and income, were not influential in the ownership model of cash value life insurance, whereas they were significant in the ownership model of term insurance. In addition, more financial assets such as CDs, mutual funds, bond, and annuities had a positive effect on the possibility of purchasing cash value life insurance, but they were not significant factors in the term insurance ownership model. The reason for this result might be that households that owned these investments were more likely to consider cash value life insurance as an alternative investment vehicle.

Table 5-3 Regression Results for Cash Value Life Insurance

Variables	Decision to Own Insurance			Amounts of Insurance		
	Coefficient	Standard Error		Coefficient	Standard Error	
Intercept	-2.060	0.319	***	4.707	0.947	***
Demographic factors						
Age	0.032	0.009	***	0.128	0.025	***
Age^2	-0.0001	0.0001		-0.0011	0.0002	***
Education						
High school	0.241	0.090	**	0.301	0.248	
Some college	0.274	0.098	**	0.534	0.266	*
College degree or more	0.183	0.093	*	0.716	0.253	**
(Less than high school)						
Head's employment status						
Employed (Unemployed)	0.070	0.067		0.157	0.158	
Spouse's employment status						
Employed (Unemployed)	-0.039	0.054		-0.356	0.123	**
Health status						
Excellent	-0.201	0.108		-0.604	0.293	*
Good	-0.188	0.114		-0.554	0.296	
(Fair and Poor)						
Number of children	0.016	0.021		0.145	0.052	**
Marital status						
Married (Non-married)	0.126	0.059	*	0.882	0.153	***
Race						
White (Non-white)	-0.059	0.058		-0.234	0.152	
Economic factors						
Income	0.005	0.003		0.024	0.007	***
Debts	0.006	0.002	*	0.002	0.006	
Home ownership						
Owner (Renter)	0.242	0.072	***	-0.028	0.221	
Assets factors						
Liquid assets	0.012	0.006	*	0.062	0.017	***
Certificates of deposit	0.008	0.003	**	-0.002	0.006	
Mutual funds	0.006	0.002	*	0.010	0.005	*
Bonds	0.006	0.002	*	0.016	0.005	**
Stocks	0.002	0.002		0.017	0.005	***
Retirement accounts	0.007	0.002	**	0.016	0.006	**
Annuities	0.009	0.003	**	0.027	0.006	***
Other misc. financial assets	0.004	0.003		0.021	0.006	***
Nonfinancial assets	0.005	0.006		0.116	0.018	***
Psychographic factors						
Attitude toward risk						
Above average	0.075	0.052		0.275	0.120	*
No risk taking	-0.162	0.058	**	-0.365	0.148	*
(Average)						
Attitude toward leaving bequest	-0.032	0.014	*	-0.175	0.033	***
Life expectancy	0.002	0.002		0.003	0.005	
F value 22.016 ***						

Note: Reference groups are in parentheses.

**** Significant at 0.001 level; ** Significant at 0.01 level; * Significant at 0.05 level.*

5.3.2 The amount of insurance model: cash value life insurance

Factors that predicted the amount of cash value life insurance holdings included: age, head's education, spouse's employment status, number of children, marital status, income, homeownership, attitude towards risk, attitude toward leaving a bequest, liquid assets, mutual funds, stocks, retirement accounts, annuities, bonds, other miscellaneous financial assets, and nonfinancial assets.

Like term life insurance, the amount of cash value life insurance initially increased with the household's age and then it declined at greater age of the head of household. The age where cash value insurance coverage peaked was found to be 58.2 years. More cash value life insurance was purchased by households when married and with more educated household heads, and greater number of children because the greater financial loss might occur if heads of households unexpected die. When households had a positive attitude toward a bequest, the amount of cash value life insurance rose since the proceeds of cash life insurance can help pay the estate taxes, leaving more for the beneficiaries. Income positively affects a household's amount of cash value life insurance holdings due to greater financial loss if the head dies unexpectedly. Among assets categories, only CDs were not found to be significantly related to the amount of cash value life insurance carried by households. All other assets categories were significant factors in amount of cash value life insurance held indicating households with more investments may have more investment knowledge and experience, and then were more likely to increase the amount of cash value life insurance as one element of diversified portfolios.

As seen in Table 5-4, fewer variables had a significant influence on the demand for cash value life insurance as compared with for term life insurance. For example, the head and the spouse's employment status, and the head's health status did not influence the purchase of cash value life insurance, but did affect that of term life insurance. The possible explanation could be that because cash value life insurance has a saving element, households view it not only as a protection against financial loss due to the household head's unexpected death but also as an investment vehicle, reducing the factors that influenced the purchase decision of households.

In summary, demographic factors (age, education and marital status), assets factors (liquid assets, mutual funds, retirement accounts, bonds and annuities), and psychographic factors (attitude toward leaving a bequest and attitude toward risk) significantly affect both the probability of owning cash value life insurance and the amount of cash value life insurance purchased.

Table 5-4 Summary of Heckman Selection models Results

Variables	Term Life		Cash Value Life	
	Ownership	The amount	Ownership	The amount
Intercept	- ***	+ ***	- ***	+ ***
Demographic factors				
Age	+ ***	+ ***	+ ***	+ ***
Age^2	- ***	- ***		- ***
Education				
High school	+ ***		+ **	
Some college	+ **		+ **	+ *
College degree or more	+ **	+ ***	+ *	+ **
(Less than high school)				
Head's employment status				
Employed (Unemployed)	+ *	+ ***		
Spouse's employment status				
Employed (Unemployed)	+ *	- ***		- **
Health status				
Excellent				- *
Good	- *			
(Fair and Poor)				
Number of children		+ ***		+ **
Marital status				
Married (Non-married)	+ *	+ ***	+ *	+ ***
Race				
White (Non-white)				
Economic factors				
Income	+ **			+ ***
Debts	+ ***	+ *	+ *	
Home ownership				
Owner (Renter)	+ **		+ ***	
Assets factors				
Liquid assets	+ ***		+ *	+ ***
Certificates of deposit			+ **	
Mutual funds		+ *	+ *	+ *
Bonds		+ *	+ *	+ **
Stocks	+ **	+ ***		+ ***
Retirement accounts	+ ***	+ **	+ **	+ **
Annuities			+ **	+ ***
Other misc. financial assets		+ ***		+ ***
Nonfinancial assets		+ ***		+ ***
Psychographic factors				
Attitude toward risk				
Above average		+ **		+ *
No risk taking	- ***	- **	- **	- *
(Average)				
Attitude toward leaving bequest		- ***	- *	- ***
Life expectancy				

Note: Reference groups are in parentheses. + Positive relationship; - Negative relationship.

**** Significant at 0.001 level; ** Significant at 0.01 level; * Significant at 0.05 level.*

Chapter Six

Conclusions

6.1 Summary and Conclusions

This study answered four research questions: (1) What are the demographic, economic, and psychographic characteristics of households who hold term or cash value life insurance? (2) Which factors significantly influence households owning term or cash value life insurance as well as the amount of either type of life insurance? (3) What is the relationship between demand for either term or cash value life and other households' financial assets?

This study developed a comprehensive model of households' demand for either term or cash value life insurance. The models included 28 independent variables classified as demographic factors (age, education, employment status, health status, number of children, and marital status), economic factors (income, homeownership, debts, as well as portfolio elements such as liquid assets, certificates of deposit, mutual funds, bonds, stocks, individual retirement accounts, annuities, other miscellaneous financial assets, and nonfinancial assets), and psychographic factors (attitudes toward risk, attitudes toward leaving a bequest, and life expectancy). The analysis used a Heckman two-stage model that allowed the effect of the independent variables on the probability of purchasing life insurance to differ from the effect on amount of life insurance purchased. The data used in this study were from the 2004 Survey of Consumer Finances (SCF).

The descriptive statistics indicated that, in 2004, 40% of households owned term life insurance, 14% owned cash value life insurance, 11% held both types of life insurance, and 35% of households did not have any life insurance. Compared to term life insurance holders, cash value life insurance holders were older, more educated, less risk-taking, more likely to own a home, expected to live longer, and had more positive attitudes toward leaving bequests. Households that held term life insurance reported better health and were more likely to be employed than those that held cash value life insurance. Households without any life insurance were relatively young, less educated, unemployed, not married, and renters; they expected to die in their 70s, had low income, were not concerned with leaving a bequest, and preferred not to take risks.

Results of the Heckman two-stage selection model for term life insurance indicated that the likelihood of holding term life insurance and the amount of the insurance increased as age of the household head increased until the head's age reached 48-57 years but then declined as the household head aged. Household heads that were employed, more educated, married, preferred no risk, and those had more debts were more likely to own term life insurance and to purchase a greater amount of term life insurance. In addition, income, less healthy heads, spouses' employment, homeownership increased the likelihood of holding term life insurance. Households whose head had a positive attitude toward a bequest, more children, and above average risk tolerance owned a greater amount of term life insurance.

The results for cash value life insurance analysis indicated that households whose head was married, had more education, owned a home, had a positive attitude toward leaving a bequest, and preferred no risk were more likely to hold cash value life insurance

and to purchase a greater amount of cash value life insurance. Moreover, the likelihood of holding cash value life insurance was greater for households that had more debts. Households that had more income and preferred above average risk owned more cash value life insurance.

The results of this study provide three significant contributions. First, the results supported the hypotheses that other assets positively affect the demand of households for both term and cash value life insurance, indicating life insurance demand is jointly determined in the context of other elements within the household's portfolio. The results indicated that liquid assets, stocks, and retirement accounts increased the likelihood of owning term life insurance. liquid assets, mutual funds, bonds, retirement accounts, stocks, other miscellaneous financial assets and nonfinancial assets positively associated with the amount of term life insurance; liquid assets, CDs, mutual funds, bonds, retirement accounts, and annuities are positively associated with the ownership of cash value life insurance; and except for CDs, which were not significant, all other assets categories were associated with an increase in the amount of cash value life insurance purchased by households.

Second, the study support for the Heckman two-stage selection model. The results of two-stage models showed that several variables that influenced the probability of owning life insurance and the amount life insurance purchased by households were different such as spouse's employment status variable and number of children variable. Last, the results support the need to examine the two types of life insurance separately since the factors that associated with the demand for term life and cash value life insurance were different.

6.2 Implications and Limitation

Results of this study indicated that 35% of households did not have any type of life insurance. These households without life insurance include two groups: those who really need life insurance but do not have life insurance and those who do not need life insurance such as those without dependents and those with enough wealth to protect against financial risk. The survey by LIMRA conducted in 2006 also reported that nearly one third of Americans have no life insurance. Households that need life insurance but did not have life insurance were characterized as relatively young, less educated, unemployed, not married, and renters. Those households, representing lower income groups might be underinsured for future financial risks. In fact, underinsurance in households is prevalent, according to the report of the Life and Health Insurance Foundation for Education in 2007. As we know, the premature death of household heads may bring serious consequences to households that really need life insurance but do not purchase them. These results urge financial professionals to advise and educate households about the need for life insurance and how to determine sufficient amount of life insurance to purchase.

The future extension for this research is adding interaction terms to examine the subgroups' effects on the dependent variables. For example, the interaction of age and income and the interaction of age and financial assets could be associated to determine whether or not income and financial assets influence the demand for life insurance among different age groups. Also, price is an important factor that affects consumers' purchasing behavior and is only partially proxied in the term insurance equation. Thus, future research should examine the effect of life insurance premiums in the modeling life

insurance demand by households. In addition, due to data limitations the study did not examine different types of cash value life insurance, such as universal life insurance, variable life insurance, and variable universal life insurance. The data only provided information on the life insurance holding of whole family, but not the information on life insurance owned by the head, spouse, and others as separate products. A future study could include these variables to learn about how factors affect cash value life insurance demand in depth.

Appendix A

The RII Technique

The linear regression analysis are performed on each of the five implicates separately. The results obtained independently from the five separate implicates are combined to obtain the RII estimates.

Q_1, Q_2, Q_3, Q_4, and Q_5 represent the point estimates and U_1, U_2, U_3, U_4, and U_5 represent the variance estimated from five separate implicates. Q is 1×54 vector and U is a 54×54 matrix in this study. The best point estimate of the regression coefficients is the average of the results from the five implicates (m=5).

$$\overline{Q}_M = \frac{\sum_{i=1}^{m} Q_i}{m} \quad (1)$$

The total variance of the point is combined by the average of the five separate variance estimates (the "within" imputation variance), and the variance due to imputation of missing values (the "between" imputation variance).

The "within" imputation variance is estimated by

$$\overline{U}_M = \frac{\sum_{i=1}^{m} U_i}{m} \quad (2)$$

The "between" imputation variance is estimated by

$$B_M = \frac{\sum_{i=1}^{m} (Q_i - \overline{Q}_M)^t (Q_i - \overline{Q}_M)}{m-1} \quad (3)$$

Where t indicates the transpose of the vector.

The total variance-covariance matrix is given by

$$T_M = \overline{U}_M + (1 + m^{-1}) B_M \quad (4)$$

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