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Is Private Long-Term Care Insurance Affordable For Older Adults?

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IS PRIVATE LONG-TERM CARE INSURANCE AFFORDABLE FOR OLDER ADULTS?

by

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DEDICATION

To my husband.

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I would like to thank Dr. Gail Jensen-Summers for all her support and advice throughout the years. She had been a great ***mentor*** to me so it was honor to be one of her students.

I want to express my appreciation to my family. Their support encourages me to achieve my dreams. I also thank to my committee members, Dr. Allen Goodman, Dr. Stephen Spurr, and Dr. Tom Jankowski. I am thankful for financial support provided by the Department of Economics, the Institute of Gerontology, and Blue Cross Blue Shield of Michigan.

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CHAPTER 1

INTRODUCTION

Long-term care (LTC) consists of services provided to people who cannot perform certain activities of daily living (ADL) – such as walking, bathing, dressing, toileting, or eating – due to chronic disease or disabilities for an extended period of time. LTC delivers assistance and care in a variety of settings, such as in one's private home, an assisted living facility, or a nursing facility.

LTC represents one of the largest uninsured financial risks that older Americans confront. According to Brown and Finkelstein (2009), one-third of current 65-year olds will enter a nursing home at some point in the future. Other estimates indicate that 1 in 5 people turning age 65 will need more than five years of LTC (Kemper, Komisar, and Alecxih, 2005/2006). Also, estimates indicate that about 7 in 10 people turning age 65 today will die with needing long-term care (Feder, Komisar, and Friedland, 2007). On average, a nursing home charges $69,422 per year for a private room, and $61,116 per year for a semi-private room. A home health aide costs $18 to $20 per hour for a visit, and an assisted living facility costs $30,265 on average per year, just for basic services (Melnyk, 2005). Nationwide only 10 percent of LTC spending in 2004 was paid for by private insurance, while 18 percent was paid for out of pocket (Congressional budget Office, 2004). Nearly 72 percent of spending on LTC came from public funds such as Medicaid and Medicare (Feder, Komisar, and Friedland, 2007).

An active private LTC insurance market exists, but the market is small and few people actually purchase policies. The General Accounting Office (2006) estimates that nationwide, there are fewer than 7 million LTC insurance policies in force. Several theories have been offered as possible explanations why older people do not buy private LTC insurance, including the availability of Medicaid, misperceptions that Medicare or other policies cover LTC, beliefs that one's own risk of needing LTC services is small, or desires to simply rely on children or one's spouse for LTC needs.

This dissertation explores another possibility: that private LTC insurance is simply "unaffordable" for most older Americans, and therefore they do not buy it. Like other goods and services, unless consumers believe they are able to bear the cost of private LTC insurance, they will not purchase it. This study provides an operational framework for defining affordability, and then uses data from the 2004 Health and Retirement Study (HRS) to examine the extent to which the affordability of private LTC insurance, or the lack thereof, can explain why so few older adults purchase it.

This study extends earlier work on the affordability of LTC insurance in three ways. First, it updates previous estimates of coverage affordability and refines the methods used to derive them. All of the estimates in the literature are now at least a decade old. Second, this study analyzes data from the 2004 HRS, a nationally representative sample of older Americans, which enables generalization of the findings to older adults nationwide in the U.S. Finally, in contrast to other studies, this study examines several alternative definitions for affordability, making it possible to assess the sensitivity of the finding to variations in the definition used. As a result, this study provides more general conclusions

regarding of the role of affordability in explaining why so few Americans purchase private LTC insurance.

This dissertation proceeds as follows. Chapter 2 reviews the literature that contemplates the meaning of affordability in the context of LTC insurance, acute-care health insurance and in housing. These are goods and services where prior research exists on the notion of affordability. In chapter 3, a general description of the meaning of affordability is developed, and three different operational definitions of affordability of LTC insurance are offered. In chapter 4, the definitions are applied to the 2004 HRS dataset. Chapter 5 reports the results. Chapter 6 concludes the dissertation with a synthesis of the key finding that emerge.

CHAPTER 2

LITERATURE REVIEW

There are three relevant areas of prior research: (1) studies on the demand for LTC insurance, (2) studies on the affordability of acute-care health insurance, and (3) studies on the affordability of housing.

LTC Insurance

Cohen et al. (1993) point out that there is no real agreement on the reasons why so relatively few seniors carry LTC policies. They suggest there are two good reasons, however, to examine the issue of affordability. First, the role of the public sector in financing LTC will in part be determined by whether private LTC insurance can solve the problems faced by middle-income elders. Second, clarifying the reasons for the low demand for LTC insurance may provide insights about how best to design market policies and to attract purchasers.

They reveal that middle-income elders comprise a sizable proportion of the growing LTC insurance market: about one-third of purchasers have income less than $20,000 and about 25% have assets less than $30,000. They also present that both age and risk evaluation are important components in the decision about how much to spend on LTC insurance. For the typical policy, individuals 65 to 69 years old pay $73 per day for about 6 years of nursing home care, but purchasers over age 75 cover 4 years of nursing home care at $65 per day. Individuals who evaluate their risk for needing nursing home care as

greater than 75 percent are willing to pay about 45 percent more of their income on LTC insurance than those who assess their risk to be less than 25 percent. In contrast to other studies, their paper shows that there are between 60 percent and 70 percent purchasers who use some proportion of their savings to buy LTC insurance. They conclude that private insurance may be a reasonable way to finance for more people than once thought, especially for individuals 65 to 74 years old. They also suggest that middle-income elders can look to the private LTC insurance as an alternative way as long as the federal government does not significantly change its current role in direct financing of LTC through the Medicaid program.

Crown et al. (1992) developed a conceptual model of the demand for private LTC insurance that illuminates the factors affecting demand, including the affordability of coverage. From the perspective of affordability, they suggest the potential buyers of private LTC insurance are individuals who are ineligible for Medicaid and who have sufficiently large assets to both warrant protection and achieve protection in the face of uncovered costs. Based on the restriction that only nursing home care is defined as LTC, they construct a model suggesting that perfectly rational individuals will consider buying private LTC insurance only after they meet their daily expenses.

They report that the size of the potential market for private LTC insurance differs by age, marital status, the percentage of income that an individual is willing to pay on premiums, and the cost of the premiums themselves. Among married individuals aged 65-69, they estimated that 64 percent could afford to spend half of their discretionary income on a typical basic plan, which covers 4 years in a nursing home, with a $100 daily

benefit, no inflation protection, and a $2,000 deductible. Their estimates of the potential market for LTC insurance suggest less affordability than those of previous studies, so they conclude the actual LTC insurance market could be expected to be far smaller.

Zedlewski and McBride (1992) address two questions: what the future need for LTC services is likely to be, and whether LTC insurance will be affordable for a large portion of the future elderly population. They compute the ratio of premiums to income in 1990, and estimate that in 2030 only 10.6 percent of the elderly ages 65-69 will be able to purchase a fairly generous private LTC insurance at a cost of less than 5 percent of their income.

Cohen et al. (1987) examine the financial capacity of the elderly to purchase either LTC insurance or coverage in a managed care environment (MCE) such as a continuing care retirement community (CCRC). After reviewing 16 LTC insurance policies, they find that annual premiums of LTC insurance range from $400 to $1,400 in year, depending on age of purchasing and the extent of coverage. They estimate income, assets and expenditure of the elderly. They assume that the elderly would be inclined to spend only between 10 percent and 25 percent of their assets on a purchase of LTC insurance. Moreover they make two adjustments to estimate the discretionary resources: excluding the costs of MCE, and accounting for the lump-sum entry fees of CCRC. As a result, they find that if a married couple household is willing to devote 10 percent of their discretionary income to purchase LTC insurance premiums, and is charged $50 per month on each person; only 9 percent of the elderly could afford total premiums.

Acute-care Health Insurance

More recently, Bundorf and Pauly (2006) have investigated the affordability of acute-care health insurance. The question they seek to answer is: "How many of the uninsured in the U.S. are uninsured because they cannot afford health insurance?" Using a normative approach to defining affordability, they estimate the proportion of the uninsured who cannot afford coverage. According to their normative definition, health insurance is affordable as long as there are sufficient resources left over for health insurance after buying a "*socially acceptable*" level of non-health insurance goods and services. They note that at the poverty level, 82 percent of the uninsured could afford health insurance for a year. By raising the "socially acceptable" allowance for other goods to two times the poverty level, 55 percent of individuals could afford coverage for a year. They report that increasing the level of income relative to the poverty threshold dramatically reduces the proportion of the uninsured who could afford to buy health insurance.

They conclude that the normative definition shows that individuals with higher income are more able to afford health insurance. For the effects of policies on affordability higher premiums make health insurance less affordable, due to either higher loading costs or higher expected health care expenditures, which leaves less available income to spend on other goods and services.

According to their alternative, behavioral definition, if with the median preferences individuals purchase at least the adequate amount of health insurance at a certain level of income, then health insurance is said to be affordable to individuals with the same level

of income. To define affordability, they set the threshold probability at 0.5, and in addition, use alternative values. By applying the threshold of 0.5, to the model including only controls for financial resources they find that health insurance was affordable to 74 percent of the uninsured. On the other hand, 25 percent of them can afford health insurance when the threshold is set at 0.8.

Therefore, increasing the affordability threshold makes less uninsured be able to afford health insurance. In contrast to the normative definition, higher loading, holding expected expenditures constant, diminishes the probability that individuals buy private coverage, making health insurance appear to be less affordable.

Blumberg et al. (2007) offered two definitions for the affordability of acute care health insurance. The first was based on household budget approach, and the second was based on patterns of actual household spending on health insurance. The household budget definition states that consumers at every income level spend their resources on living expenses, and then the remainder is available for health care. The second approach reflects consumers' actual purchasing decisions, and then reveals what they are both willing and able to spend.

Bernard et al. (2009) point out that income along does not fully explain insurance purchase decisions, because there are unafforders who buy insurance, and afforders who do not buy insurance. They suggest that a role for assets and debt in determining the affordability of health insurance. They introduce a *wealth model* that adds savings, assets, and debt to the standard income model. They find that in the employer coverage market

the standard income model performs well, but in the individual market the wealth model performs substantially better that the standard model.

Housing Market

Thalmann (1999) developed a conventional ratio definition of housing affordability and a quality-based definition. The former one states that housing is affordable for a household if the ratio of the housing costs to income is less than or equal to some limit. A quality-based definition, a variant of the conventional definition, sets the particular level of housing cost which society would find suitable for a given type of household. If the ratio of the particular housing cost to income does not exceed the limit, then households can afford appropriate housing. To estimate the average market cost of housing, he uses a hedonic approach that is a function of attributes and residual determinants of rent differentials.

Stone (2006) points out that there are practically a variety of different approaches to defining affordability as well as either a ratio or a difference approaches. A relative approach, first, investigates changes in the relationship between summary measures of house prices and household incomes. A subjective approach is based on the idea that households are utility-maximizers, so they pay what they can afford for housing. Thus, it is not possible to have a normative standard of affordability other than individual choice. Next, a family budget standards approach conceptualizes monetary standards based on actual, aggregate households' expenditure patterns. A ratio definition claims that if a household pays more for housing than a certain percentage of its income, it doesn't have

sufficient income for other goods and services. Finally, a residual approach asserts that a household experiences a housing affordability problem when it cannot satisfy its basic non-housing needs after paying for housing.

Belsky et al. (2005) note there are benefits to using a cost-to-income ratio definition of affordability. This approach needs only income and housing cost to compute a ratio, so it is both easy to compute and understand. It is applied across places, to trace changes over time and to explore differences in these ratios across households. Finally, it is an immediate measure of actual expenses of households relative to their actual incomes.

CHAPTER 3

CONCENPTUAL FRAMEWORK

3.1. THE MEANINGS OF AFFORDABILITY

"Afford" is defined as being able to bear a cost.[1] Since deciding the level of the bearable cost is subjective, there is no single, agreed upon definition for affordability. In general, in referring to the affordability of a certain good (or service), we are considering the amount of financial burden to a consumer. Most definitions recognize that consumers have competing demands on their income. Housing, food, and other basic essentials will be consumed before more discretionary goods and services are considered. Accordingly, a consumption bundle which allows for these basic living expenses, as well as LTC insurance, is said to be affordable if it is feasible for a consumer given her income and the prices she faces.

Here to see a general meaning of affordability, I review the model developed by Mas-Colell et al. (1995). The model is particularly useful because it recognizes that the consumer's problem is actually a multiperiod one, and a consumer must be able to afford what they purchase in each and every period. With her income in each period every consumer faces the decision problem to choose consumption levels of the various goods and services. Suppose that, in the market, there are l commodities that are available for purchase. The consumer can have a list of purchases $(x_1, x_2, \cdots, x_l)$, where x_i is the quantity of the i^{th} commodity. Each quantity x_i belongs to $\mathbf{R}_L^+$ because purchases cannot

[1] Merriam-Webster dictionary.

be negative. Let **x** be a particular consumption bundle for the consumer, then she has **x** = (x_1, x_2, ⋯, x_l). Then the consumer's problem is to choose an *affordable* consumption bundle ***x*** in the consumption set $\boldsymbol{X} \subset \mathbf{R}_L^+$ that yields the most satisfaction. In addition, suppose that the consumer lives the *t*-period, and then the particular consumption bundle for the consumer during the *t*-period becomes:

$$\mathbf{x}^1 = (x_1^1, x_2^1, x_3^1, \cdots, x_l^1),$$

$$\mathbf{x}^2 = (x_1^2, x_2^2, x_3^2, \cdots, x_l^2),$$

$$\vdots$$

$$\mathbf{x}^t = (x_1^t, x_2^t, x_3^t, \cdots, x_l^t).$$

The consumer, then, has consumption set, $\boldsymbol{X}$, which contains all bundles of *L* commodities:

$\boldsymbol{X} = \mathbf{R}_L^+ = \{x \in \mathbf{R}_L : x_l^t \geq 0$ for $l = 1, \ldots, L$, t=1,……$T\}$.

Suppose that each good at each period has its own price. The price vector, ***P***, which defines dollar cost for a unit of each of the *L* commodities:

$\boldsymbol{P} = \{p \in \mathbf{R}_L : p_l^t > 0$ for $l = 1, \ldots, L$, t=1,……$T\}$.

Then, we can say that the affordability of a consumption bundle relies on the market prices, *p*, and the consumer's income in dollars, *y*. A consumption bundle is affordable if its total cost, given prices, does not exceed the consumer's income, that is, if:

$$p_1^1 x_1^1 + p_2^1 x_2^1 + \cdots + p_l^1 x_l^1 \leq y^1,$$

$$p_1^2 x_1^2 + p_2^2 x_2^2 + \cdots + p_l^2 x_l^2 \leq y^2,$$

$$\vdots$$

$$p_1^t x_1^t + p_2^t x_2^t + \cdots + p_l^t x_l^t \leq y^t,$$

In general, we can write the set of consumption bundles that satisfies this criterion, given *p* and *y* is:

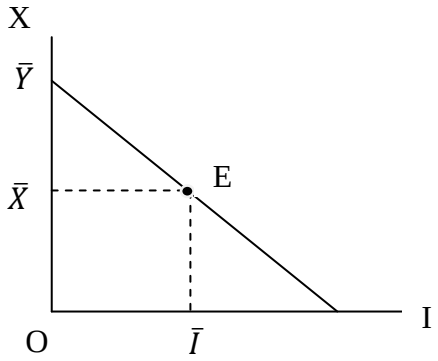
$$\boldsymbol{B}_{p\,y} = \{x \in \mathbf{R}_L^+ : \boldsymbol{P} \cdot \boldsymbol{X} \leq y\}.$$

This framework provides a precise definition of affordability for aggregate consumption. A consumption bundle is affordable if it is feasible for a consumer given her income and the prices she faces. The consumer's problem is to choose a particular consumption bundle, **x** , from this set, given *p* and *y*.

3.2. FIRST DEFINITION

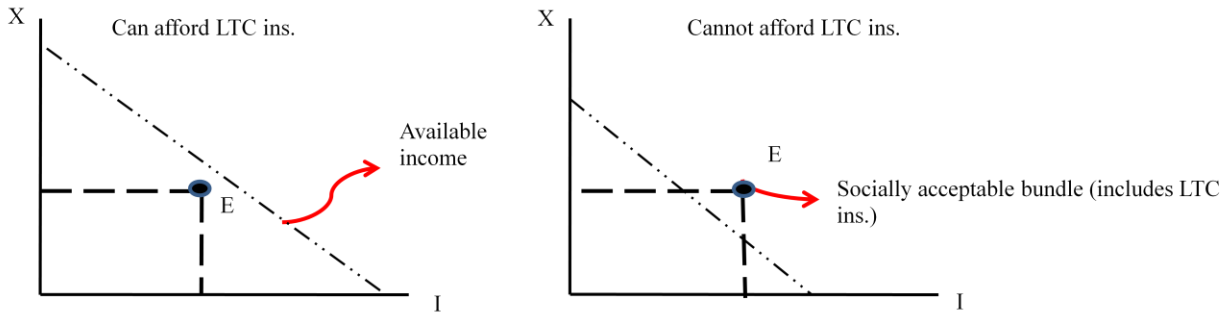
Based on the general model of resource allocation, I develop a first definition of affordability of private LTC insurance. Households are assumed to spend their income on private LTC insurance and other goods and services. When considering this first definition, we should specify the adequate amount of other goods and services as well as that of LTC insurance.

Figure 1. General model of affordability



At first, let I and X represent the quantity of LTC insurance and other goods and services, respectively. In Figure *1* let $\bar{I}$ illustrate the socially defined minimum amount of LTC insurance, and $\bar{X}$ do other minimum standard of consumption of all other goods and services, that is, minimum consumption level externally defined by society. Point E, therefore, represents a minimum need consumption bundle for a household. To spend $\bar{X}$ and $\bar{I}$, that is, point E, the household needs certain amount of income $\bar{Y}$. We can say, therefore, $\bar{Y}$ is the socially required minimum level of income.

Figure 2. Comparison between afforders and non-afforders



Then, how can we use this to measure affordability for LTC insurance? If $\bar{Y}$ is supposed as household income which can achieves point E, then the household which has $\bar{Y}$ or higher can afford at least amount of private LTC insurance. It is shown at the left graph in Figure *2*. In other words, if the household has income Y that is greater than or equal to $\bar{Y}$, then it has sufficient income to buy $\bar{X}$ and $\bar{I}$. We, therefore, classify the household as being able to afford LTC insurance. All households with incomes below $\bar{Y}$, however, would not have the adequate amount of incomes to purchase the socially

minimum amount of private LTC insurance. Therefore, we can say these households cannot afford LTC insurance, as shown at the right graph in Figure *2*. This basic idea is embodied in the first normative definition for affordability, which is:

DEF 1. *A private LTC insurance policy with coverage $\bar{I}$ that costs P^* is said to be affordable for a household, i, if:*

$$y_i^t - \bar{x}_i^t \geq p_i^{*2004}(D_i, \bar{I}_i), \qquad t = 2004, 2005, 2006, \ldots, T.$$

Life expectancy, *T*, is used because lifetime values should be considered for affordability of LTC insurance. *y* stands for the non-purchase household's income. *p** represents the premium of a socially defined minimum LTC insurance when private LTC insurance, $\bar{I}$, and varies with characteristics of household members, *D*. The price of *x* is set as 1, and so $\bar{x}$ illustrates costs for other consumption. LTC insurance is affordable to household *i* if in each remaining year of life, its remaining income is greater than or equal to the sum of its expenses for LTC insurance and its spending on other goods and services. Finally, savings are allowed from year to year. If household *i* has income that is more than enough for meeting its budget constraint, then its remaining income can be saved and used to buy private LTC insurance in the next period, if needed.

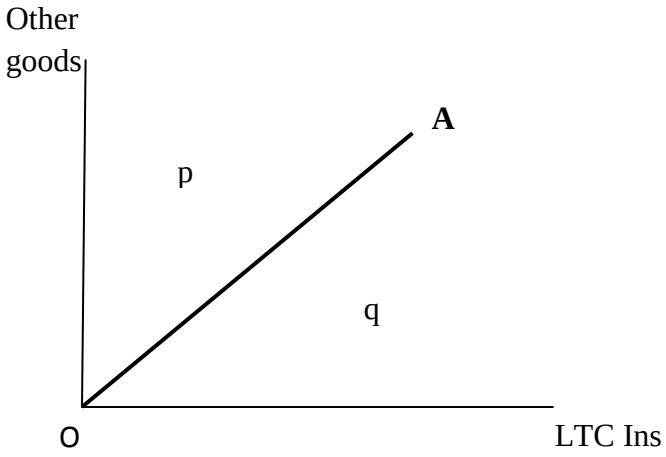
3.3. SECOND DEFINITION

Following the definition used in earlier studies of affordability of LTC insurance and housing affordability, the second definition examines the relationship between premium

and income. One broadly accepted approach in studies of housing to measure the affordability is the ratio of housing costs to income. That is, affordability is explained as the relationship between household income and housing expenditure; housing is affordable if expenditure relative to income is reasonable. The conventional view defines a housing affordability problem to occur when housing cost exceed 30% of income.

First, it identifies that households spend a fraction of income on LTC insurance, and then demonstrates that if households spend more on LTC insurance than a certain (threshold) percentage of their incomes, they are considered as not having sufficient income left for other spending so that they are not able to afford LTC insurance.

Figure 3. Affordability – Second Definition



Suppose households spend some of their income *Y* to buy LTC insurance *I*. At any given set of relative prices of income and LTC insurance, the second definition of affordability can be represented as *OA*, in Figure *3*. *OA* shows the least income that is

necessary to purchase a certain amount of LTC insurance without spending more than the proportion, some limit, of that income. The slope of the ray relies on both the ratio of LTC insurance premiums to income and the relative prices of the two goods. Any point on the line, therefore, is pairs of premiums relative to incomes which equal the target ratio. Points above the ray, area *p* in Figure *3*, represent ratios of premiums to incomes below the target level. In other words, for those incomes, the premiums are not an excessive burden on households so that LTC insurance is affordable for households. Any households, however, below the line, area *q* in Figure *3*, describe ratios that exceed the reasonable charge, and so they cannot afford LTC insurance. The second definition is defined for affordability is given by:

DEF 2. *A private LTC policy with coverage $\bar{I}$ that costs P^* is affordable during a household's lifetime if the household's share-of-income is less than or equal to the target ratio, M. In other words, if the ratio of household i's LTC insurance premium to its income is greater than the threshold ratio, then the household cannot afford LTC insurance:*

$$\frac{p_i^{*2004}(D_i, \bar{I}_i)}{y_i^t} \leq M, \qquad t = 2004, 2005, 2006, \dots, T.$$

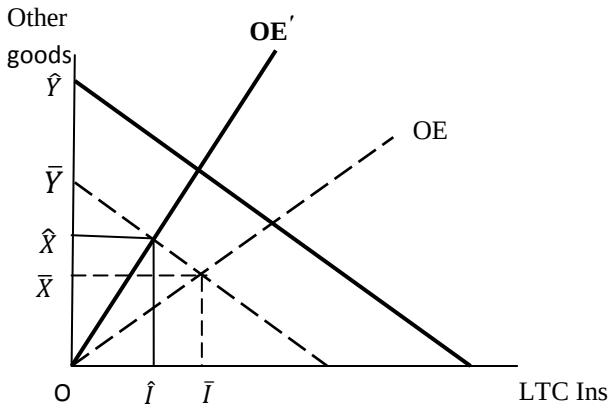
3.4. THIRD DEFINITION

The third (or behavioral) definition of affordability is based on the actual purchasing behavior of consumers. A non-purchaser is considered as being able to afford LTC

insurance if she has characteristics similar to those of a purchaser, e.g. her financial covariates, as well as demographic, income, employment, and health status variables are similar to those of a buyer. As an example, suppose that there are two individuals, **A** and **B**. **A** has LTC insurance, **B** does not. Both, however, have comparable income, residence, financial wealth, health status, and so on. Then, the third definition classifies **B** as being able to afford LTC insurance.

The behavioral definition considers what individuals *actually* do purchase, instead of exploring what individuals *could* buy. Suppose there are individuals who have the normatively defined income. They want to consume less of LTC than the normative standard, instead of preferring to purchase more acceptable levels of other goods and services. Conversely, there might be individuals who purchase more of LTC insurance and less of other spending than each normative criterion. The behavioral definition reflects these cases.

Figure 4. Affordability – Third Definition



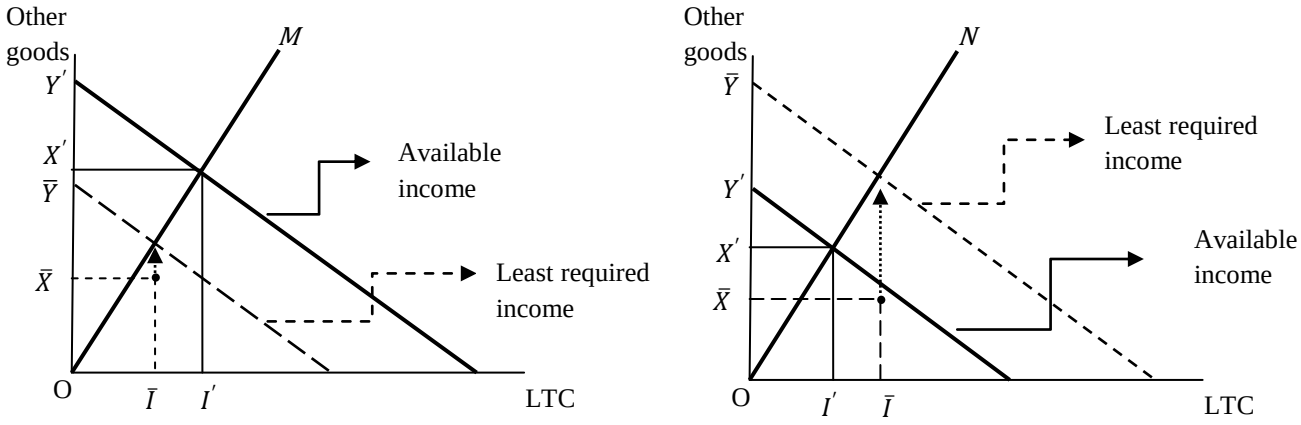
Graphically, in Figure *4*, *OE* represents the allocation between the socially minimum LTC insurance and other consumption with the level of income at which the LTC insurance is affordable. Suppose an individual, however, has a preference OE' rather than *OE*. In this case, $\hat{I} < \bar{I}$. That is, with the normatively defined minimum adequate income, $\bar{Y}$, the individual purchases less adequate LTC insurance, $\hat{I}$. Instead, she buys more than adequate levels of other goods and services, $\hat{X}$. Under this preference, sufficient individual income should be $\hat{Y}$ to achieve socially minimum level of LTC insurance, $\bar{I}$. In this case, the adequate income is greater than that of the normative definition, $\hat{Y} > \bar{Y}$.

Suppose that $I\,(Y, c)$ represents the quantity of LTC insurance consumed by the individual, and is a function of *Y* and *c*. I define LTC insurance is affordable if, given *Y* and *c*, $I\,(Y, c) \geq \bar{I}$. That is, if the individual purchases at least the adequate amount of LTC insurance at a specified level of income, LTC insurance is said to be affordable for the individual with that level of income. For example, on the left graph in Figure *5*, suppose that the line *OM* represents the allocation between LTC insurance and other goods and services given income Y' and *c*. When the individual has the preference *OM*, she needs at least income $\bar{Y}$ to purchase the adequate quantity of LTC insurance $\bar{I}$. The individual's available income, however, is Y' which is greater than $\bar{Y}$, and is sufficient to purchase I', so that she can afford LTC insurance. With the third definition LTC insurance is deemed affordable for not only this individual, but also other individuals who have the same amount of income and who face the same prices. In the same way, we

can imagine the case of unaffordability on the right graph in Figure *5*. The behavioral definition is:

DEF 3. *(Based not on people who could purchase private LTC insurance, but on them who actually do purchase it) If the individual purchases the* ***minimum level*** *of private LTC insurance* ***in particular circumstances****, e.g. who face the same parameters for their choice problem.*

Figure 5. Affordable and Unaffordable – Third Definition



CHAPTER 4

APPLICATIONS OF DEFINITIONS

4.1. DATA

This study uses nationally representative data from the ongoing Health and Retirement Study (HRS) and the Rand HRS data. The HRS survey is conducted by the Institute for Social Research at the University of Michigan, with funding from the National Institute on Aging (NIA). Prior to 1998, the HRS consisted of two sub-studies. One is the original Health and Retirement Study (HRS), which surveyed a cohort born between 1931 and 1941 with age 51-61 at a baseline, and the other is the Study of Asset and Health Dynamics among the Oldest Old (AHEAD), which surveyed another cohort born in or before 1923. Starting from 1998 (wave 4), the two sub-studies were merged and new sub-samples were added so that they create one complete panel of respondents representing all persons over 50 years old in the United States. The combined HRS surveys more than 22,000 Americans over age 50 every two years, and provides extensive information on the utilization of formal LTC services and informal care, as well as demographic characteristics, family structure, financial resources, employment, insurance coverage, and health and disability.

The Rand Center for the Study of Aging created and maintains the Rand HRS data files with funding and support from the National Institute on Aging (NIA) and the Social Security Administration (SSA). It contains data from all waves of the HRS on a subset of variables in the "core interviews," whereas the HRS contains wave-specific files and

includes several auxiliary and special topic files for each wave. Within the 2004 HRS data I use a sample of 12,577 adults ages 50 and older. The Rand HRS data is used to augment these data. Specifically, for respondents with missing values the Rand HRS provides data from previous waves to impute the missing values.

4.2. METHODS FOR IMPLEMENTING THE FIRST DEFINITION

Purchasers of LTC insurance have to pay their premiums annual throughout their remaining lifetime. Therefore, in examining the affordability of LTC insurance, lifetime values, such as lifetime income and lifetime other consumptions etc., instead of just using current income and current consumptions should be considered, not just current income and current consumption. To estimate lifetime values, life expectancy should be predicted. Although HRS data collects respondents' life expectancy, unless respondent reports their life expectancy, I estimate time-to-death using the Life Table for the Total Population, 2004, from the National Center for Health Statistics (NCHS).

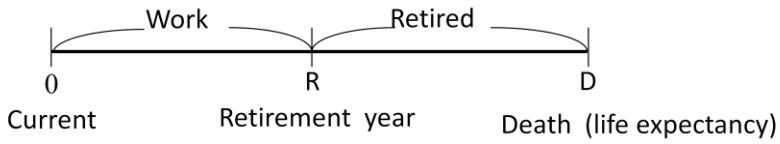
4.2.1. Lifetime household income

Two different groups, current workers and current retirees, should be considered separately when lifetime income is examined, because they have different income sources. For current workers they have two income sources in their lifetime. One is wages from a current job, and the other is (future) retirement income after retiring. In contrast, current retirees have only one income source, retirement income.

A. Current workers

A life span of current workers is divided into two periods, in Figure *6*, work years and retirement. In order to divide these two periods, I first need to estimate a retirement year (*R*) for every respondent. I assign the average retirement year, computed from other respondents' retirement years in the past, unless a respondent does not report it. The Bureau of Labor Statistics (BLS) reports that older Americans are remaining in the labor force relatively later in their life. Although labor force participation rates of older Americans had been dropping until 1985, they have been rising since then. In fact, HRS data also demonstrate results similar to BLS reports. An average retirement year is computed on every age (or respondent) based on expected retirement years of other respondents from wave 1 to wave 6 of Rand HRS data. It demonstrates that the average expected retirement age was 54.6 years old in 1992, but in 2002 it reached an average of age 60.5. For even the elderly aged 65 and older, they expect to work 2 to 8 more years. Over the past two decades, workers have tended to extend their working lives for the purpose of earning more wages that would be considered as an important source of retirement income. The BLS estimates relatively modest growth in the participation of older Americans in the future. The rates for workers aged 65 and older are projected to increase by about 3 percentage points over the next 15 and 20 years, compared to 13.1 percent of them in 2001.

Figure 6. Time span for current workers



Work incomes from year *1* to year *R* - *1* for every worker are estimated based on current work income (CWI) converted to present values, and then added from current(*0*) to a retirement year(*R*) for total work income (TWI) in year *t*.

$$TWI_i^t = \left(\frac{1+g}{1+r}\right)^t \times CWI_i^t, \qquad t = 2004, 2005, 2006, \ldots, R-1.$$

where *g* stands for an average real economic growth rate from OECD Country Statistical Profiles of the U.S. between 1971 and 2007 and *r* is a real interest rate from OECD Country Statistical Profiles of the U.S. in 2004 to convert values to present ones.

Next, since there is no specific amount of current workers' retirement income, I estimate the income of first retirement year, *H*. Before estimating *H*, life expectancy, *T*, needs to be considered. Life expectancy at birth stands for the average number of years that a group of infants would live if the infants were to experience throughout life the age-specific death rates present in the year of birth (National Vital Statistics Reports, 2007). For the U.S. population, life expectancy reached a record high of 77.8 years in 2004, rising from 77.4 years in 2003.

The HRS asks each respondent to report a specific ages for their life expectancy. Unless the respondent reports his or her life expectancy, I follow the Life Table for the

Total Population (2004) from National Center for Health Statistics. According to it, a person aged 65 years could anticipate living an average of 18.7 more years for a total of 83.7 years. In the case of a person aged 85, he or she may look forward to living 6.8 more years on average.

Consider an individual's income in year t of retirement. Call this *H.* It is calculated by multiplying an individual's average work income, from 2004 until *R - 1*, by the income "*replacement rate*", γ.[2] After calculating retirement income in each remaining year of life. I add these values up from year *R* to year *T* to obtain the person's retirement income (TRI) in year *t* for every current worker.

$$TRI_i^t = \left\{\left(\frac{1+g}{1+r}\right)^t \times \left[\left(\frac{\sum_{t=0}^{R-1} Y_i^t}{R}\right) \times \gamma\right]\right\}, \qquad t = R, R+1, R+2, \dots, T$$

[2] Replacement rates are used to measure the extent to which older people can maintain their pre-retirement levels of consumption once they retire. Although the comparison working consumption with retirement one, such data are hardly possible so that an indirect approach is to compare pre- and post-retirement income. I use the replacement rate constructed by Munnell and Soto (2005).

In the U.S. retirement income system, Social Security serves a basic level of replacement, upon which individuals can have additional saving. This additional saving comes mainly from employer-sponsored pension plans and the accumulation of home equity even though most people save very little besides pensions and their home. They defined retirement as the first year that workers start receiving Social Security benefits.

To compute replacement rates, they use HRS since it has information on earnings before retirement and on Social Security and pension benefits as well as 401(K) balances and homeownership.

Without pensions:

$$\text{median replacement rate} = \frac{\text{Social Security Benefits}}{\text{AIME}},$$

where AIME represents average indexed monthly earnings, which is the 35 highest years of earnings indexed to the present by wage growth. For retirees, the AIME is computed in two steps. First, the worker's annual taxable incomes since 1950 are indexed to indicate the general income level in the indexing year, at age 60.

Income after age 60 is not indexed but is continued at their actual value. A worker's income prior to age 60 is indexed by multiplying it by the ratio of the average wage in the national economy for the indexing year to the corresponding average wage figure for the year to be indexed.

Second, the AIME is computed by taking the highest 35 years of wage-indexed income between age 22 and 62 and dividing that total by the number of months in that period.

With pensions:

$$\text{median replacement rate} = \frac{\text{Social Security Benefits} + \text{Pensions}}{\text{AIME}}.$$

They provide the replacement rate for couples and singles separately.

These two components of income, total work income, TWI_i, and total retirement income, TRI_i, are then added together to give us a current workers' total expected income:

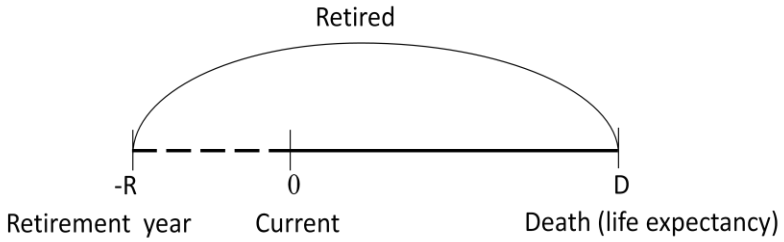
$$\textit{Expected income in year } t = \left[\left(\frac{1+g}{1+r}\right)^t \times CWI_i^t\right] + \left[\left(\frac{1+g}{1+r}\right)^t \times H_i^t\right],$$

$$t = 2004, 2005, 2006, \ldots, T.$$

B. Current retirees

Because current retirees have only retirement years left (*Figure 7*), their lifetime income, based on current retirement income, can be easily estimated. After determining the retirement income, *H*, total retirement income is calculated by the same method with that of current worker's total retirement income.

Figure 7. Time span for current retirees



Given life expectancy (*T*) of every respondent, retirement incomes from *1* to *T* are estimated based on current total retirement income converted to present values, and then added from current (*0*) to life expectancy (*T*) for total retirement income.

$$\textit{Expected income in year } t = \left(\frac{1+g}{1+r}\right)^{t} \times TRI_i^t,$$

$$t = 2004, 2005, 2006, \ldots, T.$$

C. Setting Parameters for these Equations

Lifetime Household Consumption. For consumption on other goods and services, I use the poverty threshold released by U.S. Census Bureau. The poverty thresholds is a most widely-used measurement of what income level is necessary (or adequate) to survive. It was originally developed in 1964 by the Social Security Administration. They were based on the Economy Food Plan, the cheapest of four food plans developed by the U.S. Department of Agriculture, which described the plan as designed for "temporary or emergency use when funds are low" (Kutty 2005). By being revised every year the threshold adjust for price changes. There are separate income levels for 48 categories of family composition. Family composition is defined by the number of resident family members, the number of under 18 years old, and the age of the head of household. Though the threshold is different for the family-size, it does not adjust to reflect different cost of living in various locations of the country.

Table 1. Spending Thresholds for "Other Expenses"

Size of family unit	Threshold (no child)	2 times threshold	3 times threshold	4 times threshold
One person				
Under 65 years	$9,827	$19,654	$29,481	$39,308
65 years and older	9,060	18,120	27,180	36,240
Two persons				
Householder under 65 years	12,649	25,298	37,947	50,596
Householder 65 years +	11,418	22,836	34,254	45,672

Source: U.S. Census Bureau.

For the criteria of sufficient consumption to live on, I consider four different thresholds, defined as one, two, three, and four times the current U.S. poverty standard. In Table *1*, a single person aged 65 or over needs $9,060 per year for his or her living. If the threshold is tripled, then the single person household spends $27,180 to live. With the same threshold when two persons consist of a household, and the head of the household is at 65-year-old or over, they need $34,254 to live.

Benefit Provisions and Cost of LTC Insurance. I consider four alternative LTC policies, specifically, the four policies available under the Federal LTC insurance program for federal employees. The Federal Government sponsors four different policies: "Facilities 100," "Comprehensive 100," "Comprehensive 150," and "Comprehensive 150+," ordered from least- to most-generous in terms of their coverage. Table *2* describes

the coverage of these four policies. The least-generous policy, Policy 1 (or Facilities 100), covers only facility-based care, and policy holders have to wait 90 days before being covered. If holders choose a longer waiting period, then they pay lower premium. With Policy 1, the benefit per day is $100 for 3 years. The most-generous policy provides both facility-based and home-based care. Its daily benefit is $150 without the limitation of benefit period after 90 days of waiting period.

Table 2. LTC Provisions Used for Simulations Policies 1 through 4 Ordered from Least- to Most-Generous

	Policy 1	Policy 2	Policy 3	Policy 4
Policy name	Fac100	Comprehensive 100	Comprehensive 150	Comprehensive 150+
Benefits	Facility-based care	Facility- and home-based care	Facility- and home-based care	Facility- and home-based care
Inflation protection	No	No	Yes	Yes
Benefit period	3yrs	3yrs	5yrs	Unlimited
Waiting period	90days	90days	90days	90days
Daily benefit	$100.00	$100.00	$150.00	$150.00

Source: Federal Long Term Care Insurance Program

How much premium must policy holders pay for coverage under these policies? This was calculated using the Federal LTC insurance premium (FLTCIP) calculator, available on-line (https://www.ltcfeds.com/ltcWeb/do/assessing_your_needs/ratecalcOut). Table *3* reports illustrative LTC insurance monthly premiums by age at time of purchase, based on this calculator. A sixty-year-old individual, for example, pays $27.80 per month if he or she chooses Policy 1. If the individual's initial age of purchasing is, however, at 70 or 80, then he or she has to pay $63.20 or $190.79 per month, respectively, for the same policy.

Table 3. LTC Monthly Premiums in 2004 by Policy Type and Age

Age	Policy 1	Policy 2	Policy 3	Policy 4
60	$27.80	$40.60	$93.20	$231.59
70	63.20	86.80	154.40	379.20
80	190.79	258.60	369.19	913.80
90	412.04	558.21	732.07	1811.26

Source: Calculated using rates paid by federal employees under the Federal Long Term Care Insurance Program.

4.3. METHODS FOR IMPLEMENTING THE SECOND DEFINITION

According to Stone (2006), the rationale for the conventional ratio standard has been built on interpretations of empirical studies of what households actually spend for

housing. He states also that it makes the ratio standard become legitimated as appropriate indicator.

Households use some of their income to purchase LTC insurance. A fraction of income is spent on LTC insurance. By computing the ratio of the premium to the incomes of the older adults based on lifetime income and lifetime premiums that were developed in the previous section, we can represent that LTC insurance policy is affordable only if the resulting ratio is less than or equal to the threshold affordability ratio. As a result, the percentage of elderly households who could afford LTC insurance, based on a ratio criterion for affordability, can be estimated.

The big question is where to set the threshold ratio (Stone, 2006). There are a few studies of Americans' willingness to buy LTC insurance (America's Health Insurance Plans, 2007; LifePlans, Inc., 2000). They suggest that most households are unwilling to spend more than 5 percent of their income on LTC insurance. There are other studies that examine how much of their income buyers actually spend on LTC insurance. The *Health Insurance Association of America* (prepared by LifePlans, Inc., 2000) reveals from surveys that purchasers spent on an average 4.8% of their income on LTC insurance premiums in 2000, - down from 6 percent of their income in 1995. In 2000, 54 percent of purchasers spent 1 to 3 percent of their income to buy LTC insurance, and 20 percent of those used 4 to 5 percent of their income for LTC insurance. An average of 52 percent of purchasers reported that they liquidated their savings to support paying for LTC insurance. At age 55 to 64, 41 percent of purchasers liquidate assets to help pay LTC insurance, but 61 percent of those did so among policyholders ages 70 to 74. The

liquidation rate decreases with the level of income as we can expect. Nearly 67 percent of purchasers with incomes of less than $25,000 liquidate assets to pay for LTC insurance, while only 40 percent of those with incomes greater than $50,000 did (HIAA, 2000). On top of that, most of older adults, 99 percent of purchasers, indicate that they purchased their LTC insurance without any financial assistance from their children. In this study the threshold ratio, therefore, is set as 5 percent of income (or 0.05). Then, to allow for sensitivity analysis, we also examine two alternative income thresholds: 3 percent and 7 percent.

4.4. METHODS FOR IMPLEMENTING THE THIRD DEFINITION

This definition of affordability is based on a behavioral model of whether or not individuals purchase LTC insurance. Loosely speaking, an individual can afford LTC insurance if there are other individuals with circumstances similar to their own who are purchasing LTC insurance. To apply the definition, I first estimate a probit regression model for whether an individual actually purchases LTC insurance. I then use the estimated model to identify individuals who can afford coverage, even if they are choosing not to buy it.

The model presumes there are two possible outcomes, purchasing and not-purchasing private LTC insurance. Suppose $h_i = 1$ if subject $i (i = 1, \cdots, N)$ is assigned to purchasing LTC insurance, and $h_i = 0$ if subject i is assigned to not purchasing LTC insurance. Let x_i be a vector of observed measurements or covariates. The model to be estimated can be written:

$$Pr(h_1 = 1|X_1) = Pr(X_i'\beta + \varepsilon_i > 0),$$

where ε_i is assumed to follow a standard normal distribution.

Upon estimating the model I then match non-purchasers with purchasers on the basis of their background measurements (or covariates). Matched subjects have the property that the distribution of observed covariates for the purchasing and non-purchasing groups is almost the same. There is, however, an issue regarding determining how to match subjects within some bands of tolerance.

Stratification (or subclassification) is commonly used technique to control for systematic differences between purchasing and non-purchasing groups. This technique sorts subjects out by strata determined by observed background characteristics. Once the strata are defined, in the same stratum purchasers and non-purchasers are compared directly. If, however, the number of covariates increases, then directly comparing purchasing and non-purchasing groups is not straightforward. Cochran and Chambers (1965) indicates that as the number of covariates increases, the number of strata grows exponentially.

This problem, however, is cleared up by matching on the basis of propensity scores. Because the propensity score is a scalar summary of all the observed background covariates, stratification on it can balance the distributions of the covariates in the purchasing and non-purchasing groups without the exponential increase in number of strata (D'agostino, 1998). We can simply determine strata, using the propensity score, which is estimated by logistic regression. Then the researcher has to decide whether the stratum boundaries should be based on the vales of the propensity score for both groups

combined or in the purchasing and non-purchasing groups alone (D'agostino, 1998). In general, the quintiles of the estimated propensity score from the combined group are employed to determine the cut-offs for the different strata.

I use propensity scores to match non-purchasers to purchasers on the basis of their characteristics.

A. Estimating the propensity score

In a binary response model, a response possibility is:

$$p(\boldsymbol{x}) \equiv P(y = 1|\boldsymbol{x}) = P(y = 1|x_1, x_2, x_3 \cdots x_L)$$

Suppose there are an observed binary variable y and an unobserved (or latent) variable y^* between $-\infty$ and ∞. The latent y^* is assumed to be a linearly structured model as follows:

$$y^* = \boldsymbol{x\beta} + \varepsilon, \qquad y = 1[y^* > 0] ,$$

where ε is independent of $\boldsymbol{x}$ and symmetric about zero.

Binary response model (BRM) is:

$$P(y = 1|\boldsymbol{x}) = G(\boldsymbol{x\beta}) \equiv p(\boldsymbol{x}), \qquad (3)$$

where $\boldsymbol{x}$ is $1 \times L$ and $\boldsymbol{\beta}$ is $L \times 1$. $0 < G(\boldsymbol{v}) < 1$ for all $\varepsilon \in \boldsymbol{\mathcal{R}}$. $G(\boldsymbol{v})$ is an index model since $p(\boldsymbol{x})$ is a function of $\boldsymbol{x}$ only through the index $\boldsymbol{x\beta} = \beta_1 + \beta_2 x_2 + \cdots + \beta_L x_L$.

The probit model employed in this study is the special case of (3) with

$$G(\boldsymbol{v}) \equiv \boldsymbol{\Phi}(\boldsymbol{v}) \equiv \int_{-\infty}^{\boldsymbol{v}} \emptyset(t)dt$$

where $\emptyset(t)$ is the standard normal density,

$$\emptyset(v) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{v^2}{2}\right),$$

and therefore **Φ(.)** is the standard cumulative normal probability distribution, that is:

$$\boldsymbol{\Phi}(\boldsymbol{v}) = \int_{-\infty}^{v} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{t^2}{2}\right) dt \, .$$

The interpretation of a probit coefficient, $\boldsymbol{\beta}$, is that a one-unit increase in the predictor leads to increasing the probit score by $\boldsymbol{\beta}$ standard deviations.

The propensity score is defined in terms of the observed covariates. The main role of the propensity score, therefore, is reducing the dimensions of the conditioning. In estimating the propensity score with a probability model, the selection of which interaction or higher order term to include depends on the need to condition fully on the observable characteristics (Rosenbaum and Rubin, 1983).

Table 4 describes the variables used to predict the purchase of LTC insurance.

Table 4. Variable Definitions

Variable	Definition
Dependent	
LTCI	1 if has private long-term care insurance; 0
Explanatory	
Age	Age at interview
Married	1 if married or partnered; 0 divorced, widowed or never married
Race	
White	1 if white; 0 otherwise
Black	1 if black; 0 otherwise
Other	1 if other race; 0 otherwise
Premium	Monthly premium of the LTC policy
Edu	Years of education
Totincm	Household total income
Employment	
WrkFT	1 if work full time; 0 otherwise
WrkPT	1 if work part-time; 0 otherwise
Ret	1 if retired; 0 otherwise
Disabled	1 if disabled; 0 otherwise
Mcare	1 if eligible for Medicare; 0 otherwise
Mcaid	1 if eligible for Medicaid; 0 otherwise

Emcov	1 if insurance covered by employer; 0 otherwise
Lifins	1 if having life insurance; 0 otherwise
Wealth	Household wealth
Residence	
Home	1 if owns home; 0 otherwise
Rent	1 if rents home; 0 otherwise
Freerent	1 if rents but free; 0 otherwise
Othome	1 if other home; 0 otherwise
Health	
Healthy	1 if self-reported health is excellent, very good, good, or fair; 0 otherwise
ADL	1 if any difficulties on activities of daily living; 0 otherwise
IADL	1 if any difficulties on instrumental activities of daily living; 0 otherwise
Mobil	1 if any functional limitations on mobility, Large Muscle, Gross Fine Motor Activities; 0 otherwise
Memrye	1 if ever had memory-related disease; 0 otherwise
Memryc	1 if have memory-related disease; 0 otherwise
Child	Number of living children
Bro	Number of living brothers
Sis	Number of living sisters
Prob75	Self-reported probability of living to age 75

Prob 85	Self-reported probability of living to age 85 or over

Sample size: 11,663.

In this study, the dependent variable is binary: if the subject has LTC insurance, then the dependent variable, *y*, is defined as 1; otherwise, 0. To check the sensitivity of the findings to how well the model is specified, I use five different models to estimate the propensity score. Model 1 is the simplest model that just includes demographics, education, income, and employment status. Model 2 adds insurance information variables to Model 1, such as eligibility of Medicaid or Medicare, existence of insurance covered by employer, and having life insurance. Wealth and residence information are added to Model 3 so that their effects of wealth and residence on the probability of purchasing LTC insurance can be compared with the first two models. Including these covariates follows the recent study by Bernard, Banthin, and Encinosa (2009) that emphasizes the importance of wealth (or assets) and residence for the decision to purchase acute-care health insurance. Even though the study on LTC insurance is not exactly the same as that of acute-care health insurance, including this information is also worth while in LTC insurance. Model 4 reflects the health status of subjects without including wealth and residence information. The model includes the sources about memory problems as well as daily activities. The final model contains all possible information by adding family structure and life expectancy.

To estimate the propensity score, this study employs a "reduced sample" rather than the whole sample. This approach avoids a large effect of non-purchasers' characteristics

on estimating the propensity score. Instead of using all possible non-purchasers, I randomly select them so that the size of the sample of non-purchasers is balanced with the size of the sample of purchasers, 2,134. Thus, the total size of sample to estimate the propensity score model becomes 4,268.

B. Matching Methods

The essential logic of matching is to find control subjects having backgrounds that are similar to those of treated subjects. The important role of matching is to balance the distributions of all observed pre-treatment characteristics in the treated and control groups, and, therefore, to fulfill independence between potential outcomes and assignment into treatment, resulting in an unbiased estimate.

The use of matching can be found in diverse fields of study. It fits all cases that we have a treatment (or participation), so that we have both a group of treated subjects and a group of non-treated subjects. The character of treatment may be very diverse, such as the effect of online banking on the profitability of customers (Hitt and Frei, 2002), the effect on the percentage bid-ask spread of Canadian firms being interlisted on an US-Exchange (Davies and Kim, 2009), the effect of subsidies on the innovation activities of firms in Germany (Hujer and Radic, 2005), the effect of elite college attendance on career outcomes (Brand and Halaby, 2003), the effect of a migration decision on the wage growth of young men (Ham, Li, and Reagan, 2003), the effect of union membership on wages of employees (Bryson, 2002), and the impact of preschool programs on cognitive,

psycho-social and anthroprometric outcomes of children (Behrman, Cheng, and Todd, 2004).

Matching is a method used to select non-purchasers who are 'matched' with the purchasers on background covariates that the investigator believes need to be controlled. Although the idea of finding matches seems straightforward, it is often difficult to find control subjects who are similar (that is, can be matched) with treated subjects on all important covariates, even when there are only a few background covariates of interest. As mentioned above, conditioning on all observed covariates is restricted in case of a high dimensional vector. In this case, it is impossible to match accurately in practice because an increase in the number of variables raises the number of matching exponentially. Matching with the propensity score, however, solves this problem by allowing an investigator to match on a single scalar variable and control for many background covariates simultaneously. Once the propensity scores are estimated and the purchasers are randomly ordered, all non-purchasers are selected by the following two different matching methods: nearest neighbor matching and caliper matching.

Nearest Neighbor matching

Let's first look at nearest neighbor (NN) matching that is the most popular matching method. Let V_0 and V_1 denote the set of covariates for non-purchases and purchasers respectively. Define a neighborhood $C(P_i)$ for every purchaser i. Denote as neighbors for i those non-purchasers $j \in V_0$ for whom $P_j \in C(P_i)$. Non-purchasers matched to i are in the set K_i, where $K_i = \{j \in V_0 | P_j \in C(P_i)\}$. Nearest neighbor matching sets as follows:

$$C(P_i) = min\left\|P_i - P_j\right\|, \quad j \in V_0,$$

where $\|.\|$ is a norm. The non-purchaser, having the propensity score of P_j that is the nearest to P_i, is chosen as a match.

There are two ways to use this method: (1) reusing P_i for other matches (with replacement), and (2) not reusing it (without replacement). In the case of "with replacement," a non-purchaser can be used more than once as a match, while in the other case it is matched only once. Traditionally, the second method is common, and also used in this study.

Caliper matching

There might be the risk of bad matches if the nearest neighbor is far. This issue can be solved by imposing a tolerance level on a maximum distance $\left\|P_i - P_j\right\|$ allowed. This method is known as caliper matching (Cochrane and Rubin, 1973). A match for subject i is selected only if

$$\left\|P_i - P_j\right\| < \delta, \qquad j \in V_0,$$

where δ is a predefined level of tolerance. As Smith and Todd (2005) point out, a drawback of caliper matching is that it is hard to find *a priori* what choice of the tolerance level is reasonable.

This study applies a variant of caliper matching, called, *radius matching* (Dehejia and Wahba, 2002). It uses all non-purchasers within the caliper as well as the nearest neighbors. This method makes it possible to use as many non-purchasers as available

within the caliper and, therefore, to allow for usage of extra subjects when good matches are available (Caliendo, 2006).

C. Replicating Bundorf and Pauly's method

The behavioral definition is evaluated with another method. Bundorf and Pauly argue that, in theory, one way to examine affordability is to set the threshold based on the preferences of the median person. In the empirical implementation, however, they switch the definition from the median to the predicted probability, that is, 0.5. Since they cannot identify the person with the median preferences, they approximate the median person with the predicted probability of purchasing health insurance. In addition, they vary the threshold probability form 0.5 to 0.8 for sensitivity analysis. In this study, I set the threshold probability at 0.5, and then see how many older Americans have the propensity score that is greater than or equal to 0.5. Also, for sensitivity analysis, I vary the threshold from 0.5 to 0.7.

CHAPTER 5

RESULTS AND DISCUSSION

5.1. SAMPLE CHARACTERISTICS

In 2004, the incomes of the elderly are heavily influenced by ages. Table **5.**5 demonstrates that in their 50s, 41.2 percent of households earn between $5,000 and $49,000. However, only about 63 and 80 percent of households continue to belong to the same range of income in their 60s and 70s, respectively. That is, although in their 50s over half older adults earn more than $50,000, only 34.6 percent and 19.4 percent earn the same level of income in their 60s and 70s, respectively.

Table 5. Household Income by Age

Age \ Income	Less than $5,000	$5,000-$24,999	$25,000-$49,999	$50,000-$99,999	$100,000 or more
51-60	4.7%	18.8%	22.4%	30.7%	23.4%
61-70	2.7	33.1	29.7	21.9	12.7
71-80	0.9	48.2	31.6	14.0	5.4
81-90	2.5	61.3	25.4	8.6	2.2
90 or over	4.6	71.8	16.5	5.6	1.5

Source: RAND HRS.
Sample size: 12,558.

Table 6 represents characteristics of the sample used in this study. The average age of purchasers, 68.40, is higher than those of non-purchasers, 67.72. Married couples and

relatively higher educated persons purchase LTC insurance. Purchasers have much higher total income and total assets. On the other hand, purchasers have lower number of children and siblings. So if they have family members on whom they are able to rely when they need LTC, then they tend not to buy LTC insurance. If they are covered by Medicaid, then they are not willing to have LTC insurance.

5.2. FIRST DEFINITION

Table *7* shows the percentage of households that can afford private LTC insurance under the first definition. Using the poverty level as a gauge for "other spending" after buying LTC insurance, I find that the least-generous policy ("Policy 1") is unaffordable for about 25 percent of households in the whole data set. Even 20 percent of the youngest age group, people in their 50s, cannot afford Policy 1. When the spending threshold is increased to three and four times the poverty thresholds, the affordability is far lower than that of the poverty threshold. With the three times the poverty level, about 65 percent of households in the whole data set cannot afford LTC insurance. We see even higher unaffordability, 75 percent, when using four times poverty level.

Table 6. Characteristics of sample

Variable	LTCI purchasers	LTCI non-purchasers
Sample size	2422	16805
Age	68.40 (9.93)	67.72 (10.75)
Married	0.71 (0.45)	0.63 (0.48)
Race	1.13 (0.40)	1.25 (0.54)
Education	13.60 (2.85)	12.10 (3.34)
Year retired	1992.49 (8.80)	1991.94 (9.30)
Total household income	80739.86 (125243.45)	54527.48 (93010.10)
Total Assets (incl. 2nd home)	681617.89 (1350750.50)	400429.05 (1495095.12)
Pension & Annuity	7760.08 (22140.19)	4500.02 (35660.88)
No. of household member	2.04 (0.85)	2.21 (1.17)
No. of living children	3.17 (1.95)	3.41 (2.12)
No. of living sisters	1.18 (1.32)	1.44 (1.53)
No. of living brothers	1.05 (1.27)	1.25 (1.42)
Prob. to live 75	71.49 (24.91)	63.97 (29.13)
Prob. to live 80+	52.78 (30.80)	48.47 (32.59)
Life insurance (Y/N)	0.76 (0.43)	0.73 (0.89)
Covered by	0.03 (0.16)	0.10 (0.30)

Medicaid (Y/N)		
Covered by Medicare (Y/N)	0.63 (0.48)	0.60 (0.49)
Work (retire=0; not work =1; work=2)	0.66 (0.89)	0.73 (0.89)

Note: Standard deviation in parenthesis.

We know that age at first purchase for LTC insurance is critical. The older the purchaser, the far more expensive is the premium. Age, therefore, is a major factor in the percentage of household that can afford private LTC insurance. With three times the poverty threshold, the least-generous LTC insurance policy is affordable for 50.9 percent of households in their 50s. With the same policy, however, in their 60s, only 39 percent of them can afford LTC insurance. The same thing can be seen in the case of four times the poverty level. While 39 percent of household can afford the least-generous policy in their 50s, only 27.9 percent and 16.8 percent of households have sufficient income to buy the same policy in their 60s and 70s, respectively.

Table 7. The Percentage Who Can Afford Policy by Age and First Definition of Affordability

	AGE	LTCI Policies			
		Policy 1	Policy 2	Policy 3	Policy 4
Poverty level					
	51-60	80.6%	80.4%	79.1%	77.0%
	61-70	78.8	77.9	75.7	67.6
	71-80	76.1	74.0	69.5	50.6
	Total	**75.7**	**73.8**	**70.4**	**58.2**
2 times poverty level					
	51-60	64.5	64.3	63.3	60.8
	61-70	56.4	55.5	53.0	46.8
	71-80	45.5	43.8	40.6	39.2
	Total	**51.3**	**50.0**	**47.8**	**40.1**
3 times poverty level					
	51-60	50.9	50.7	49.9	47.7
	61-70	39.0	38.6	37.0	32.5
	71-80	26.3	25.6	23.9	17.8
	Total	**35.3**	**34.7**	**33.1**	**28.4**

4 times poverty level					
	51-60	39.0	39.0	38.4	36.1
	61-70	27.9	27.5	26.1	23.4
	71-80	16.8	16.2	15.4	11.4
	Total	**25.0**	**24.6**	**23.6**	**20.5**

Source: Author's calculation based on RAND HRS.
Sample size: 12,558.

A much lower percentage of households can afford private LTC insurance when considering the most-generous policy. With the least-generous policy, we see that a relatively higher percentage of households can afford private LTC insurance. That is, if using the most-generous policy at the same age many more households may not be able to purchase private LTC insurance with their income. With the three times threshold, households that don't have sufficient income to purchase the most-generous policy are almost 72 percent in total; even in their 50s about 53 percent of households cannot afford it. In the case of the four times threshold, nearly 80 percent of households are classified as unafforders in total. Even the youngest group reports 36 percent of affordability.

5.3. SECOND DEFINITION

Table *8* shows the simulation results from the analysis of the ratio definition using the standard five income affordability threshold, and also two alternative thresholds of three

and seven percent. The premium-income ratio definition shows slightly different results from those of the first definition.

First, setting the affordability threshold ratio at 0.05, I find about 53 percent of households can afford the least-generous LTC insurance policy. In addition, for people in their 50s, Policy 1 is affordable for almost 93 percent of elderly households. However, only 26 percent of them can bear the costs of the most-generous policy ("Policy 4"). The policy effect is much larger than that of the first definition. When the households buy Policy 3 or Policy 4, there is a sharp decline in affordability compared to Policy 1 or Policy 2. For persons in their 70s, only 1.1 percent are able to afford Policy 4, but nearly 26 percent can afford Policy 1.

By decreasing the threshold ratio to three percent, we can see a little lower affordability for older households. Although 85 percent of households can afford Policy 1 in their 50s, only 10.5 percent are able to bear spending on the same policy in their 70s. As with the 5 percent threshold, changing a policy has a large effect on affordability. At the same age group, for example, people in their 60s, 47.8 percent can afford Policy 1, but only 11.5 percent and 2.4 percent are able to afford Policy 3 and Policy 4, respectively.

Table 8. The Percentage Who Can Afford Policy by Age and Second Definition of Affordability

	AGE	LTCI Policies			
		Policy 1	Policy 2	Policy 3	Policy 4
Less than 3% of income	51-60	85.0%	77.6%	42.4%	12.5%
	61-70	47.8	33.8	11.5	2.4
	71-80	10.5	5.3	1.9	0.3
	Total	**40.0**	**32.0**	**14.9**	**4.0**
Less than 5% of income	51-60	92.8	87.0	64.0	25.9
	61-70	69.5	55.4	25.2	5.4
	71-80	25.9	15.1	5.0	1.1
	Total	**53.3**	**44.3**	**25.7**	**8.6**
Less than 7% of income	51-60	95.3	92.1	75.0	39.4
	61-70	81.9	69.3	38.9	10.2
	71-80	40.7	26.8	10.6	1.8
	Total	**62.2**	**53.3**	**34.5**	**13.7**

Source: Author's calculation based on RAND HRS.
Sample size: 12,558.

The seven percent threshold shows a higher percentage of affordability compared to two other thresholds. However, effects from different ages and policies are still crucial factors on affordability.

In conclusion, age is an important factor for affordability under the second definition, ration definition. In addition to the age effect, the ratio definition has the large policy effect on affordability.

5.4. THIRD DEFINITION

To compute propensity scores, five different models are tested on LTC insurance by a probit model. Tables B.1 through B.4 represent the results of them. Age has a positive effect on LTC insurance purchasing, too. Likewise, purchasers of life insurance tend to buy LTC insurance. Having more than $75,000 in wealth has a positive effect on purchasing private LTC insurance. As expected, if individuals benefit from Medicaid, then they tend not to purchase private LTC insurance. African-Americans and other minorities reported a lower probability of purchasing private LTC insurance, compared to a white group.

Figures A.1 through A.20 present histograms of the distributions of estimated propensity scores for each sample of LTC insurance purchasers and non-purchasers with five models having four different policies. Although the distribution of the propensity score between LTC insurance purchasers and non-purchasers is not exactly separated and there are some overlaps, in general, purchasers' bins belonging to higher propensity scores are taller than those of non-purchasers. In other words, the propensity scores of purchasers are skewed toward relatively higher propensity scores, but those of non-purchasers are inclined to the lower level of propensity scores, as would be expected. With Model 1 that has only demographics, income, and employment status as

explanatory variables, 68.4 percent of purchasers who have the cheapest premium have propensity scores that are more than 0.5, while only 36.2 percent of non-purchasers do. Unlike the expectation, different premiums have almost no effect on the propensity score. Although the most generous premium is employed in the model, the distributions of propensity scores present the similar shape in Model 1. While 68.3 percent of purchasers have the propensity score that is larger than 0.5, only 36.5 percent of non-purchasers have the probability of 0.5. Like the results from the normative definitions, therefore, the difference of premium does not have as a great effect as expected.

Next, we focus on the propensity scores when the model changes. The premium is fixed, but the model varies. For example, consider Policy 1 that is the least generous with five different models, and examine the difference in the propensity scores. Varying premiums with the same model does not produce very different results, but changing models with the same premium shows differences among models. For Model 2 having Policy 1, 68.6 percent and 35.6 percent pertain into the propensity score level of 0.5 or higher, purchasers and non-purchasers respectively. With Model 4 applying the cheapest premium, 77.7 percent of purchasers show that the propensity score is higher than 0.5, whereas 44.4 percent of non-purchasers belong to that level of the propensity scores.

Based on the estimated propensity scores, two matching methods are implemented, radius matching and nearest available matching. First, with radius matching, propensity scores are matched by three different calipers, 0.00003, 0.0005, and 0.0001. In the case of the least generous LTC insurance policy, applying the tightest caliper, 0.00003, Table *9* shows that 20.4 percent of the youngest people can afford LTC insurance in Model 1. At

the same age group with the Model 1, 22 percent and 24.6 percent of people have the money for LTC insurance with a caliper of 0.0005 and 0.0001, respectively. For the oldest group with the tightest caliper in the Model 1, only 17.4 percent can afford LTC insurance.

Next, Model 2 that considers the group that has other insurance, including insurance covered by an employer, Medicaid or Medicare eligibility, and having life insurance. In the case of Model 2 with the cheapest policy, the result is slightly different: the affordability is slightly less than the case of Model 1. Model 2 has more explanatory variables to estimate the propensity scores. When using the tightest caliper for the oldest age group, only 12.2 percent of the elderly can spare sufficient money for LTC insurance. Even with the least expensive premium, if the propensity scores are measured by all observed covariates, then only 4.5 percent of older adults in their 50s can afford LTC insurance when applied the tightest caliper.

Table 9. Radius matching with Policy 1

	Age	Radius		
		±0.00003	±0.0005	±0.0001
Model 1				
	51-60	20.4%	22.0%	24.6%
	61-70	21.4	24.3	28.5
	71-80	17.4	20.3	24.6
	Total	18.2	20.9	25.5
Model 2				
	51-60	16.2	19.1	23.0
	61-70	14.4	17.9	25.4
	71-80	12.2	14.2	20.6
	Total	13.0	15.9	21.9
Model 3				
	51-60	15.0	18.3	25.7
	61-70	12.0	16.2	25.1
	71-80	8.2	12.4	22.4
	Total	10.6	14.4	23.3
Model 4				
	51-60	7.2	10.6	17.5
	61-70	5.6	8.9	16.7

	71-80	6.3	9.4	16.3
	Total	6.0	9.0	15.8
Model 5				
	51-60	4.5	7.7	14.7
	61-70	5.0	8.2	15.3
	71-80	4.5	7.2	15.5
	Total	4.5	7.5	14.9

Sample size:4,288.

Model 3 contains respondents' health status information and life expectancy. It has more observed covariates than the two previous models, and shows relatively different results. The percentage of people who can afford LTC insurance is relatively dramatically reduced. For the youngest group, only 7.2 percent of older adults have enough income and wealth to buy LTC insurance when the narrowest caliper is applied. For the case of the loosest caliper, the affordability is improved of 17.5 percent for the same age group. There is no great difference even when considering people in their 70s: 6.3 percent and 16.3 percent of them can afford private LTC insurance with the caliper of 0.00003 and 0.0001, respectively.

Model 4 has all observed covariates, including information on family structure. In general, many older adults think their children or siblings, even relatives, would take care of them when needing LTC insurance. Most people who need LTC use unpaid services at home from family members and friends. There are people who receive only paid services

at home, but those are fewer than 10 percent. In general, relying solely on assistance from family members is the most common way to get LTC, although there are people who use both paid and unpaid services at home. Therefore, the number of children and siblings can be a serious factor in deciding whether to purchase LTC insurance or not. By using the narrowest caliper in Model 4 for the youngest group, only 4.5 percent of older adults can afford LTC insurance, but with the loosest caliper, 14.7 percent can. In this case, the oldest group reveals almost same results as the youngest group.

There are substantial difference between first two models, Model 1 and Model 2, and last two models, Model 3 and Model 4. In contrast, Model 1 and Model 2 do not have significant differences. There are also no substantial differences between Model 3 and Model 4.

When using Policy 2 for estimating the propensity score, Table *10*, the matching results do not vary greatly from those of Policy 1. Rather, the percentage who can afford LTC insurance policy is less than those of Policy 1 at almost every model and age group. First, in Model 1 with the narrowest caliper, 19.4 percent and 18.2 percent can afford LTC insurance for people in their 50s and 70s, respectively. People who are in their 60s have the largest percentage of affordability. In the case of Policy 1, the youngest group, those in their 50s, is the largest one. In Model 1, 21.3 percent and 29.4 percent of those in their 60s can afford LTC insurance with calipers of 0.00003 and 0.0001, respectively. For people in their 50s, 19.4 percent can afford with the caliper of 0.00003.

Table 10. Radius matching with Policy 2

	Age	Radius		
		±0.00003	±0.0005	±0.0001
Model 1				
	51-60	19.4%	21.5%	24.8%
	61-70	21.3	23.5	29.4
	71-80	18.2	20.9	25.9
	Total	18.2	20.9	26.2
Model 2				
	51-60	17.1	18.6	23.5
	61-70	14.1	18.2	24.9
	71-80	12.6	16.2	21.4
	Total	13.2	16.4	22.2
Model 3				
	51-60	13.3	16.7	26.3
	61-70	11.8	15.3	24.6
	71-80	8.6	13.2	23.2
	Total	10.2	14.1	23.7
Model 4				
	51-60	6.9	9.6	15.0
	61-70	4.9	7.7	16.1

	71-80	5.9	8.6	15.0
	Total	5.6	8.4	14.9
Model 5				
	51-60	4.5	7.3	14.6
	61-70	4.2	6.1	13.3
	71-80	4.4	7.3	14.7
	Total	4.4	7.0	13.9

Sample size:4,288.

Model 2 with Policy 2 shows similar results as Policy 1. With 17.1 percent and 14.1 percent affordability with the tightest caliper for people in their 50s and 60s, respectively, the youngest group has greater affordability than the older one. The oldest group has an even smaller percentage, 12.6 percent with the narrowest caliper. However, although the difference is not huge, with the most relaxed caliper the people who are in their 60s present the largest percentage of affordability, 24.9 percent, compared with 23.5 percent and 21.4 percent for people in their 50s and 70s, respectively.

Model 3 has the unexpected results that those in their 70s have greater affordability than those in their 60s, except for the loosest caliper. However, the youngest age group shows the largest affordability in the calipers of 0.00003 and 0.0005.

Table 11. Radius matching with Policy 3

	Age	Radius		
		±0.00003	±0.0005	±0.0001
Model 1				
	51-60	20.8%	22.6%	27.2%
	61-70	22.6	25.0	30.2
	71-80	19.7	22.6	26.7
	Total	20.0	22.6	27.2
Model 2				
	51-60	17.2	19.9	25.8
	61-70	14.6	17.4	23.9
	71-80	13.0	16.4	23.9
	Total	13.6	16.7	23.0
Model 3				
	51-60	14.2	17.9	25.0
	61-70	13.8	17.7	26.5
	71-80	11.2	14.7	24.3
	Total	11.9	15.7	24.3
Model 4				
	51-60	5.6	8.4	13.6
	61-70	5.9	9.5	16.5

	71-80	5.6	7.4	13.8
	Total	5.5	8.3	14.1
Model 5				
	51-60	4.5	7.9	15.2
	61-70	4.4	7.4	14.4
	71-80	5.1	8.5	15.5
	Total	4.3	7.4	14.4

Sample size:4,288.

Table 12. Radius matching with Policy 4

	Age	Radius		
		±0.00003	±0.0005	±0.0001
Model 1				
	51-60	21.0%	23.6%	25.3%
	61-70	21.2	23.9	30.7
	71-80	19.2	21.5	25.4
	Total	19.5	22.2	27.2
Model 2				
	51-60	16.1	18.8	24.5
	61-70	15.2	17.0	23.6
	71-80	12.7	15.9	21.6
	Total	13.7	16.4	22.6
Model 3				
	51-60	13.4	15.9	25.3
	61-70	12.6	16.4	24.8
	71-80	10.8	14.8	23.5
	Total	11.0	14.6	23.6
Model 4				
	51-60	4.4	7.7	13.0
	61-70	6.3	9.4	16.3

	71-80	5.8	8.4	13.9
	Total	5.5	8.4	14.3
Model 5				
	51-60	4.4	6.8	14.6
	61-70	4.7	8.0	15.5
	71-80	5.5	8.3	14.6
	Total	4.5	7.4	14.4

Sample size:4,288.

When using the most generous policy, Table *12*, all models provide similar results as the three previous premiums. At this point, therefore, I argue that the price of LTC insurance is not a significant factor in the decision to purchase. With two narrow calipers in Model 1, those in their 50s and 60s show analogous results: with the caliper of 0.00003, 21.0 percent of the younger age group and 21.2 percent for the other group, with the caliper of 0.0005, 23.6 percent and 23.9 percent, respectively.

Model 2 presents the same results. Among people in their 50s with the narrowest caliper, only 16.1 percent can have sufficient income to buy LTC insurance.

The results with Model 3 are similar to the results with Model 2. For people inn their 50s, 13.4 percent and 25.3 percent with the calipers of 0.00003 and 0.0001, respectively, are able to afford private LTC insurance.

Model 4 shows comparable results over all policies. With all policies as the percentage of who-can-afford is between four and six percent with the narrowest caliper, it represents the lowest percentage.

Overall, Model 1 has relatively small number of explanatory variables so that it might roughly estimate the propensity score used for matching. It might suggest approximate predictions on affordability of LTC insurance. In contrast, Model 2 and Model 3 present reasonable results. These two models include variables of wealth and residence, and health status, respectively.

In addition to caliper matching, this study tries another matching method, *nearest available matching*. Actually, this matching method is more common in other literatures than the caliper matching method. This method matches the propensity scores of purchasers with that of non-purchasers, and then finds the closet subjects. The outcomes are relatively constant over all models, compared to the radius matching method. The percentages of who-can-afford in all models range from 10 to 20 percent. People who are in their 60s show the largest percentage in all models.

With Policy 4 in Model 1, 24.4 percent of age 60s can afford LTC insurance, and, overall, 22.6 percent of older adults can. As mentioned above, Model 2, 3, and 4 do not show very different results from Model 1. The similar results are reported from Model 5: 17.8 percent and 20.9 percent of the elderly are able to buy LTC insurance in their 50s and 60s, respectively. (See Table *B.5*.)

Finally, I follow Bundorf and Pauly's (2006) behavioral model. They provide the concept of threshold probability. They set at 0.5, and vary the threshold probability to do sensitivity analysis. So this study also sets the threshold probability at 0.5, and varies it as 0.6 and 0.7. First when setting the threshold probability as 0.5, with Model 1 36.6 percent of older adults, in total, can afford LTC insurance: 18.5 percent in their 50s and 44.3

percent in their 60s. When the threshold is raised to 0.7, 7.6 percent of them overall can afford private LTC insurance, but only 1.9 percent in their 50s, and 42.9 percent in their 60s. It shows that quite small numbers of older adults can afford LTC insurance.

Model 2, which has insurance but not health information, shows analogous results with those of Model 1. With P = 0.5, about 36 percent of people can afford LTC regardless of their age. When the threshold is raised to 0.7, the affordability is only 7.6 percent.

The result of Model 3 is not much different from those of the previous two models. Model 3 includes wealth and residence data, but does not have health information. When setting the threshold probability at 0.5, the percentage of people who can afford LTC is about 40 percent; it is 7.7 percent when P = 0.7.

Model 4 and Model 5 reveal similar results with other models, but have slightly larger percentage of affordability. Model 4 has insurance and health information, but not wealth information; Model 5 has all observed covariates. With P = 0.5, LTC insurance is affordable for 42.1 percent and 44.3 percent of older adults in Model 4 and Model 5, respectively. In contrast, only 8.9 percent and 11.9 percent of them have sufficient conditions to purchase LTC insurance. (See Table *B.6* through *B.9*)

Based on these results I argue that all three definitions present substantially consistent results. There are only a small number of older adults who can afford LTC insurance.

CHAPTER 6

CONCLUSIONS

This study finds that the majority of older Americans cannot afford private LTC insurance. Findings from both definitions indicate that lack of affordability can explain why few Americans buy private LTC insurance. Using Definition 1 with the poverty level as a gauge for "other spending," the least-generous policy (Policy 1) is found to unaffordable for about 25 percent of older households in the U.S. Even in their 50s 20 percent of them cannot afford Policy 1. The affordability of Policy 1 is far lower with 3 times poverty level. About 65 percent cannot afford LTC insurance in this case. Even among adults in their 50s, about 49 percent cannot afford a policy when using 3 times poverty level for non-insurance spending.

Using Definition 2 with the 5 percent threshold, 53.3 percent and 8.6 percent of older Americans can afford Policy 1 and Policy 4, respectively. Using the 3 percent threshold with Policy 1 and Policy 4, 40 percent and 4 percent can afford coverage. For the case of the 7 percent, 62.2 percent and 13.7 percent can afford coverage, respectively.

Using Definition 3 with Policy 4, applying caliper matching to Model 2 shows that only 16.1 percent of people at age 50s with the narrowest can have sufficient income to buy LTC insurance. With Model 3 the results are similar with those of Model 2. In their 50s 13.4 percent and 25.3 percent with the calipers of 0.00003 and 0.0001, respectively, are able to afford private LTC insurance. However, Model 4 presents relatively different

outcome. With the calipers of 0.00003 and 0.0001 in their 50s only 4.4 percent and 13.0 percent, respectively, are considered as being able to afford.

An important finding of this study is the role of age. All definitions consistently reveal that affordability drops dramatically as age increases. In the first definition, when I consider 3 times poverty level with Policy 4, the affordability goes down from 47.7 percent to 32.5 percent for those aged 50s and 60s, respectively. The second definition shows a more rapid decline of affordability. In considering a 5 percent threshold ratio with Policy 4, we can see 25.9 percent and 5.4 percent of affordability for those aged 50s and 60s, respectively.

The effect of different policies on affordability varies slightly between definitions. Only the second definition shows a large policy effect, while the first definition indicates small effects. At the 5 percent threshold ratio for adults in their 60s, 69.5 percent can afford Policy 1, but only 5.4 percent of them can afford Policy 4. With the second definition, therefore, there is a large policy effect as well for age. In contrast, the first definition has relatively small affordability variation due to policy changes. In all age groups, the effects of policies are not quite as large.

By contrasting and comparing results from three definitions, I can draw more general conclusions regarding of the role of affordability in explaining non-purchase. This is critical point for the study of affordability. Because the level of the bearable cost is subjective the concept of affordability is difficult to define. Therefore, there is no consensus on the definition of affordability. Regardless of definition, there is a low level of affordability of private LTC insurance among older adults. In other words, both

definitions consistently show that a minority of older adults can afford private LTC insurance. As a result, the lack of affordability is undoubtedly a substantial barrier of the uninsured on LTC. To make private LTC insurance supportable for financial resources on LTC spending, as the results of this study propose, the fundamentals of unaffordability should be resolved so that the private LTC insurance can be the alternative method to supply financial supports on LTC spending.

Unlike other previous studies on the affordability of private LTC insurance that used much smaller samples, often from private companies, this study uses nationally representative data from the 2004 HRS and the Rand HRS files. The HRS surveys more than 22,000 Americans over age 50 every other year, and provides extensive information on the utilization of formal LTC services and informal care, as well as demographic characteristics, family structure, financial resources, employment, insurance coverage, and health and disability. The Rand HRS data contains all waves from HRS by only incorporating the core interviews although the HRS contains several auxiliary files. So using these two data sets enables generalization of my findings to older adults nationwide in the U.S.

The findings from this study have implications for policymakers. The findings suggest that size of a private market for LTC insurance may be severely limited because most older adults cannot afford coverage. A small market throws doubt on the role of private insurance in the formation of financial supports to protect the aged against LTC expenditures. In other words, there is a possibility that the potential market could remain relatively small in terms of its capacity to protect large segments of the elderly against

LTC risks. Moreover, private insurance still appears a relatively unattractive investment even for many affluent potential purchasers based on the comparison of total expected lifetime consumption and insurance costs.

APPENDIX A

Figure A. 1. Distribution of Propensity Score - Model 1 with Policy 1

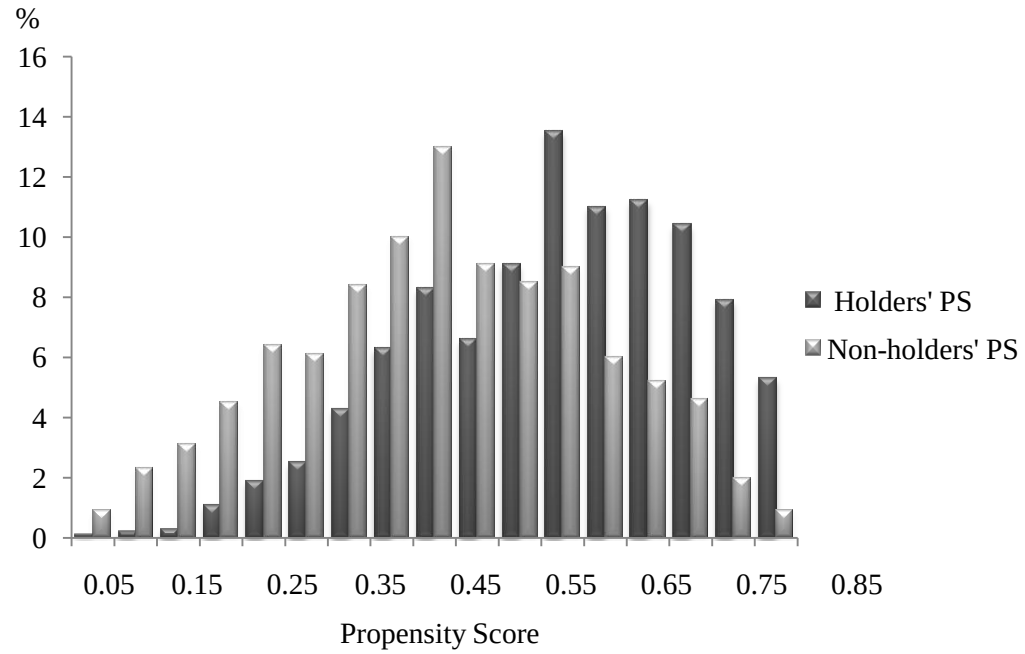


Figure A. 2. Distribution of Propensity Score - Model 2 with Policy 1

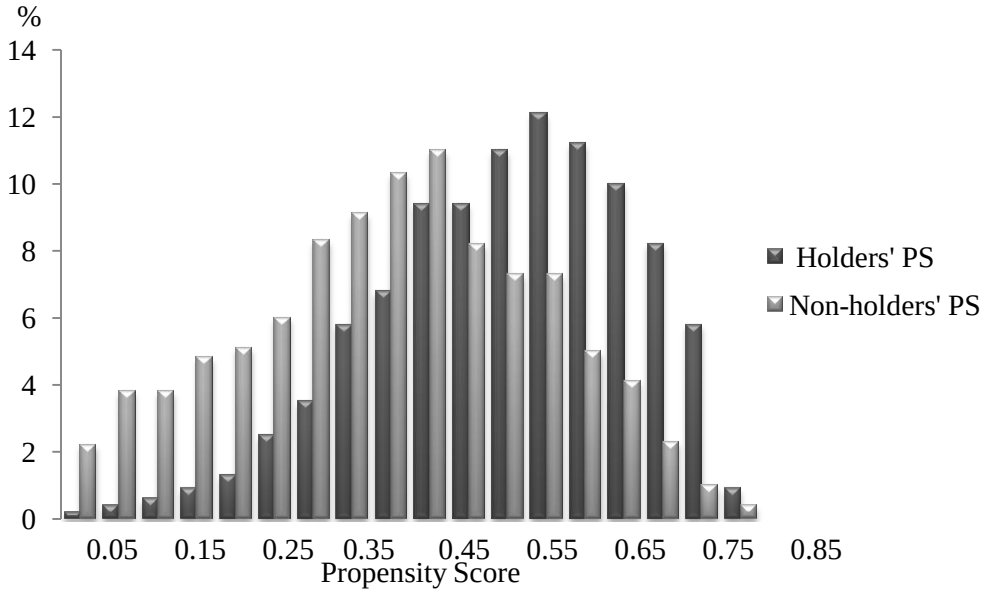


Figure A. 3 . Distribution of Propensity Score - Model 3 with Policy 1

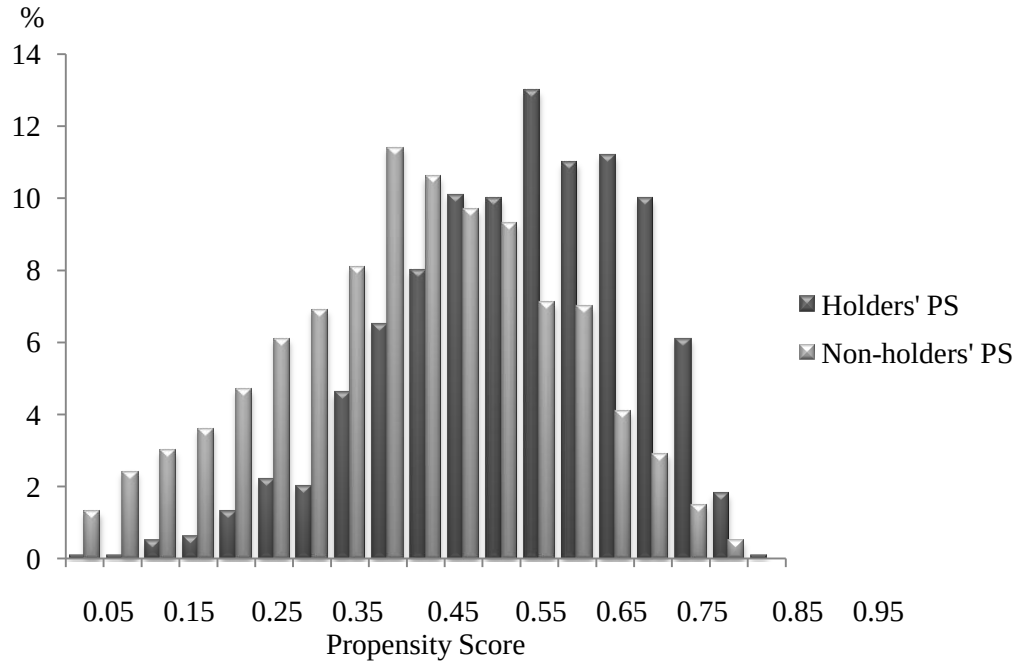


Figure A. 4 . Distribution of Propensity Score - Model 4 with Policy 1

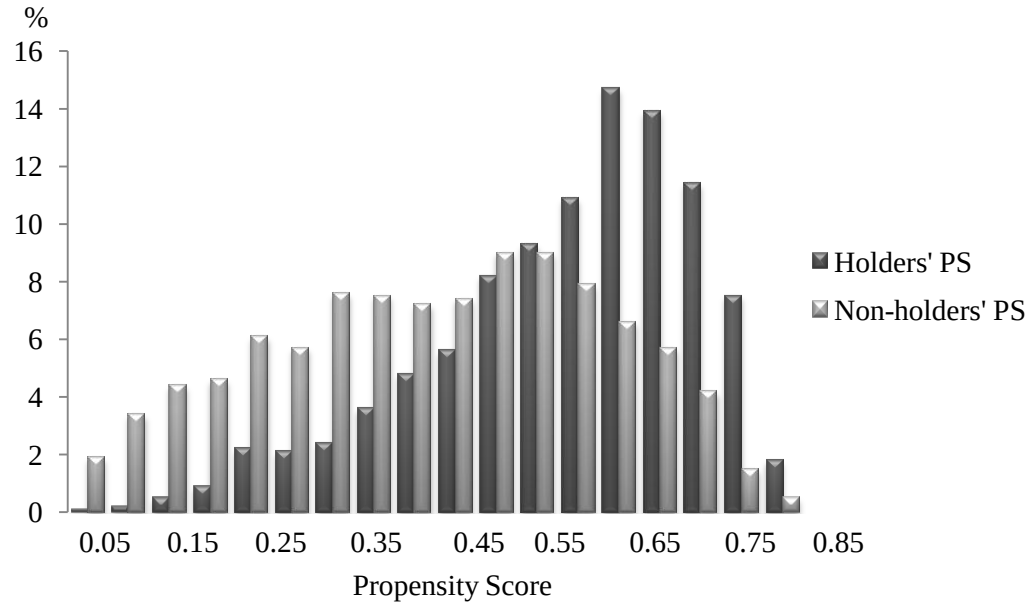


Figure A. 5 . Distribution of Propensity Score - Model 5 with Policy 1

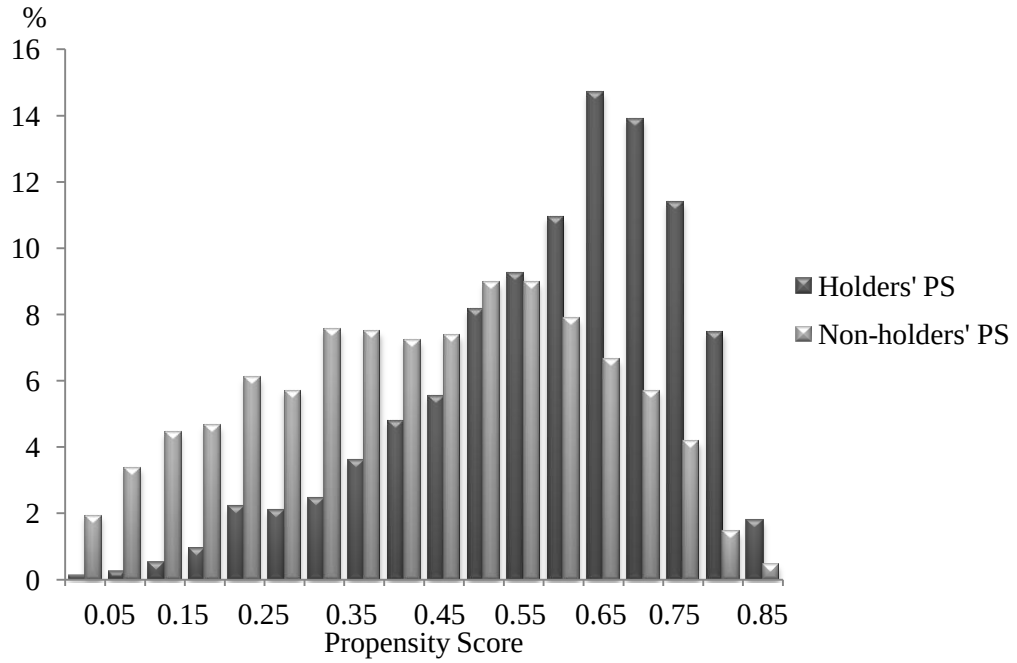


Figure A. 6 . Distribution of Propensity Score - Model 1 with Policy 2

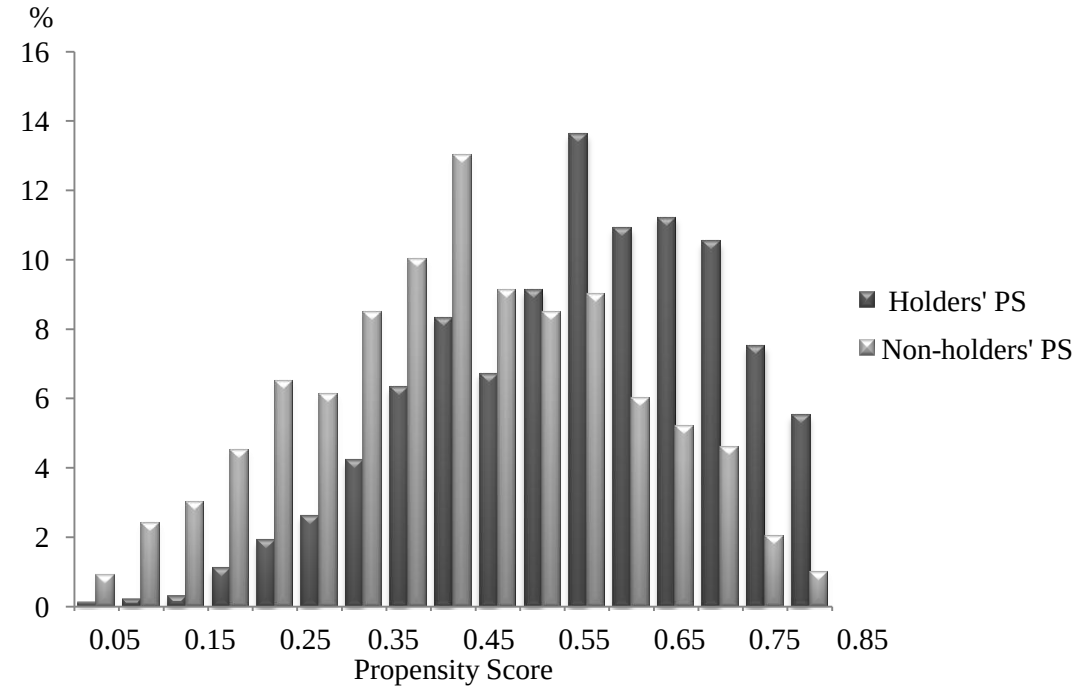


Figure A. 7 . Distribution of Propensity Score - Model 2 with Policy 2

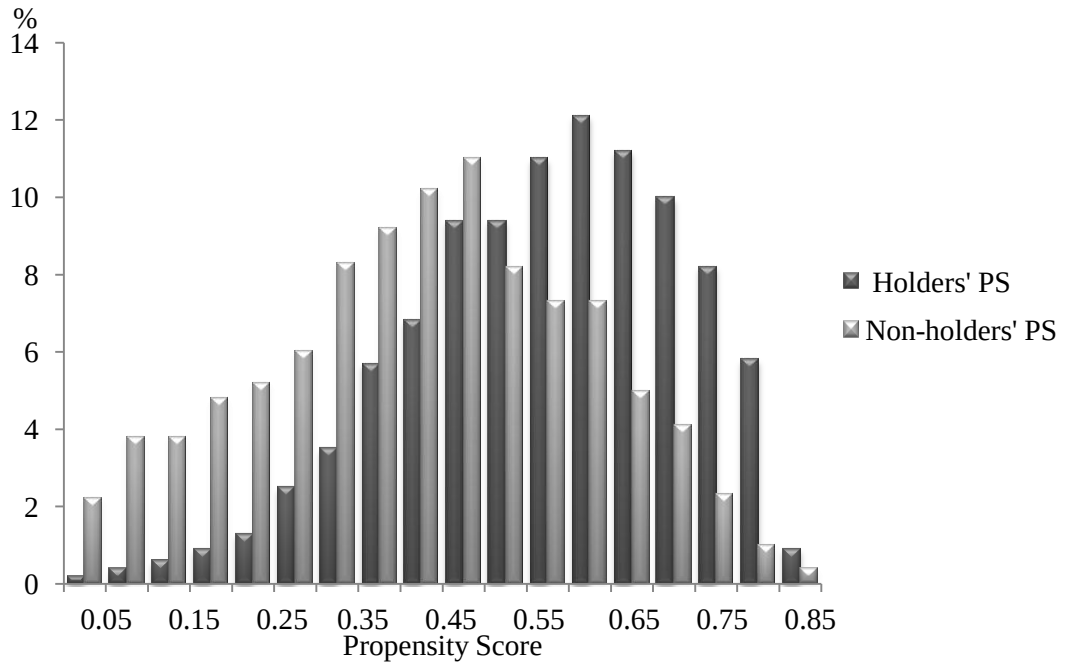


Figure A. 8 . Distribution of Propensity Score - Model 3 with Policy 2

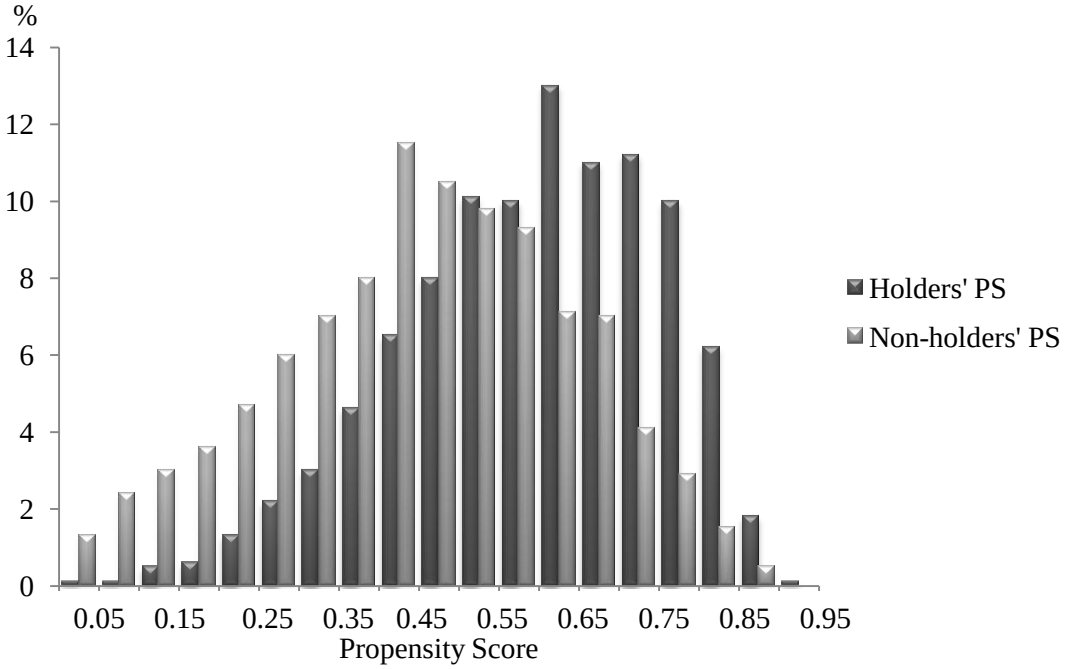


Figure A. 9 .Distribution of Propensity Score - Model 4 with Policy 2

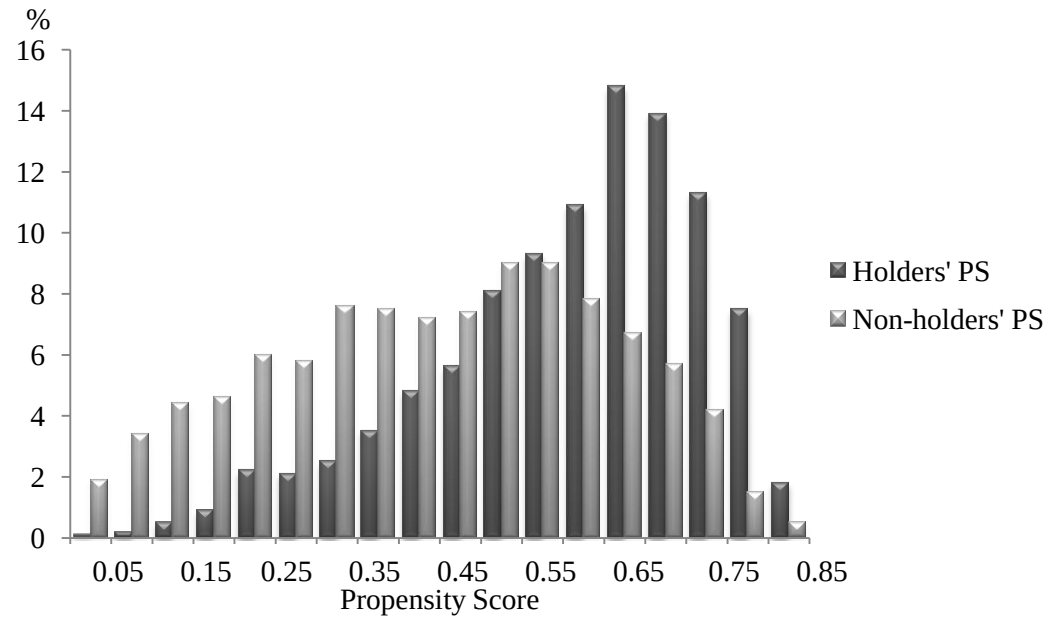


Figure A. 10 . Distribution of Propensity Score - Model 5 with Policy 2

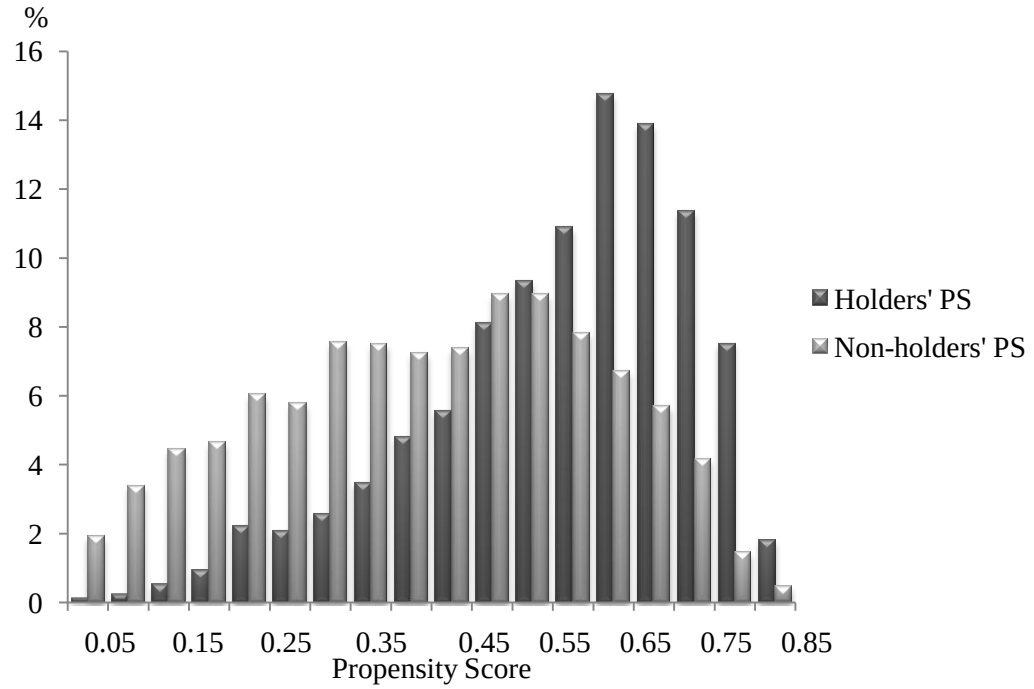


Figure A. 11. Distribution of Propensity Score - Model 1 with Policy 3

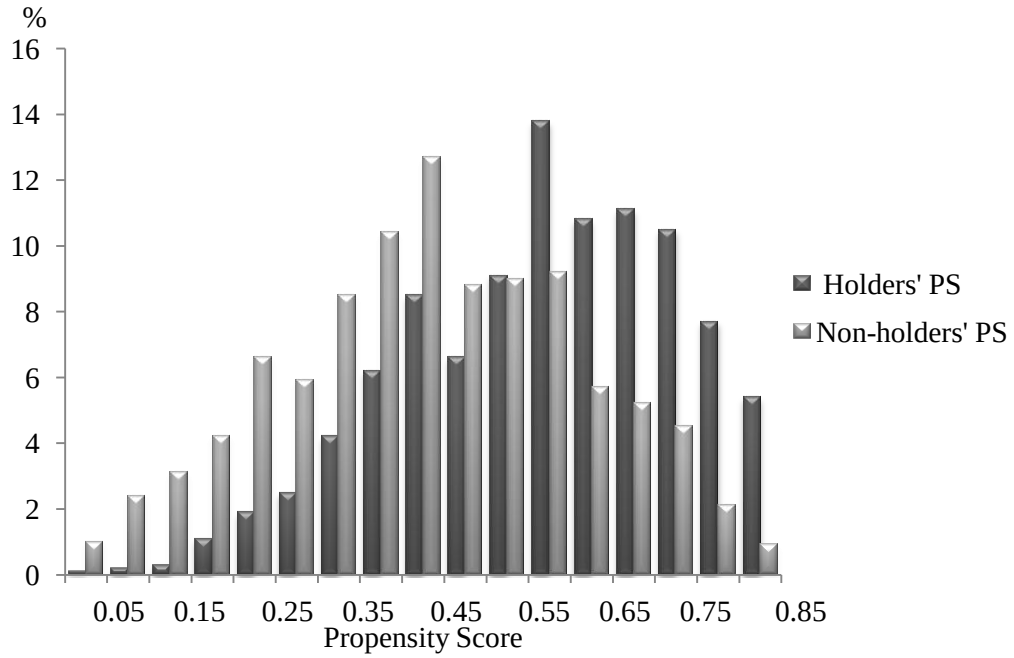


Figure A. 12. Distribution of Propensity Score - Model 2 with Policy 3

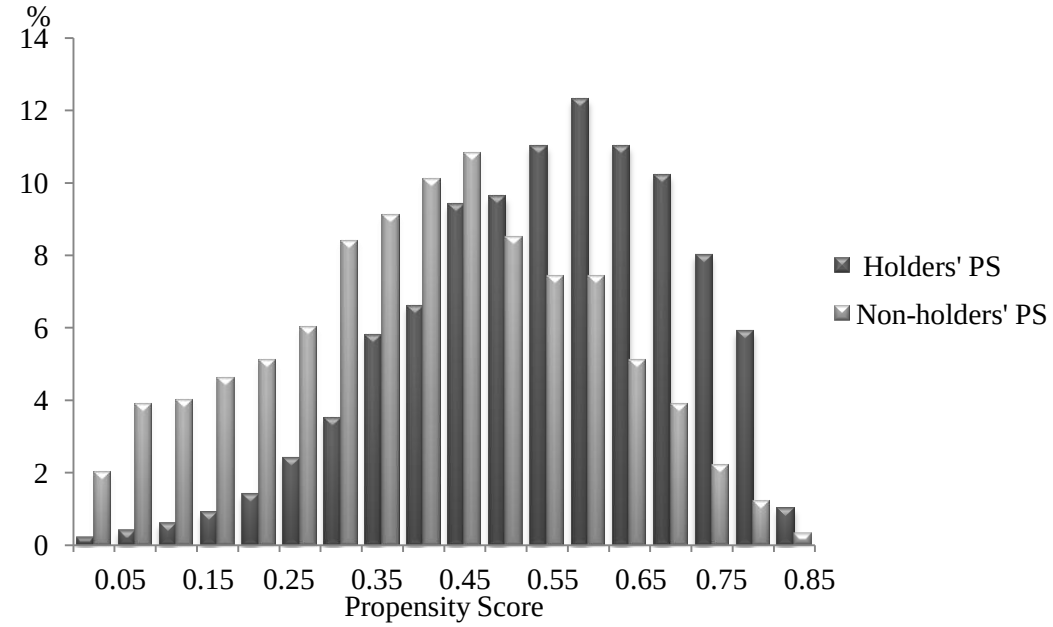


Figure A. 13. Distribution of Propensity Score - Model 3 with Policy 3

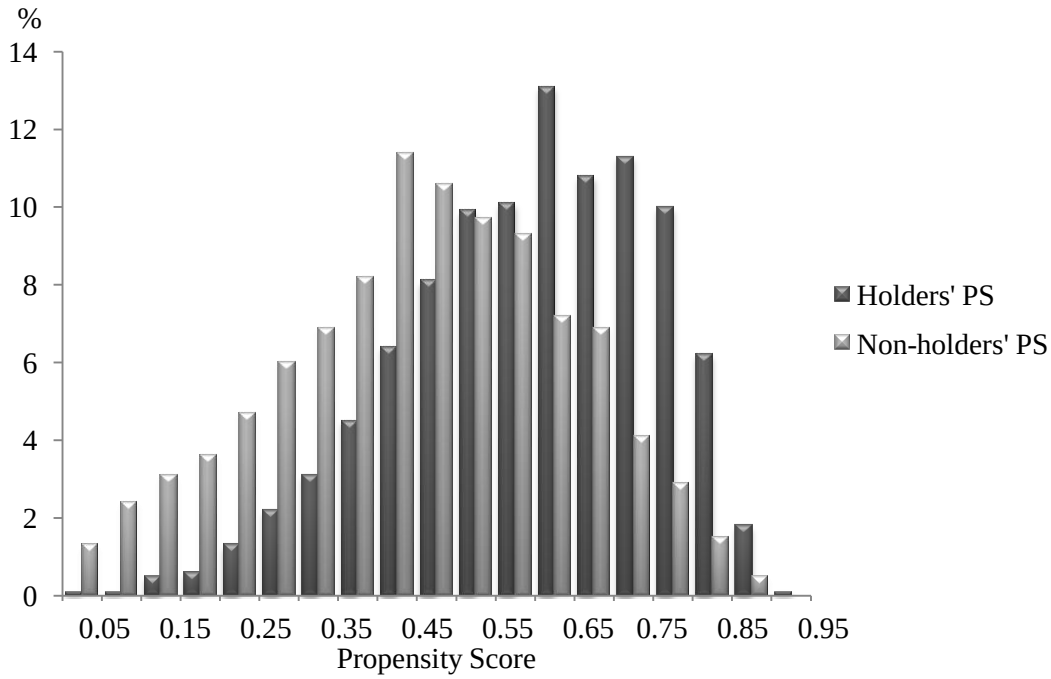


Figure A. 14. Distribution of Propensity Score - Model 4 with Policy 3

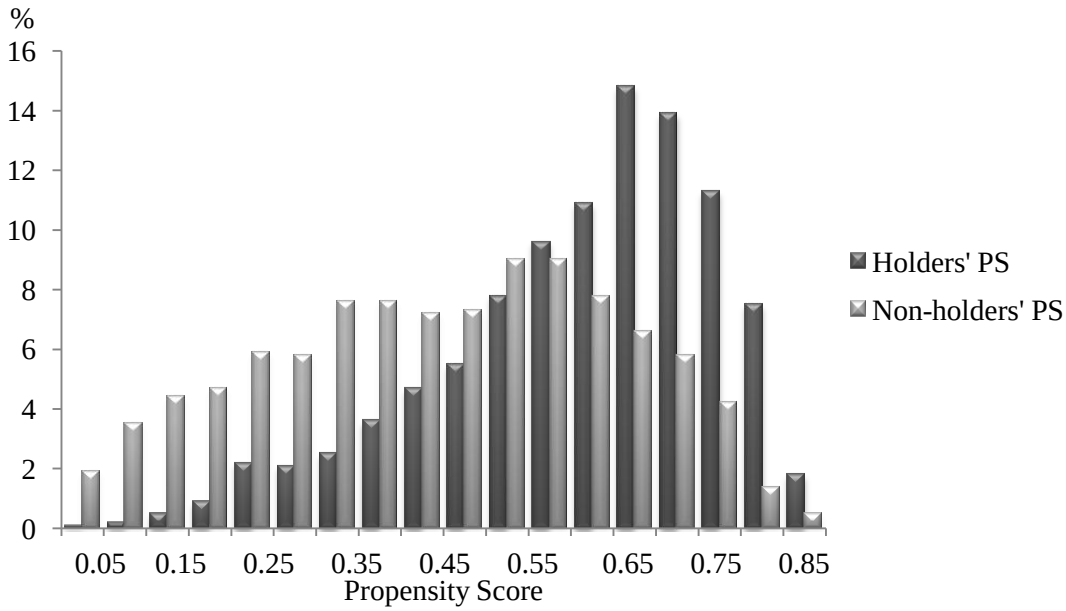


Figure A. 15. Distribution of Propensity Score - Model 5 with Policy 3

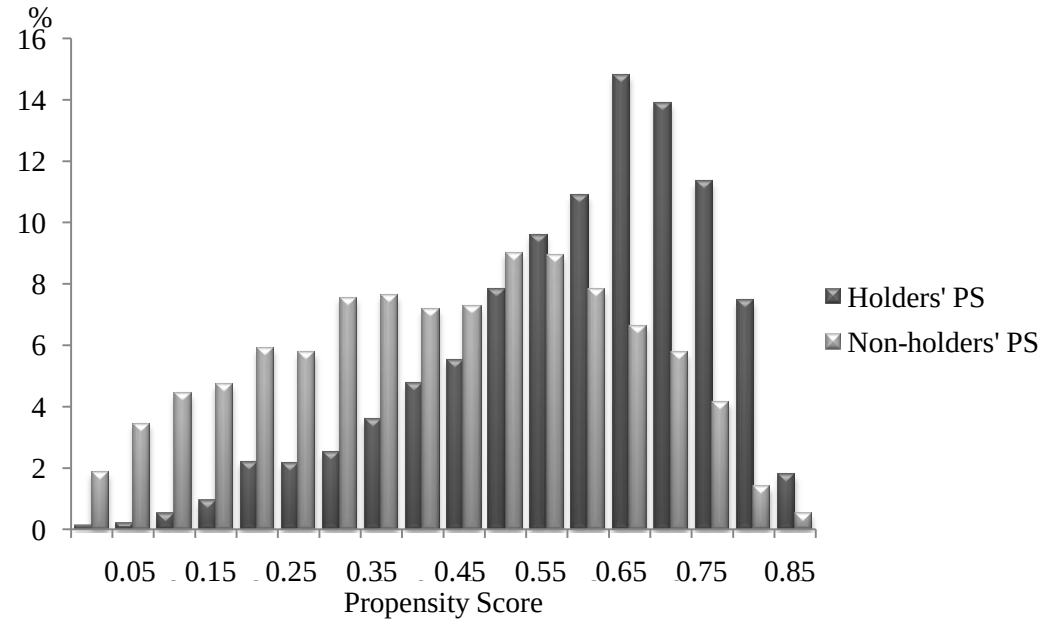


Figure A. 16. Distribution of Propensity Score - Model 1 with Policy 4

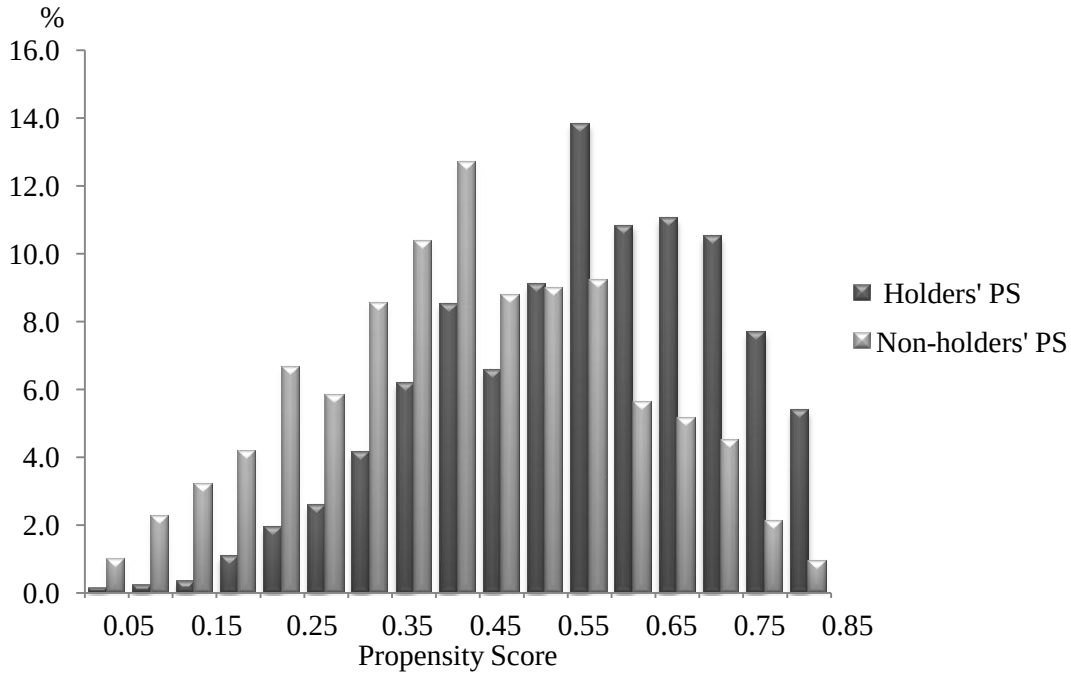


Figure A. 17. Distribution of Propensity Score - Model 2 with Policy 4

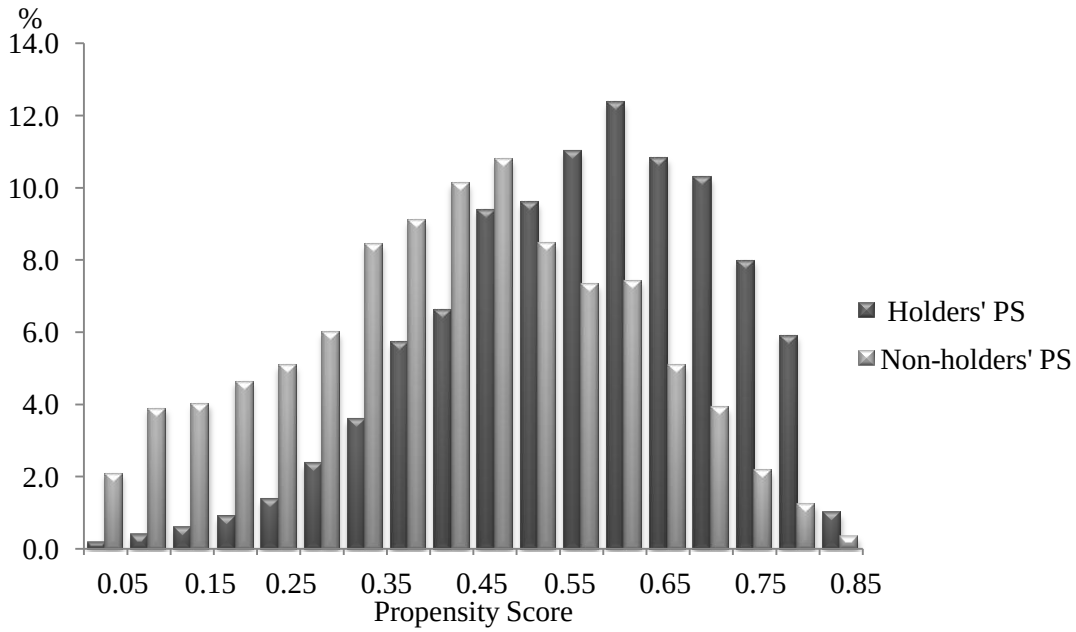


Figure A. 18. Distribution of Propensity Score - Model 3 with Policy 4

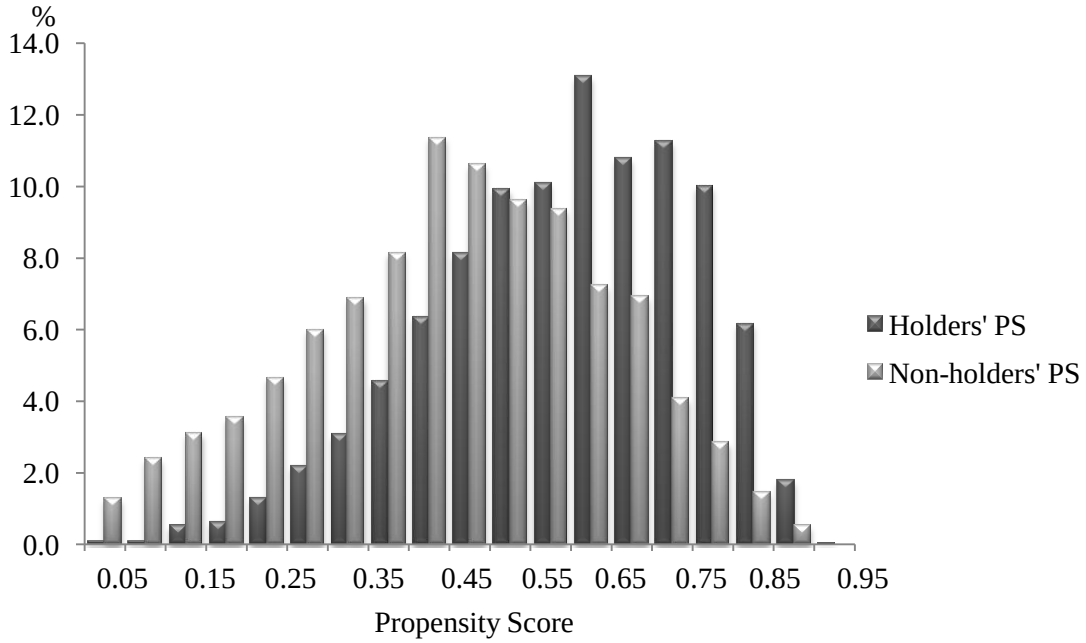


Figure A. 19. Distribution of Propensity Score - Model 4 with Policy 4

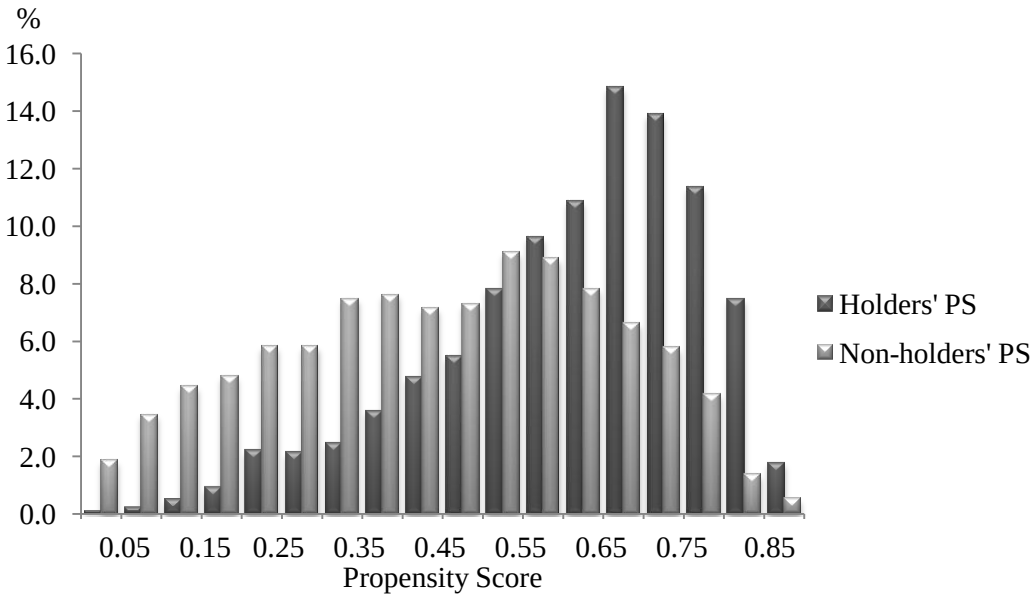
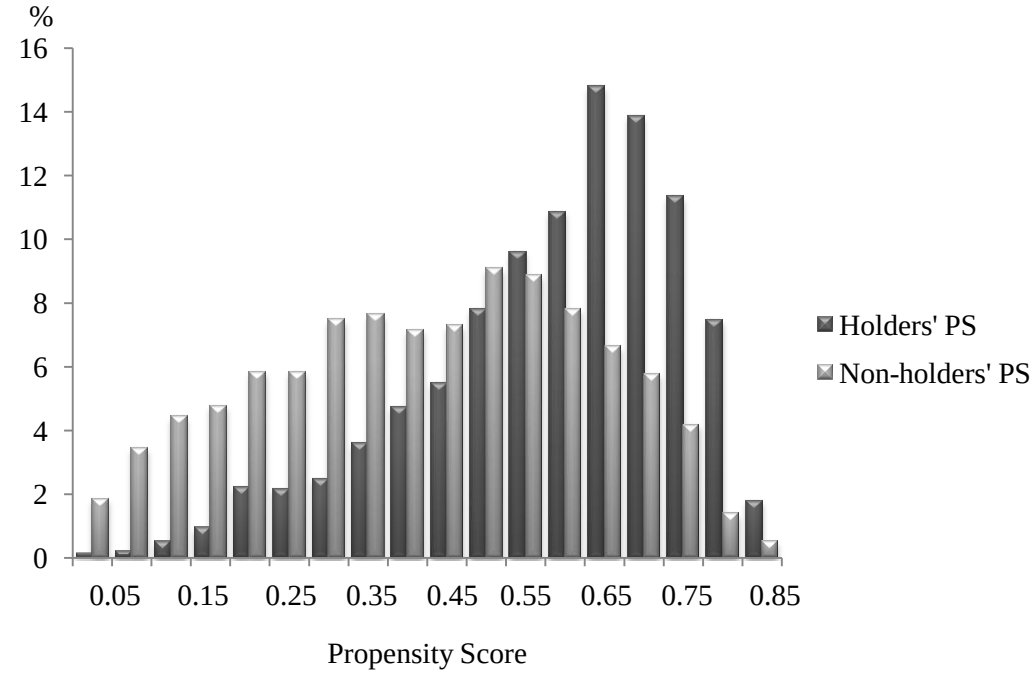


Figure A. 20. Distribution of Propensity Score - Model 5 with Policy 4



APPENDIX B

Table B. 1. Regression results from estimating propensity score

(Dependent variable: LTC insurance; Policy 1)

Variable	Coefficients				
	Model 1	Model 2	Model 3	Model 4	Model 5
Age	0.036***	0.036***	0.032***	0.034***	0.026***
	(0.005)	(0.006)	(0.007)	(0.008)	(0.009)
Married	-0.041	-0.050	-0.118**	-0.046	-0.101*
	(0.050)	(0.051)	(0.055)	(0.055)	(0.061)
Race[1]					
Black	-0.245***	-0.260***	-0.135*	-0.265***	-0.139*
	(0.067)	(0.069)	(0.073)	(0.077)	(0.084)
Other	-0.392***	-0.367***	-0.295**	-0.384***	-0.320**
	(0.124)	(0.127)	(0.131)	(0.138)	(0.145)
Premium	-0.003***	-0.002***	-0.002***	-0.001*	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Premium/Income	-0.084	-0.091	-0.138	-0.075	-0.117
	(0.106)	(0.120)	(0.141)	(0.105)	(0.121)
Edu	0.086***	0.080***	0.063***	0.071***	0.050***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)
Total income[2]					

[$5,000, $25,000]	-0.213	-0.312	-0.577***	-0.363*	-0.550**
	(0.191)	(0.195)	(0.217)	(0.220)	(0.243)
[$25,000, $50,000]	0.204	0.057	-0.282	-0.024	-0.296
	(0.192)	(0.197)	(0.219)	(0.221)	(0.245)
[$50,000, $100,000]	0.416**	0.247	-0.162	0.149	-0.193
	(0.194)	(0.199)	(0.222)	(0.224)	(0.247)
$100,000 <	0.543***	0.381*	-0.080	0.259	-0.126
	(0.198)	(0.203)	(0.226)	(0.227)	(0.251)
Employment[3]					
WrkFT	-0.028	-0.165*	-0.108	-0.167*	-0.102
	(0.084)	(0.088)	(0.095)	(0.095)	(0.103)
WrkPT	-0.051	-0.107	-0.172	-0.137	-0.197
	(0.118)	(0.120)	(0.128)	(0.128)	(0.137)
Ret	0.180**	0.122*	0.116	0.136*	0.139
	(0.072)	(0.074)	(0.079)	(0.080)	(0.086)
Disabled	-0.120	-0.032	0.059	0.079	0.101
	(0.178)	(0.184)	(0.198)	(0.218)	(0.234)
Mcare		0.015	-0.003	0.035	-0.015
		(0.072)	(0.078)	(0.088)	(0.096)
Mcaid		-0.353***	-0.266**	-0.282**	-0.172
		(0.102)	(0.116)	(0.123)	(0.137)
Emcov		0.116**	0.091*	0.151***	0.123**

	(0.048)	(0.051)	(0.052)	(0.055)
Lifins	0.333***	0.344***	0.304***	0.319***
	(0.074)	(0.050)	(0.051)	(0.055)
Wealth[4]				
[$5,000, $25,000]		0.070		0.261
		(0.141)		(0.163)
[$25,000, $75,000]		0.115		0.171
		(0.132)		(0.152)
[$75,000, $200,000]		0.273**		0.366**
		(0.127)		(0.147)
$200,000 <		0.636***		0.721***
		(0.128)		(0.149)
Residence[5]				
Rent		-0.033		-0.071
		(0.091)		(0.100)
Freerent		-0.260		-0.426*
		(0.187)		(0.218)
Othome		0.096		0.098
		(0.162)		(0.190)
Health				
Healthy			0.177	0.125
			(0.112)	(0.122)

ADL				-0.045	-0.057
				(0.048)	(0.053)
IADL				-0.177*	-0.195*
				(0.091)	(0.100)
Mobil				-0.030	0.005
				(0.022)	(0.024)
Memrye				0.287	0.467
				(0.476)	(0.512)
Memryc				-0.059	-0.249
				(0.521)	(0.573)
Child					-0.009
					(0.012)
Bro					-0.023
					(0.020)
Sis					0.005
					(0.019)
Prob75				0.000	-0.000
				(0.001)	(0.001)
Prob 85				0.002**	0.002**
				(0.001)	(0.001)
Intercept	-3.554***	-3.557***	-3.144***	-3.511***	-2.875***
	(0.359)	(0.430)	(0.473)	(0.554)	(0.618)

Sample size: 4,267.
Note:
1: The reference group is white.
2: The reference group is total income < $5,000.
3: The reference group is not in the labor force.
4: The reference group is total wealth < $5,000.
5: The reference group is home owners.
***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table B. 2. Regression results from estimating propensity score

(Dependent variable: LTC insurance; Policy 2)

Variable	Coefficients				
	Model 1	Model 2	Model 3	Model 4	Model 5
Age	0.036***	0.036***	0.032***	0.034***	0.026***
	(0.005)	(0.006)	(0.007)	(0.008)	(0.009)
Married	-0.041	-0.050	-0.118**	-0.046	-0.101*
	(0.050)	(0.051)	(0.055)	(0.055)	(0.061)
Race[1]					
Black	-0.245***	-0.260***	-0.135*	-0.265***	-0.139*
	(0.067)	(0.069)	(0.073)	(0.077)	(0.084)
Other	-0.392***	-0.367***	-0.295**	-0.384***	-0.320**
	(0.124)	(0.127)	(0.131)	(0.138)	(0.145)
Premium	-0.002***	-0.002***	-0.001***	-0.001*	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Premium/Income	-0.054	-0.058	-0.091	-0.048	-0.077
	(0.070)	(0.079)	(0.095)	(0.070)	(0.081)
Edu	0.086***	0.080***	0.063***	0.071***	0.050***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)
Total income[2]					
[$5,000, $25,000]	-0.211	-0.310	-0.574***	-0.361	-0.548**

	(0.191)	(0.195)	(0.217)	(0.220)	(0.243)
[$25,000, $50,000]	0.206	0.059	-0.280	-0.022	-0.293
	(0.192)	(0.197)	(0.219)	(0.221)	(0.244)
[$50,000, $100,000]	0.418**	0.249	-0.160	0.151	-0.191
	(0.194)	(0.199)	(0.221)	(0.223)	(0.247)
$100,000 <	0.545**	0.384*	-0.077	0.261	-0.123
	(0.198)	(0.203)	(0.225)	(0.227)	(0.251)
Employment[3]					
WrkFT	-0.028	-0.165*	-0.108	-0.167*	-0.102
	(0.084)	(0.088)	(0.095)	(0.095)	(0.103)
WrkPT	-0.050	-0.107	-0.172	-0.137	-0.197
	(0.118)	(0.120)	(0.128)	(0.128)	(0.137)
Ret	0.180**	0.122**	0.116	0.136*	0.139
	(0.072)	(0.074)	(0.079)	(0.080)	(0.086)
Disabled	-0.120	-0.031	0.059	0.080	0.102
	(0.178)	(0.184)	(0.198)	(0.218)	(0.234)
Mcare		0.014	-0.004	0.034	-0.015
		(0.072)	(0.078)	(0.088)	(0.096)
Mcaid		-0.353***	-0.266**	-0.282**	-0.172
		(0.102)	(0.116)	(0.123)	(0.137)
Emcov		0.116**	0.091*	0.151***	0.123**
		(0.048)	(0.051)	(0.052)	(0.055)

Lifins	0.333***	0.344***	0.304***	0.319***
	(0.047)	(0.050)	(0.051)	(0.055)
Wealth[4]				
[$5,000, $25,000]		0.069		0.260
		(0.141)		(0.163)
[$25,000, $75,000]		0.115		0.171
		(0.132)		(0.152)
[$75,000, $200,000]		0.272**		0.366**
		(0.127)		(0.147)
$200,000 <		0.635***		0.720***
		(0.128)		(0.149)
Residence[5]				
Rent		-0.033		-0.071
		(0.091)		(0.100)
Freerent		-0.260		-0.426*
		(0.187)		(0.218)
Othome		0.095		0.098
		(0.162)		(0.190)
Health				
Healthy			0.177	0.125
			(0.112)	(0.122)
ADL			-0.045	-0.057

				(0.048)	(0.053)
IADL				-0.177*	-0.195*
				(0.091)	(0.100)
Mobil				-0.030	0.006
				(0.022)	(0.024)
Memrye				0.288	0.467
				(0.476)	(0.512)
Memryc				-0.059	-0.249
				(0.521)	(0.573)
Child					-0.009
					(0.012)
Bro					-0.023
					(0.020)
Sis					0.005
					(0.019)
Prob75				0.000	-0.000
				(0.001)	(0.001)
Prob 85				0.002**	0.002**
				(0.001)	(0.001)
Intercept	-3.544***	-3.550***	-3.139***	-3.513***	-2.879***
	(0.357)	(0.428)	(0.471)	(0.552)	(0.616)

Sample size: 4,267.
Note:
1: The reference group is white.

2: The reference group is total income < $5,000.
3: The reference group is not in the labor force.
4: The reference group is total wealth < $5,000.
5: The reference group is home owners.
***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table B. 3. Regression results from estimating propensity score

(Dependent variable: LTC insurance; Policy 3)

Variable	Coefficients				
	Model 1	Model 2	Model 3	Model 4	Model 5
Age	0.036***	0.036***	0.032***	0.034***	0.026***
	(0.005)	(0.006)	(0.007)	(0.009)	(0.010)
Married	-0.039	-0.048	-0.117**	-0.045	-0.100
	(0.050)	(0.051)	(0.055)	(0.055)	(0.061)
Race[1]					
Black	-0.245***	-0.260***	-0.135*	-0.265***	-0.139*
	(0.067)	(0.069)	(0.073)	(0.077)	(0.084)
Other	-0.392***	-0.368***	-0.296**	-0.384***	-0.320**
	(0.124)	(0.127)	(0.131)	(0.138)	(0.145)
Premium	-0.002***	-0.001***	-0.001***	-0.001*	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Premium/Income	-0.017	-0.017	-0.029	-0.015	-0.026
	(0.025)	(0.027)	(0.032)	(0.025)	(0.029)
Edu	0.086***	0.080***	0.063***	0.071***	0.050***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)
Total income[2]					
[$5,000, $25,000]	-0.201	-0.297	-0.558***	-0.350	-0.532**

	(0.190)	(0.193)	(0.215)	(0.219)	(0.241)
[$25,000, $50,000]	0.217	0.073	-0.263	-0.011	-0.277
	(0.191)	(0.195)	(0.217)	(0.220)	(0.242)
[$50,000, $100,000]	0.429**	0.262	-0.143	0.162	-0.176
	(0.193)	(0.198)	(0.220)	(0.222)	(0.245)
$100,000 <	0.555***	0.397**	-0.061	0.272	-0.108
	(0.197)	(0.201)	(0.224)	(0.226)	(0.249)
Employment[3]					
WrkFT	-0.030	-0.166*	-0.109	-0.167*	-0.102
	(0.084)	(0.088)	(0.095)	(0.095)	(0.103)
WrkPT	-0.051	-0.107	-0.172	-0.137	-0.198
	(0.118)	(0.120)	(0.128)	(0.128)	(0.137)
Ret	0.181**	0.122*	0.116	0.136*	0.139
	(0.072)	(0.074)	(0.079)	(0.080)	(0.086)
Disabled	-0.120	-0.034	0.056	0.079	0.101
	(0.178)	(0.184)	(0.198)	(0.218)	(0.234)
Mcare		0.020	0.001	0.035	-0.014
		(0.072)	(0.078)	(0.088)	(0.096)
Mcaid		-0.351***	-0.264**	-0.281**	-0.171
		(0.102)	(0.115)	(0.123)	(0.137)
Emcov		0.117**	0.092*	0.151***	0.124**
		(0.048)	(0.051)	(0.052)	(0.055)

Lifins	0.333***	0.344***	0.304***	0.319***
	(0.047)	(0.050)	(0.051)	(0.055)
Wealth[4]				
[$5,000, $25,000]		0.067		0.258
		(0.141)		(0.163)
[$25,000, $75,000]		0.115		0.171
		(0.132)		(0.152)
[$75,000, $200,000]		0.272**		0.365**
		(0.127)		(0.147)
$200,000 <		0.635***		0.720***
		(0.128)		(0.149)
Residence[5]				
Rent		-0.034		-0.071
		(0.091)		(0.100)
Freerent		-0.260		-0.425*
		(0.187)		(0.218)
Othome		0.090		0.093
		(0.162)		(0.190)
Health				
Healthy			0.177	0.125
			(0.112)	(0.122)
ADL			-0.046	-0.058

				(0.048)	(0.053)
IADL				-0.178*	-0.196**
				(0.091)	(0.100)
Mobil				-0.030	0.006
				(0.022)	(0.024)
Memrye				0.286	0.466
				(0.476)	(0.512)
Memryc				-0.058	-0.248
				(0.521)	(0.573)
Child					-0.009
					(0.012)
Bro					-0.024
					(0.020)
Sis					0.005
					(0.019)
Prob75				0.000	-0.000
				(0.001)	(0.001)
Prob 85				0.002**	0.002**
				(0.001)	(0.001)
Intercept	-3.525***	-3.516***	-3.114***	-3.515***	-2.877***
	(0.355)	(0.423)	(0.467)	(0.558)	(0.622)

Sample size: 4,267.
Note:
1: The reference group is white.

2: The reference group is total income < $5,000.
3: The reference group is not in the labor force.
4: The reference group is total wealth < $5,000.
5: The reference group is home owners.
***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table B. 4. Regression results from estimating propensity score

(Dependent variable: LTC insurance; Policy 4)

Variable	Coefficients				
	Model 1	Model 2	Model 3	Model 4	Model 5
Age	0.036***	0.036***	0.032***	0.034***	0.026**
	(0.005)	(0.006)	(0.007)	(0.009)	(0.010)
Married	-0.039	-0.048	-0.117**	-0.045	-0.100
	(0.050)	(0.051)	(0.055)	(0.055)	(0.061)
Race[1]					
Black	-0.245***	-0.260***	-0.135*	-0.265***	-0.139*
	(0.067)	(0.069)	(0.073)	(0.077)	(0.084)
Other	-0.392***	-0.368***	-0.296**	-0.384***	-0.320**
	(0.124)	(0.127)	(0.131)	(0.138)	(0.145)
Policy	-0.001***	-0.001***	-0.000***	-0.0004*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Premium/Income	-0.007	-0.007	-0.012	-0.006	-0.010
	(0.010)	(0.011)	(0.013)	(0.010)	(0.012)
Edu	0.086***	0.080***	0.063***	0.071***	0.050***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)
Total income[2]					
[$5,000, $25,000]	-0.201	-0.297	-0.558**	-0.350	-0.532**

	(0.190)	(0.193)	(0.215)	(0.219)	(0.241)
[$25,000, $50,000]	0.217	0.073	-0.262	-0.011	-0.277
	(0.191)	(0.195)	(0.217)	(0.220)	(0.242)
[$50,000,	0.429**	0.262	-0.143	0.162	-0.175
$100,000]	(0.193)	(0.198)	(0.220)	(0.222)	(0.245)
$100,000 <	0.555***	0.397**	-0.061	0.272	-0.108
	(0.197)	(0.201)	(0.224)	(0.226)	(0.249)
Employment[3]					
WrkFT	-0.030	-0.166*	-0.109	0.167*	-0.102
	(0.084)	(0.088)	(0.095)	(0.095)	(0.103)
WrkPT	-0.051	-0.107	-0.172	-0.137	-0.198
	(0.118)	(0.120)	(0.128)	(0.128)	(0.137)
Ret	0.181**	0.122*	0.116	0.136*	0.140
	(0.072)	(0.074)	(0.079)	(0.080)	(0.086)
Disabled	-0.120	-0.033	0.057	0.080	0.101
	(0.178)	(0.184)	(0.198)	(0.218)	(0.234)
Mcare		0.019	0.000	0.035	-0.014
		(0.072)	(0.078)	(0.088)	(0.096)
Mcaid		-0.352***	-0.264**	-0.281**	-0.171
		(0.102)	(0.115)	(0.123)	(0.137)
Emcov		0.117***	0.092*	0.151***	0.124**
		(0.048)	(0.051)	(0.052)	(0.055)

Lifins	0.333***	0.344***	0.304***	0.319***
	(0.047)	(0.050)	(0.051)	(0.055)
Wealth[4]				
[$5,000, $25,000]		0.067		0.258
		(0.141)		(0.163)
[$25,000, $75,000]		0.115		0.171
		(0.132)		(0.152)
[$75,000, $200,000]		0.272**		0.365**
		(0.127)		(0.146)
$200,000 <		0.635***		0.720***
		(0.128)		(0.149)
Residence[5]				
Rent		-0.034		-0.071
		(0.091)		(0.100)
Freerent		-0.260		-0.425*
		(0.187)		(0.218)
Othome		0.090		0.093
		(0.162)		(0.190)
Health				
Healthy			0.177	0.125
			(0.112)	(0.122)
ADL			-0.046	-0.058

				(0.048)	(0.053)
IADL				-0.187*	-0.196**
				(0.091)	(0.100)
Mobil				-0.030	0.006
				(0.022)	(0.024)
Memrye				0.286	0.466
				(0.476)	(0.512)
Memryc				-0.058	-0.248
				(0.521)	(0.573)
Child					-0.009
					(0.012)
Bro					-0.024
					(0.020)
Sis					0.005
					(0.019)
Prob75				0.000	-0.000
				(0.001)	(0.001)
Prob 85				0.002**	0.002**
				(0.001)	(0.001)
Intercept	-3.516***	-3.509***	-3.107***	-3.507***	-2.870***
	(0.354)	(0.422)	(0.466)	(0.555)	(0.620)

Sample size: 4,267.
Note:
1: The reference group is white.

2: The reference group is total income < $5,000.
3: The reference group is not in the labor force.
4: The reference group is total wealth < $5,000.
5: The reference group is home owners.
***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table B. 5. Nearest available matching on the estimated propensity score

Model	Age	Policy 1	Policy 2	Policy 3	Policy 4
Model 1	51-60	22.5%	22.2%	22.5%	22.7%
	61-70	25.0	24.2	25.1	24.4
	71-80	20.9	22.4	22.1	21.7
	Total	22.6	22.5	23.0	22.6
Model 2	51-60	21.4	22.1	22.3	21.6
	61-70	25.5	26.2	25.7	25.5
	71-80	21.1	21.6	22.8	21.2
	Total	22.2	22.6	22.9	22.4
Model 3	51-60	19.6	20.2	20.2	20.2
	61-70	23.1	23.3	23.8	23.2
	71-80	18.8	19.5	18.9	19.0
	Total	20.1	20.2	20.4	20.1
Model 4	51-60	18.7	18.3	18.9	18.7
	61-70	23.3	23.5	23.7	23.5
	71-80	20.3	20.1	19.1	19.0
	Total	19.6	19.9	19.6	19.5
Model 5	51-60	16.7	16.9	17.7	17.8
	61-70	20.2	20.3	20.8	20.9

71-80	15.5	15.8	15.5	16.6
Total	16.5	16.7	16.9	17.2

Table B. 6. Bundorf & Pauly's Method – Policy 1

	Age	Threshold Probability		
		P = 0.5	P = 0.6	P = 0.7
Model 1				
	51 - 60	18.4%	11.0%	1.9%
	61 - 70	44.8	46.6	43.5
	71 - 80	26.6	31.3	40.4
	Total	36.2	18.7	7.6
Model 2				
	51 - 60	19.0	14.1	3.0
	61 - 70	42.5	43.7	41.8
	71 - 80	27.0	32.9	41.2
	Total	35.6	20.1	7.8
Model 3				
	51 - 60	22.3	16.6	4.5
	61 - 70	41.3	42.2	42.4
	71 - 80	25.6	28.8	37.9
	Total	39.6	23.2	9.4
Model 4				
	51 - 60	18.5	13.4	2.0
	61 - 70	41.9	45.6	42.9

	71 - 80	27.9	30.6	41.6
	Total	42.0	23.0	9.0
Model 5				
	51 - 60	21.7	15.9	9.6
	61 - 70	42.0	42.1	40.5
	71 - 80	25.6	30.2	35.4
	Total	44.2	26.3	11.8

Table B. 7. Bundorf & Pauly's Method – Policy 2

	Age	Threshold Probability		
		P = 0.5	P = 0.6	P = 0.7
Model 1				
	51 - 60	18.4%	11.0%	1.9%
	61 - 70	44.8	46.6	43.5
	71 - 80	26.6	31.3	40.4
	Total	36.2	18.7	7.6
Model 2				
	51 - 60	19.0	14.1	3.0
	61 - 70	42.5	43.7	41.8
	71 - 80	27.0	32.9	41.2
	Total	35.6	20.1	7.8
Model 3				
	51 - 60	22.3	16.6	4.5
	61 - 70	41.3	42.2	42.4
	71 - 80	25.6	28.8	37.9
	Total	39.6	23.2	9.4
Model 4				
	51 - 60	18.4	13.4	2.0
	61 - 70	42.0	45.6	42.9

	71 - 80	27.8	30.6	41.6
	Total	42.1	23.0	9.0
Model 5				
	51 - 60	21.7	15.9	9.6
	61 - 70	42.0	42.1	40.5
	71 - 80	25.6	30.2	35.3
	Total	44.2	26.3	11.8

Table B. 8. Bundorf & Pauly's Method – Policy 3

	Age	Threshold Probability		
		P = 0.5	P = 0.6	P = 0.7
Model 1				
	51 - 60	18.5%	11.2%	1.9%
	61 - 70	44.3	47.5	42.9
	71 - 80	26.1	29.6	40.4
	Total	36.5	18.4	7.6
Model 2				
	51 - 60	19.0	14.4	3.1
	61 - 70	42.1	43.3	41.4
	71 - 80	26.7	32.7	41.4
	Total	35.9	20.1	7.7
Model 3				
	51 - 60	22.6	16.7	4.6
	61 - 70	41.5	42.1	43.1
	71 - 80	25.3	28.7	36.8
	Total	39.5	23.1	9.3
Model 4				
	51 - 60	18.6	13.4	2.0
	61 - 70	41.8	45.5	43.1

	71 - 80	27.7	30.3	41.2
	Total	42.1	23.1	8.9
Model 5				
	51 - 60	21.7	15.9	9.5
	61 - 70	41.9	42.1	40.2
	71 - 80	25.6	30.2	35.2
	Total	44.3	26.3	11.9

Table B. 9. Bundorf & Pauly's Method – Policy 4

	Age	Threshold Probability		
		P = 0.5	P = 0.6	P = 0.7
Model 1				
	51 - 60	18.5%	11.3%	1.9%
	61 - 70	44.3	47.6	42.9
	71 - 80	26.1	29.7	40.4
	Total	36.5	18.3	7.6
Model 2				
	51 - 60	19.0	14.3	3.1
	61 - 70	42.1	43.4	41.4
	71 - 80	26.7	32.6	41.4
	Total	35.9	20.1	7.7
Model 3				
	51 - 60	22.6	16.7	4.6
	61 - 70	41.5	42.1	43.4
	71 - 80	25.3	28.7	36.4
	Total	39.5	23.1	9.2
Model 4				
	51 - 60	18.6	13.4	2.0
	61 - 70	41.8	45.5	43.1

	71 - 80	27.7	30.3	41.2
	Total	42.1	23.1	8.9
Model 5				
	51 - 60	21.7	15.9	9.5
	61 - 70	41.9	42.1	40.2
	71 - 80	25.6	30.2	35.2
	Total	44.3	26.3	11.9

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ABSTRACT

IS PRIVATE LONG-TERM CARE INSURANCE AFFORDABLE FOR OLDER ADULTS?

by

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May 2010

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Nationwide there are fewer than 7 million long-term care (LTC) insurance policies in force. Why do so few Americans buy private long-term care (LTC) insurance? Several theories have been offered as possible explanations, including the availability of Medicaid, misperceptions that Medicare or other policies cover LTC, beliefs that one's own risk of needing LTC services is small, or desires to simply rely on children and spouses for LTC. This study examines another possible explanation – that private LTC insurance is simply "unaffordable" for most older Americans, which may be why they don't buy it.

This study begins by investigating the meaning of affordability in the context of private LTC insurance. I propose several definitions for affordability, drawing on concepts recently developed to gauge the affordability of acute-care health insurance and housing. Then using nationally representative data from the ongoing Health and Retirement Study (HRS) and the Rand HRS data the study examines the incidence of

"unaffordability" of LTC insurance premiums among Americans over age 50, given each of our alternative definitions for it. I consider definitions for affordability, first, based on simple normative standards, such as whether remaining household income after paying for LTC insurance is above some (arbitrarily-set) threshold, and ratio definition, such as whether the ratio of premiums to income is less than some target amount, and more behavioral definitions of affordability, such as whether other adults with similar economic, demographic, and family circumstances are seen to purchase LTC insurance. In each case, the affordability definitions take into account the steep positive relationship between LTC insurance premiums and age-at-time-of-purchase. This analysis offers researchers and policymakers an operational framework for defining affordability, and for evaluating its relative importance as an explanation for non-purchase.

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