DOES COGNITIVE ABILITY IMPACT LIFE INSURANCE POLICY LAPSATION?*

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Abstract

Life insurance is an important household risk management and financial tool. Policy lapsation has economic effects on life insurance companies, policyholders, and beneficiaries and the impact may be detrimental when these lapses are unexpected. Prior literature has examined several hypotheses of life insurance lapse focusing mainly on macroeconomic factors using aggregate data and household microeconomic factors using household-level data. We introduce and test individual cognitive ability variables in a model of the life insurance voluntary lapse decision by individual policyholders using household-level data from the Health and Retirement Study. We find that one measure of cognitive ability in particular, numeracy, is related to the voluntary lapse decision. While controlling for numeracy, we find evidence that those individuals with higher levels of net worth are less likely to voluntarily lapse a policy which is consistent with the emergency fund hypothesis. We introduce a new measure of liquidity shock, kids moving home, into the model and find it has a strong positive relationship with the decision to voluntarily lapse a policy. Consistent with life insurance demand theory, we find that those who have recently entered retirement are more likely to lapse their policy.

1. Introduction

Cognitive ability has been shown to be an important factor in the financial well-being of individuals. A number of recent studies have tested several of the identified measures of cognitive ability and found cognitive ability is related to financial outcomes. Christelis, Jappelli, and Padula (2010) find a positive relationship between cognitive ability of older individuals as measured by numeracy, verbal fluency, and recall (memory) and the likelihood to hold stocks in their portfolio. They find a positive, though weaker relationship for the likelihood of those individuals to hold bonds in their portfolio.

Using numeracy as the measure of cognitive ability, studies have shown positive relations with income (Christelis et al., 2010; Gerardi, Goette, & Meier, 2010; Lusardi & Tufano, 2009) and with wealth (Banks & Oldfield, 2007; Lusardi & Tufano, 2009). Both Christelis et al. and Smith, McArdle and Willis (2010) find numeracy to be a better measure of cognitive ability as it relates to financial decisions, though episodic memory also shows to have significance predictive ability. General financial well-being has been shown to be related to numeracy among individuals. Those individuals with higher numerical ability are less likely to take on excessive amounts of debt and more likely to pay their credit card balances in full, thus avoiding high short-term debt costs (Lusardi & Tufano, 2009), and were less likely to be victims of predatory lending practices (Moore, 2003). Banks and Oldfield (2007) found that those individuals with lower numerical ability have less in savings and they raise concern about this impact on older adults since a large portion of them were unable to perform simple interest calculations with accuracy.

Households view life insurance as an important household risk management and financial tool that potentially serves multiple needs of the policyholder. It acts as a hedge against the

uncertainty of the labor income flows of household members (Campbell 1980; Fischer, 1973; Yaari, 1965), it helps beneficiaries meet their need for smoothing consumption over the life cycle (Lewis, 1989), and it helps policy holders meet their bequest motives with a potentially guaranteed source of funds (Bernheim, 1991). It can also be used as a tax-advantaged savings tool (Rankin, 1987) and as a tool to reduce estate tax erosion (Milevsky, 2006; Mulholland, Finke & Huston, 2013).

In addition to cognitive ability being important to financial decision-making, consumer bias during life insurance purchase decisions has been shown to have negative effects on household utility. In a recent article, Gottlieb and Smetters (2013) propose and test a model of life insurance demand and find that policyholders who lapse a policy before death or policy maturity cross–subsidize those policyholders who hold their policies until death or policy maturity. This cross–subsidy from lapsing comes from consumers purchasing front-loaded policies that they subsequently lapse due to liquidity shocks that they underestimated would occur when they purchased the policy.

Gottlieb and Smetters (2013) indicate that consumers are subject to two types of risk, mortality risk that life insurance is intended to mitigate, and other non-mortality background risks, such as unemployment, medical expense shocks, or unexpected needs of dependents, that result in a need for liquidity. While consumers usually do well at estimating the mortality risk when they purchase a policy, Gottlieb and Smetters suggest consumers usually underweight the risk of experiencing uncorrelated background shocks. This underweighting may be due to narrow framing where the consumer thinks of the mortality risk in isolation from the other background risks, or it may be due to disjunction fallacy where the consumer over weights the mortality risk

at the expense of the other background risk because she focuses on life insurance as a tool to mitigate mortality risk.

As discussed above, we see that life insurance is an important household financial tool, that cognitive ability has been shown to be a factor in financial decision-making, and that consumers who lapse life insurance policies cross-subsidize those consumers who hold their policies. Given these three points, it should follow that cognitive ability may be an important factor in the financial decisions policyholders make about their life insurance purchase decisions and hold decisions, and properly understanding this relationship may improve the utility of household consumption.

A growing body of research explores the causes and impact of life insurance policy lapsation. While there are several definitions of what constitutes a lapse, we follow the definition that states that a lapse is the early contract termination of a life insurance contract, with or without a surrender value being paid to the policy owner that removes the policy from its requirement to pay a death benefit (Renshaw & Haberman, 1986). The study of lapsation is important when we consider that in a typical year in the U.S. approximately 5 percent of in force policies are lapsed. Using 2012 as a typical year, life insurance companies in the U.S. typically experience over 7 million lapses of individual policies annually. That also means millions of individuals and households are having to consider the impact of policy termination on their financial situation.

Eling and Kochanski (2013) find that a large portion of lapse research is focused around two major hypotheses, the emergency fund hypothesis (EFH) and the interest rate hypothesis (IRH). A third hypothesis has recently been articulated in the literature. Building upon empirical

research by Outreville (1990), Russell, Fier, Carson, and Dumm, (2013) describe the policy replacement hypothesis (PRH) which suggests that policyholders will surrender a policy in order to replace it with a policy which has better pricing or more favorable terms.

When exploring the IRH and the EFH, Liebenberg, Carson, and Hoyt (2010) suggest that different types of data suit each hypothesis better. They suggest that the IRH is best explored with aggregate level data while the EFH is best examined with household-level data like that contained in the Health and Retirement Study (HRS). Like the EFH, Fier and Liebenberg (2012) suggest the PRH is best examined with household-level data.

Eling and Kochanski (2013) suggest that future lapsation research explore the interconnection between theoretical modeling and empirical work as this might lead to a lapse prediction model. This model could be used to design products and/or programs that address some of the reasons policyholders lapse their policies.

In light of these two streams of research, the impact of cognitive ability on financial decision-making and the causes and impact of policy lapsation, we undertake a study of the relationship between cognitive ability and the decision to lapse a life insurance policy. As suggested by Liebenberg et al. (2010), we use household-level data to study the lapse decisions of individuals. For this study we use data from the HRS. We look to life cycle theory, life insurance demand theory and the EFH from the study of life insurance lapsation to guide us in our analysis. Due to some mixed results in prior literature, we use our model to test whether episodic memory or numeracy is a better measure of cognitive ability to use in predicting the outcome of the life insurance lapse decision.

The rest of this paper is organized as follows. Section 2 provides the purpose and rationale for this paper. Section 3 identifies the framework used in our analysis and poses our hypothesis. Section 4 describes the microeconomic data we use in our empirical analysis, identifies our model, and describes the variables we use in the analysis. Section 5 presents our empirical results for the likelihood of lapsing a life insurance policy under two different measures of cognitive ability. In Section 6, we discuss our results.

2. Background

2.1 Purpose

The purpose of this study is to examine the impact of cognitive ability among older individuals on the decision to lapse their life insurance policies.

Interest in the determinants of life insurance lapse has been especially prevalent in life insurance literature since the turn of the 21st century, as evidenced in the research review conducted by Eling and Kochanski (2013). Of the 56 theoretical and empirical articles they consider in their review, only seven of the articles were published prior to the year 2000. Eling and Kochanski indicate that the empirical research is exploring dynamic factors at both the company and policyholder level that impact the lapse decision and these areas will need further exploration as market forces along with legislative and regulatory actions influence lapse rates. Our goal is to add to this literature.

Recent events have raised concerns about the impact of cognitive ability on the decisions made by older individuals. In particular, the life insurance advisory industry will likely be very interested in these findings given the recent high profile legal battle between the State of California and Glenn Neasham, an annuity salesperson. Neasham was convicted in 2011 for theft

in the sale of a deferred annuity to an 83-year old woman who was later found to have dementia. As indicated in the detailed events summary of the case by Christensen and Olsen (2012), Neasham was prosecuted under the California statutes criminalizing elder abuse and found guilty of theft. Neasham contends he saw no signs of dementia during the several meetings he had with the client. The conviction has started a debate on the role of insurance companies, agents, and advisors in determining the cognitive ability of their older clients when financial decisions are being made. Wood (2013) discusses this debate in describing the national webinar that occurred immediately after Neasham's conviction was overturned on appeal in 2013. According to Wood, the current guidance to advisors is intended to protect the advisor from legal liability and criminal indictment by documenting the situation, having family members available at meetings to help the client with her decisions, and recording the meetings, presumably to have a complete and defensible record of the decisions made by the client.

But this raises the greater question of how cognitive ability impacts decisions about life insurance products. As Mulholland et al. (2013) suggest, life insurance is a complex product that those with higher financial sophistication are more likely to use to meet specific financial needs like bequests and estate preservation. While financial sophistication impacts the ownership decision, we question if there is a link between the cognitive ability of the person and her decision to terminate the ownership of the life insurance policies she already owns.

We believe this is the first study to look at the impact of cognitive ability as a determinant of the propensity to lapse a life insurance policy. This article adds to the literature by providing a greater understanding of the determinants of life insurance lapse decisions, especially among aging individuals.

2.2 Rationale

Life insurance lapsation is a topic of interest to a variety of groups, including insurance companies, advisors, policyholders, regulators and academics. Each group likely has varying reasons for their interest but in general the reasons are the financial implications from policy lapses.

Eling and Kochanski (2013), in their review of research on life insurance lapsation, indicate there are several ways that lapse is defined. These definitions vary from narrow to broad and include, respectively: 1) loss of the policy due to failure to pay premiums (Gatzert, Hoermann & Schmeiser, 2009); 2) early contract termination, with or without a surrender value being paid to the policy owner, that removes the policy from its requirement to pay a death benefit (Renshaw & Haberman, 1986); 3) the LIMRA broader definition that also includes conversion to a paid-up status (Purushotham, 2006); and 4) the very broad new EU regulatory regime Solvency II that includes all options a policyholder possesses which can significantly change the value of future cash flows related to a policy. In our analysis we follow the Renshaw and Haberman definition due to limitations on information about the specific contracts being terminated.

For insurance companies, lapsation, if not properly predicted and managed, may have an overall negative impact on the company. Eling and Kochanski (2013) indicate that the negative effects that lapsation has on the insurer include liquidity, profit, adverse selection, and reputation implications. They suggest liquidity issues arise if a large number of lapses occur in a short span of time. Profit implications occur if lapses occur before the insurer recovers acquisition expenses. Enhanced adverse selection implications occur if there are no substantial lapse fees, thus allowing the easy departure of healthy policyholders which can lead to a reduction in the

effectiveness of the risk pooling. Finally, high lapse rates may hurt the insurer's reputation which, in turn, may both hurt the acquisition efforts for new policies as well as lead to more lapses among existing policies.

A recent development related to life insurance lapsation is the existence of a developing life settlement market, where policyholders can sell their unneeded policies to third party purchasers for more than the cash value and less than the death benefit. Fang and Kung (2012) suggest the presence of a life settlement market may result in lower margins for insurers due to the loss of lapsation profits. They indicate lapsation profits result from higher than actuarially-fair premiums early in the policy period that are not offset by lower than actuarially-fair premiums later in the policy period due to early policy termination. In order to be competitive, the insurer reduces the premiums based upon anticipated future profits from lapses. But the sale of the policy by the policyholder to a third party transfers these profits to the life settlement company. Fang and Kung suggest that an increasing life settlement market will likely require a recalculation of expected lapse rates by insurers. They suggest the results will be both a decrease in expected lapsation profits for insurers and an increase in premiums for future policyholders, as suggested by Carson and Dumm (1999).

For financial advisors, an understanding of the impact of cognitive ability on financial decision-making can improve the advice given to clients by advisors. As already discussed, this has been highlighted by the recent high profile legal battle between the State of California and Glenn Neasham. While Neasham's conviction was overturned on appeal, Wood (2013) indicates that the conviction has started a debate on the role of insurance companies, agents, and financial advisors in determining the cognitive ability of their older clients when financial decisions are

being made. The case may have opened the door to litigation against advisors who fail to consider a client's cognitive ability when providing advice about financial matters. According to Wood, the current guidance being offered to advisors by industry groups is to take steps to protect themselves by doing such things as fully document the situation, have other family members of the client available at meetings when decisions are being made, and record the meetings to retain a record of the decisions.

Policy lapsation decisions can have both positive and negative effects on the household. Policies that are no longer needed to meet the basic life cycle purposes of life insurance – labor income protection (Campbell 1980; Fischer, 1973; Yaari, 1965), beneficiary needs (Lewis, 1989), and bequest motives (Bernheim, 1991) – may improve household utility when lapsed. Lapsation decisions can positively affect the liquidity of the household through the elimination of the premium payments that free those funds for use in other areas of consumption. After the loss of beneficiary or bequest motives, funds freed by the lapsation of cash value policies can be used to improve lifetime consumption for current household members. The subsequent removal of a sophisticated financial tool from the household portfolio may make management of the portfolio less burdensome.

For policyholders and their beneficiaries, unintended lapsation may be problematic. For married couples, the loss of the policy may remove guaranteed funds intended to provide for the final expenses associated with death, such as medical out-of-pocket expenses, health insurance co-pays, and funeral expenses. It may also reduce the assets available to fund the surviving spouse's lifestyle since a lapsed policy will provide fewer proceeds to the survivor than the death benefit would have paid at the death. In addition, if the lapsed policy has cash surrender value,

that cash is brought into the estate of the policyholder which then makes it subject to ongoing income taxation and future probate distribution, both of which are avoided in an active life insurance policy.

If a policy that was intended to provide a bequest to heirs or to charitable organizations is unintentionally lapsed prior to death, the very purpose of the policy is undermined. With the lapse, the proceeds may become subject to probate which may move those funds onto a different set of recipients than the policyholder had intended, including creditors of the estate. Even if the proceeds go to the intended heirs or charities, the proceeds will be reduced because of the loss of life insurance proceeds above the cash surrender value of the policy.

As previously discussed , lapsation has been shown to result in a reduction in the utility of household consumption due to the cross-subsidy provided by lapsing policyholders to non-lapsing policyholders who retain their policies to either death or policy maturity (Gottlieb & Smetters, 2013).

The complexity of life insurance contracts requires that those managing the policies understand the impact of various choices on policy viability. This is especially important for cash value policies like universal life and variable universal life policies that may require ongoing decisions about premium amounts and underlying investments. If policy earning assumptions were too high at the inception of the policy resulting in premium payments that were too low to sustain the policy to maturity under actual market conditions, then decisions within the scope of the policy provisions to either increase the premiums, decrease the death benefit, or terminate the policy must occur. If policy loans were taken against the policy cash value and loan interest is being accrued, the policy may be at risk of running out of money. The lack of cognitive ability

on the part of the policyholder may increase the risk of inappropriate decisions being made and unintended lapsation occurring. The unintended lapsation may have tax consequences for the policyholder, as is the case if a consumer has a policy loan at a time of lapsation. Any unpaid policy loans existing at the time the lapse occurs are treated by the IRS as ordinary income requiring ordinary income taxes to be paid in the year the event occurs, thus having a negative impact on the net worth of policyholders.

For insurance regulators, one of their many roles is to provide protection for consumers by performing various functions such as setting insurance premium limits, setting minimum standards for policies, and minimizing bad faith practices by insurance companies ("Insurance Law," n.d.). Regulations can help reduce information asymmetry that favors the insurer, thus allowing consumers to make better decisions. Without specific knowledge of an area where information asymmetry may exist, it can often be difficult for regulators to affect appropriate legislative control in order to protect those with less financial sophistication. New knowledge about the impact of cognitive ability on life insurance ownership decisions may allow regulators to explore appropriate regulatory actions that will provide the best protection possible while still allowing important market activity to occur.

The study of life insurance lapse is currently a very important topic for academic researchers. As observed in their examination of current literature, Eling and Kochanski (2013) review 56 papers on lapsation, segregated into 44 theoretical papers and 12 empirical papers, and indicate that only seven of these papers were published prior to the year 2000. Eling and Kochanski suggest that changing regulatory regimes, like Solvency II in the European Union,

and market forces, such as the flourishing life settlement market, have increased the need for improved modeling of lapse rates and a better understanding of the drivers of lapsation.

2.3 Research Question

Given new regulatory regimes for insurance companies to better prevent their insolvency, combined with the recent legal challenges faced by advisors who deal with elderly clients and the ongoing consumer protection responsibility of regulators, a better understanding of the drivers of lapsation is required. Therefore, we question if the cognitive ability of older life insurance policyholders impacts their decisions to lapse their life insurance policies?

3. Framework

3.1 Conceptual Model

Our research is guided by the theory from three important areas. Life insurance demand theory guides us on the typical behavior to be expected from a rational household, especially when dealing with beneficiary needs. Life insurance lapse theory guides us on the expected rational behavior of the household in the presence of both exogenous and endogenous shocks. We look to cognitive ability research to guide us as we consider the impact of cognitive ability on financial decisions, specifically life insurance ownership decisions.

From life insurance demand theory, we use several key theories as guides for our work. Yaari (1965), Fischer (1973), and Campbell (1980) collectively indicate that life insurance is a hedge against the uncertainty of labor income flows. Lewis (1989) suggests that the beneficiaries' desire to smooth their expected lifetime consumption will influence life insurance demand. And Bernheim (1991) suggests that policyholder bequest motives influence the demand for life insurance.

Several important hypotheses have been suggested for the reason policyholders lapse their life insurance policies: the emergency fund hypothesis (EFH), the interest rate hypothesis (IRH), and the relatively recent policy replacement hypothesis (PRH). Linton (1932) proposed the EFH, suggesting households regard the cash value in their life insurance policies as a source of emergency funds that can be accessed in times of financial need. Schott (1971) describes the foundations for the IRH which suggests that when interest rate arbitrage potential exists between high market rates and low policy interest rates, policyholders may be encouraged to take policy loans or lapse the policies to make the funds available to earn the higher rates. Russell et al. (2013), building upon empirical research by Outreville (1990), articulate the PRH which suggests that policyholders will surrender their policies in order to replace them with a policy with better pricing or more favorable terms.

Most recent life insurance lapse research has focused on exploring the EFH and the IRH. Eling and Kochanski (2013), in their review of life insurance lapse research, indicate that recent lapse research has explored these hypotheses through various modeling methods and various parameters. Of the 56 papers they review, 44 focus on modeling while 12 are empirical studies of macroeconomic and microeconomic factors. They indicate the empirical studies find that additional economic, company, and policy factors influence the lapse rate, including GDP growth, company age, company size, company legal structure, policy age, and surrender charges. Eling and Kochanski indicate the product and policyholder characteristic studies find additional significant factors such as age and gender of the policyholder, policy duration, and product type that impact life insurance lapse rates. Results supporting the two hypotheses are mixed in the group of studies included in their article.

Our analysis will be limited to use of the EFH for several reasons. First, the data we use is very limited in the cross-section on the policyholders who indicate they lapse a policy with the intention of replacing it with another policy, a practice Fang and Kung (2012) refer to as insurance optimization. Fier and Liebenberg (2012) use longitudinal HRS data from the 1996 through 2008 waves in their analysis of the PRH. Second, Liebenberg, Carson, and Hoyt (2010) suggest that different types of data allow for better analysis when exploring the IRH and the EFH. They suggest that the IRH is best explored with aggregate level data while the EFH is best examined with household-level data. The data used in our analysis is household-level in scope, thus we limit our analysis to the EFH.

Cognitive ability and its impact on financial decision-making has been an important area of current research (Banks & Oldfield, 2007; Christelis et al., 2010; Lusardi & Tufano, 2009; McArdle et al., 2009; Smith et al., 2010). Consideration has been given to whether fluid intelligence or crystallized intelligence is the most important aspect of cognition. As defined by Smith et al., fluid intelligence is deliberate processing or the ability to think about a problem in a clear and quick manner, while crystallized intelligence is the accumulation of relevant knowledge about various problems through education and lifetime experience. Smith et al. create a shorthand division of the two components of intelligence by defining fluid intelligence as the thinking part involving memory, abstract reasoning, and executive function or decision-making, and defining crystallized intelligence as the knowing part consisting of education and lifetime experience.

Several measures exist within these areas of intelligence and have been used by researchers as they explore the impact of cognitive ability on financial decisions. Smith et al.

(2010) indicate that the three measures are: 1) episodic memory, which is used as a general measure of an important aspect of fluid intelligence because memory access is important to any cognitive ability; 2) numeracy, which is used to measure actual ability to perform numerical skills learned in schools and is used to measure crystallized intelligence; and 3) mental status scores, which measure elements of both fluid and crystallized intelligence, non-specific cognitive skills needed for everything. Smith et al. find that of the three measures, numeracy is the best predictor of wealth while episodic memory also appears to be related to household total wealth and financial wealth holdings.

Financial well-being is related to numeracy among individuals. Those with higher numerical ability are less likely to take on excessive amounts of debt and pay credit card balances in full, thus avoiding high short-term debt costs (Lusardi & Tufano, 2009), and are less likely to be victims of predatory lending practices (Moore, 2003). Banks and Oldfield (2007) find that those individuals with lower numerical ability have less in savings. They raise concern about this impact on older adults since a large portion of these people were unable to perform simple interest calculations with accuracy.

Numeracy is also shown to be positively related to income (Christelis et al., 2010; Gerardi, et al., 2010; Lusardi & Tufano, 2009), wealth (Banks & Oldfield, 2007; Christelis et al., 2010; Lusardi & Tufano, 2009), gender – with men having higher numeracy scores than women (Banks & Oldfield, 2007; Lusardi & Tufano, 2009; Lusardi, 2012), and marital status – with married individuals exhibiting higher numeracy than single individuals (Lusardi & Tufano, 2009; Smith et al., 2010).

Empirical evidence links increased cognitive ability with the ownership of more sophisticated financial tools. Using European data, Christelis et al. (2010) find a positive relationship between an individual's cognitive ability, as measured by numeracy, verbal fluency, and recall (memory), and the likelihood to hold stocks in her portfolio. They find a positive though weaker relationship for the likelihood to hold bonds.

3.2 Hypothesis

Our analysis examines the following hypothesis:

H_0: We hypothesize that a policyholder's cognitive ability, whether measured by episodic memory or numeracy, will have no significant effect on her decision to voluntarily lapse a life insurance policy that she owns.

4. Data and Methods

4.1 Data

We use data from the Health and Retirement Study (HRS) from the 2008 and 2010 waves (Waves 9 and 10) for our analysis. The HRS is a longitudinal survey capturing the health and economic circumstances of a nationally representative sample of U.S. citizens over the age of 50. Conducted every two years by the Institute for Social Research at the University of Michigan since its first wave in 1992, the original cohort has been interviewed in each wave. With attrition over the time frame of the survey, additional cohorts have been added in the ensuing years, bringing the complete sample size to nearly 37,000 individuals who participated in the survey to some extent throughout the life span of the survey. The HRS is supported by the National Institute on Aging (NIA) and the Social Security Administration (SSA).

Liebenberg, Carson, and Dumm (2012) indicate that household-level panel data is well suited for showing the impact of events at the household-level on the financial decisions made by these households. We use the HRS survey because it has extensive information on life insurance ownership choices made by household members as well as respondent and household information on health, income, wealth, and family structure.

Our initial interest in modeling lapse behavior in the presence of cognitive ability measures is on the identified respondents for which information is included in both the 2008 and 2010 waves; our sample is first reduced to 17,217 respondents. Since the HRS follows participants until they are deceased, we further limit our sample to those who were alive in 2010 and who indicated their life insurance ownership status in that wave. This further reduces our sample to 14,659 respondents.

Our dependent variable is those respondents who self-lapse a life insurance policy during the prior two years. Consistent with prior research using the HRS (Fang & Kung, 2012; Fier & Liebenberg, 2012), we use two questions in combination from the HRS to develop our dependent variable. The first question allows us to identify respondents who allowed a policy to lapse in the prior two years[1]. We use the response to a follow-up question to specifically identify self-lapsers[2]. Combining those who indicated a policy lapse in the first question with an affirmative response that the lapse was their choice creates our dependent variable.

[1] HRS question MT036: "In the last two years, have you allowed any life insurance policies to lapse or have any been cancelled?"
[2] HRS question MT041: "Was this lapse or cancellation something you chose to do, or was it done by the provider, your employer, or someone else?"

Since it is not possible to lapse a life insurance policy unless you first own one, we next limit our sample to those who indicated they owned life insurance in 2008. This criterion reduced our sample size to 9,359 individuals.

Finally, we narrow our sample to those who answered the questions related to our main independent variable of interest, cognitive ability. Fisher, Hassan, Rodgers, and Weir (2013) indicate that the design of the HRS study creates some methodological issues for measuring cognitive functioning which requires appropriate adaption of the standard tests. In particular, the HRS does allow for proxy respondents for individuals who may have reached a point of incapacity that interferes with their ability to respond. Like Fisher, et al., we limit our sample to self-respondents. Smith et al. (2010) examine three measures of cognitive ability and find that two of the three, episodic memory and numeracy, are associated with wealth of the household. Our analysis will explore both of these measures to determine if either predicts lapse behavior and if so, is one measure a more powerful predictor of lapse behavior than the other. By limiting our sample to those who performed both the episodic memory (total word recall) test components and answered the series of three numeracy questions, our sample size was reduced to 8,795 respondents.

The resulting sample size following the application of each step of our selection criteria can be seen in Table 1.

Table 1 – Sample Selection Criteria

Selection Criteria	Sample Size
All individuals tracked in the HRS from 1992 to 2010 …	36,986
... Respondents included in the 2008 and 2010 waves	17,217
... those who were alive in 2010 and indicated their life insurance ownership status	14,659
… those who owned life insurance in 2008	9,359
... those who answered the Total Word Recall (TWR) & Numeracy questions in 2010	8,795

Note: The selection criteria are cumulative.

4.2 Model

Our dependent variable is the choice to voluntarily lapse a life insurance policy in the prior two years.

Our independent variable of interest is cognitive ability. Smith et al. (2010) find two significant measures of cognitive ability that impact financial decisions, episodic memory and numeracy. McArdle et al. (2009) find that within person correlations are moderate for men and women between episodic memory and numeracy. Therefore, we specify the model to use only one variable to represent cognitive ability with the intent to compare the results of our analysis between the two cognitive measures.

The decision to lapse a life insurance policy is at its roots a decision about ownership of a life insurance policy, in this case one that is already owned by the policyholder. As Zietz (2003) identifies in a review of life insurance research that spans over 50 years, the demand for life insurance is a function of its intended use. Typically, demographic and economic predictors for life insurance ownership include age, bequest motive, education, employment, children, marital status, homeownership, income, net worth, and race. We address any issues with these predictors below.

Many of these factors associated with life insurance ownership have also been shown to be associated with cognitive ability. For episodic memory, these associations include age (Christelis et al., 2010) and wealth (McArdle et al., 2009; Christelis et al., 2010). For numeracy, these factors include age (Christelis et al., 2010; Lusardi & Mitchell, 2011; Lusardi & Tufano, 2009; Lusardi, 2012), income (Christelis et al., 2010; Gerardi et al., 2010; Lusardi & Tufano, 2009), wealth (Banks & Oldfield, 2007; Lusardi & Tufano, 2009; Smith et al., 2010), gender

(Banks & Oldfield, 2007; Lusardi & Tufano, 2009; Lusardi, 2012), and marital status (Smith et al., 2010; Lusardi & Tufano, 2009).

Gender is also shown to be an important factor in determining demand for life insurance (Gandolfi & Miners, 1996), with men more likely to be insured. Eling and Kiesenbauer (2013) find that women are less likely to lapse life insurance policies than men. We control for these differences by including gender in our model.

Mulholland et al. (2013) find that the financial sophistication of the policyholder plays an important part in the decision to own life insurance. Therefore, our model includes a proxy for financial knowledge.

Stated bequest motive is the ideal variable to identify specific desires of the individual to leave a bequest. But not all datasets contain a variable answering whether a desire to leave a bequest exists, as is the case with the HRS. In the absence of a bequest motive variable, Bernheim (1991) uses marital status and the existence of children of the insured as proxies for the bequest motive. We do the same in our model.

An important factor in life insurance ownership is homeownership, or more importantly the mortgage debt that is associated with homeownership. Prior research suggests a positive relationship between the amount of total household debt and the amount of life insurance it holds (Frees & Sun, 2010; Lin & Grace, 2007). Yet, Fier and Liebenberg (2012) find increased debt is positively related to the decision to lapse a policy. We include total debt as a control variable, allowing it to proxy for homeownership.

Health of the insured plays a role in the demand for life insurance, therefore it follows that the existence of health issues may play a role in the decision to lapse a policy. In addition to

Milevsky (2006) indicating that health status of the insured household member is another significant indicator of life insurance demand, Fang and Kung (2012) indicate that the health condition of the insured is an important factor due to reclassification risk. Fang and Kung indicate that reclassification risk arises from the increasing cost of life insurance on the spot market due to declines in overall health and the resulting increase in mortality risk of the insured. As the insured's health declines, they will find it increasingly expensive to replace a policy they currently own. Accordingly, we include the health condition of the respondent in our model.

Life insurance is used as both a tax-sheltered form of savings (Brown & Poterba, 2006) and for non-human-capital-replacement issues like accumulating cash to pay estate taxes for those households vulnerable to estate taxes (Milevsky, 2006). Mulholland et al. (2013) find that households vulnerable to U.S. estate taxes are more likely to own cash value life insurance. For these reasons, we control for estate tax vulnerability under 2010 estate tax laws.

Prior life insurance loan and lapse research suggests loans and lapses are driven by various shocks affecting the household. Liebenberg, Carson and Hoyt (2010) find evidence that policy loans increase as a result of household income shocks while Kuo, Tsai, and Chen (2003) find evidence that the unemployment rate is positively related to the lapse rate of life insurance policies. Fier and Liebenberg (2012) include unemployment as a control variable in their analysis but find it is not significant, likely because they limit their examination to voluntary lapse of privately owned life insurance, thus eliminating some lapses by employers that would result from termination of employment. Like Fier and Liebenberg, we model only voluntary policy lapses. We control for income shocks but do not specify unemployment as a variable in our model.

Fang and Kung (2012) model health shocks as a latent variable influencing life insurance lapses and find some evidence in their simulations that health shocks positively impact policy lapsation. Bernheim (1991) finds evidence that bequest shocks reduce the demand for life insurance. Liebenberg et al. (2012) find a positive relationship between those who recently retired and those who lapse life insurance policies. We control for health shocks, bequest shocks, and those respondents who have retired in the past two years.

Bernheim (1991) indicates that households with bequest motives, often as intergenerational transfers, hold life insurance to enhance their bequest utility. But just as income shocks and unemployment with the resulting loss of income have been found to increase the likelihood of lapse, we question if unexpected increases in household expenses cause similar behaviors. In particular, does the sudden appearance of children as members of the household put a drain on household expenses that may cause similar results as an income shock? Therefore, we include the increase of children living in the home since the prior wave as a control variable in our model.

Our goal is to appropriately model life insurance lapse decisions while testing the hypothesis that cognitive ability has an effect on these decisions. We are not intending to re-test the validity of the control variables on the lapsation decision.

Based upon our review of prior literature, in conjunction with variables that are available in the 2008 and 2010 waves of the HRS, we use the following logistic regression model to model the life insurance lapse decision:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_{1\text{-}3}(\text{cognitive ability quartiles>25\%}) + \beta_{4\text{-}6}(\text{income quartiles>25\%}) + \beta_{7\text{-}9}(\text{net worth quartiles>25\%}) + \beta_{10}(\text{financial knowledge}) + \beta_{11}(\text{married}) + \beta_{12}(\text{children}) + \beta_{13\text{-}17}(\text{age groups<60 or >64}) + \beta_{18}(\text{gender}) + \beta_{19}(\text{log of Total Debt}) + \beta_{20\text{-}21}(\text{non-White race groups}) + \beta_{22\text{-}24}(\text{education>no-HS degree}) + \beta_{25\text{-}28}(\text{health problems>0}) + \beta_{29}(\text{estate tax vulnerable}) + \beta_{30}(\text{newly retired since 2008}) + \beta_{31}(\text{income shock}) + \beta_{32}(\text{additional kid at home shock}) + \beta_{33}(\text{marriage shock}) + \beta_{34}(\text{health shock})$$

where P_i is the probability of the individual lapsing a life insurance policy.

4.3 Variables

In our model, the dependent variable, LAPSE, is a binary variable set to 1.0 when the respondent has answered affirmatively to both HRS questions about life insurance lapse: first that they did lapse a policy in the two years prior to responding to the survey in 2010, and second that they chose to proceed with the lapse or cancellation. For all other combined responses, the variable is set to zero.

We use two separate measures of cognitive ability, episodic memory and numeracy, but for comparison purposes, we specify them in the same manner for the model.

Similar to Smith et al. (2010), we measure episodic memory using two measures of word recall found in the HRS, immediate word recall and delayed word recall (Ofstedal, Fisher, & Herzog, 2005). To test word recall, the respondent is read a list of 10 nouns. The first time they receive the word list, it is drawn randomly from four sets of words, of which no words overlap. Each subsequent wave, the respondent is presented with a different word list from the four lists, resulting in the respondent only receiving the same word list every fourth wave. Respondents

and their spouses are given different word lists in each wave. For immediate word recall, the respondents are read the list of nouns and then asked to immediately recall as many of the words as they can. The respondent receives a score of the number correctly repeated. After testing for immediate word recall and after approximately five minutes of asking other survey questions, the delayed word recall test is administered. Again, the respondent is asked to recall as many words as they can from the list. The respondent again receives a score for the number of correctly recalled words.

While Smith et al. (2010) create a combined word recall measure for each respondent by averaging her immediate and delayed word recall scores, we follow the common practice of adding the two scores to create a total word recall (TWR) score for each respondent, leading to a score range of 0 to 20 (see Browning, 2014).

Following Smith et al. (2010), we measure numeracy by using three questions that were first included in the 2002 core survey questions and repeated every second wave since. The first question asks the respondent to calculate the number of people given a known percentage[3] while the second question asks respondents to perform a division problem[4]. If the respondent gets either of the first two questions correct, they are then asked the third question where they are asked to solve a two-year compounding interest problem.[5] They receive one point for each correct answer. We create a numeracy score by adding these results for each respondent, developing a score range of 0 to 3.

[3] HRS question MD178: "If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease?"
[4] HRS question MD179: "If 5 people all have the winning numbers in the lottery and the prize is two million dollars, how much will each of them get?"
[5] HRS question MD180: "Let's say you have $200 in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years?"

To create comparable measures for episodic memory and numeracy, we quartile each measure.

We separate income and net worth into quartiles. Following Mulholland et al. (2013), we create a dummy variable to identify those households who may be vulnerable to estate taxes in 2010 because they have net worth, including a second home, of greater than $5 million, the then-current maximum estate tax exemption.

Following prior research (Brown & Poterba, 2006; Fier & Liebenberg, 2012), we separate age into bands to capture the non-linear predicted effect of life cycle stage and life insurance demand.

To proxy for unknown bequest factors, we create dummy variables for the respondent being married and having any living children, setting the affirmative to 1.0. We also create a dummy variable for gender, setting it to 1.0 for males.

We create a total household-level debt variable by first adding the total mortgage debt to the total other household debt. Following Fier and Liebenberg (2012), we control for household-level debt by using the natural logarithm of the total household-level debt.

The categories for race, education, and health problems are separated into dichotomous variables. The categories of race are separated into the binary variables white, black, and other race. Education is separated into four variables consisting of less than high school, high school, some college, and college degree. Eight separate health problems are identified in the HRS, including high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychological problems, and arthritis. Respondents are asked in each wave if they have been diagnosed with any of these health problems. Similar to Fang and Kung (2012), we total the number of health

problems the respondents indicate, creating a health problem score of 0 to 8. We then create dummy variables for each of 0 through 3 problems and create a dummy variable capturing 4 or more health problems.

The five shocks or major changes we control for include newly retired, income shock, additional kids at home shock, marriage shock, and health shock, creating dichotomous variables for each. Just as Fier and Liebenberg (2012) do, we set newly retired equal to 1.0 if the respondent identifies herself in 2008 as not retired and then identified herself as retired in 2010. Fier and Liebenberg explore the EFH over the entire range of income decline and find that lapse is related to income shock for those households with the most extreme levels of income decline, roughly the worst 24 percent of their sample. Since our focus is to explore the impact of cognitive ability and not specifically find additional validation for the EFH, we use a more conservative 10 percent income decline in real dollars from the prior wave to indicate an income shock. We set the dichotomous variable measuring additional kids in the home to 1.0 when there is an increase of one or more kids at home since the prior wave. The marriage shock variable is set to 1 if the marital status has changed to unmarried, whether because of divorce or the death of the spouse, since the 2008 wave. Finally, since the number of health conditions usually increases over time (Fang & Kung, 2012), an increase of one health condition from the prior wave may not capture a true health shock. Therefore, we specify health shock to be an increase of two health problems since the prior wave.

All variable are listed with the summary statistics in Table 2.

Table 2 – Variable Summary Statistics

Wave 10 - 2010
N =8,795 **384 respondents reported lapse**

Insurance Ownership Variables		Mean	Std Dev
% of Sample Own Life Insurance in 2010		0.86	0.35
Life Insurance Status			
Lapse a policy due to their choice in prior two years		0.04	0.20
Explanatory Variables			
Cognitive Ability			
Episodic Memory (Total Word Recall) (# Correct)		9.75	3.48
Memory Quartiles (# Correct)	< 25th Percentile	5.99	1.91
	25th to 50th Percentile	9.50	0.50
	50th to 75th Percentile	11.48	0.50
	> 75th Percentile	14.50	1.60
Numeracy (# Correct)		1.24	0.89
Numeracy Quartiles (# Correct)	< 25th Percentile	0.00	0.00
	25th to 50th Percentile	1.00	0.00
	50th to 75th Percentile	2.00	0.00
	> 75th Percentile	3.00	0.00
Economic Factors			
Income in 2010		$68,057	$84,585
Income Quartiles ($)	< 25th Percentile	$14,666	$5,961
	25th to 50th Percentile	$33,672	$5,804
	50th to 75th Percentile	$60,287	$10,703
	> 75th Percentile	$163,600	$123,344
Net Worth in 2010		$480,293	$1,002,237
Net Worth Quartiles ($)	< 25th Percentile	$11,517	$48,998
	25th to 50th Percentile	$128,233	$41,899
	50th to 75th Percentile	$340,062	$91,184
	> 75th Percentile	$1,442,672	$1,649,010
Log Total Debt		5.27	5.28

[a] 2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

Table 2 (Continued) – Variable Summary Statistics

Wave 10 - 2010
N =8,795 384 respondents reported lapse

Insurance Ownership Variables		Mean	Std Dev
Financial Knowledge			
Financial Respondent		0.70	0.46
Bequest Factors			
Married in Current Wave		0.63	0.48
Has Living Children		0.93	0.26
Demographic Factors			
Age in 2010		69.56	9.76
Age in 2010	Less than 60	0.17	0.37
	60 to 64	0.17	0.38
	65 to 69	0.15	0.36
	70 to 74	0.20	0.40
	75 to 79	0.15	0.36
	80 and Higher	0.16	0.37
Male		0.44	0.50
Race	White	0.82	0.39
	Black	0.16	0.37
	Other	0.02	0.15
Education	Less than HS Degree	0.15	0.36
	High school	0.37	0.48
	Some college	0.24	0.43
	College	0.24	0.43
Health Problems	Zero Problems	0.10	0.30
	One Problem	0.21	0.41
	Two Problems	0.26	0.44
	Three Problems	0.23	0.42
	Four or More Problems	0.20	0.40
Estate Tax Vulnerable			
Net Worth over Current Exemption [a]		0.01	0.09
Shocks or Major Changes			
Newly Retired Since 2008		0.12	0.32
Income Shock (Decline) of > 10% Compared to 2008		0.40	0.49
Additional Kids Residing at Home Since 2008		0.05	0.22
Marriage Ended Since Last Wave		0.04	0.20
Health Shock (2+ Add'l Health Issues) Since Last Wave		0.03	0.17

[a] 2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

5. Results

5.1 Descriptive Analysis

The summary statistics in Table 2 allow us to better understand our sample. Approximately 4 percent of our sample lapsed their policies in the two years prior to 2010. This appears to be in line with the typical 5 to 5.5 percent annual individual policy lapse rates as reported by ACLI in their annual industry report (ACLI, 2011). Non-voluntary policy lapsation is occurring as evidenced by the additional 10 percent decline in life insurance ownership indicated by our sample.

The sample averaged slightly fewer than 10 total words recalled and approximately 1.24 numeracy questions answered correctly. Both numbers are very similar to results from the analyses by McArdle et al. (2009) and Smith et al. (2010).

Means and standard deviations for both income and wealth are reported for the entire sample as well as the quartiles for both variables. We observe apparent non-linearity of the increase in means across quartiles in both measures.

Approximately 70 percent of our sample appears to have financial knowledge since they are identified as the financial respondent for the households they represent. Over 60 percent of the respondents are married while over 90 percent have living children.

Demographically, our sample is on average nearly 70 years old, contains a majority of females, racially is predominantly white, has nearly half of its respondents with education beyond high school, and indicates that that a little over half have fewer than three of the eight identified health problems. While our statistical summary suggests a positive level of total household debt for our sample, in an unreported analysis, we find that 48.3% of the sample had no household debt.

In our final control variable, we see that only about one percent of the sample was vulnerable to U.S. estate taxes due to household net worth in excess of $5 million, the 2010 estate tax exemption amount. We note that the U.S. estate taxes were in legislative flux that year due to the elimination in 2010 of estate taxes as a result of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA-2001). The Taxpayer Relief Act of 2010 (TRA-2010) reinstated the estate, gift, and generation-skipping transfer taxes with different exclusion amounts and top tax rates for taxable estates. TRA-2010 also presented a choice to the estates of those who died in 2010 on how they wanted to be taxed. They could either avoid any estate taxes while accepting the loss of the stepped-up basis for assets, thus making the assets susceptible to capital gains taxes, or accept the new transfer tax laws implemented by the TRA-2010 that allowed estates to retain the stepped-up basis along with a $5 million estate tax exemption.

Looking finally to the shock and major change variables we include in our analysis, we see that about 12 percent of the sample retired between their survey interviews in 2008 and 2010. Approximately 40 percent of the sample experienced real income loss in excess of 10 percent over that period. Additionally, five percent of the sample indicated they had children join them in the home, four percent had their marriages end through divorce or the death of their spouse, and three percent experienced health shocks.

5.2 Univariate Analysis

It is important to know how individual and household factors impact the respondent's decision to voluntarily lapse a life insurance policy. We first conduct a univariate comparison of the independent variables between those households choosing to lapse a policy and those that did not lapse a policy in 2010. Our results are reported in Table 3.

Both measures of cognitive ability appear to play a part in the lapse decision, though the level of cognitive ability appears to be important as to which decision is made. Both measures indicate a similar pattern across the levels of cognitive ability. A greater share of those within the lowest quartile in each cognitive measure do not lapse their policies while a larger proportion of those in the highest quartile lapse a policy. More quartiles of the numeracy measure showed a univariate relationship between cognitive ability and the decision lapse to lapse a policy.

The household economic factors indicate some level of univariate relationship. Those respondents in households with the lowest income indicate a higher proportion that do not lapse a policy while those with the highest income have a higher proportion that lapse. Respondents in households falling in the lowest and highest quartiles of net worth have greater percentages that lapse policies while those in the inner quartiles have larger percentages that don't lapse. Those who lapsed policies also had higher debt than those who didn't.

From a demographic perspective, there is a positive univariate relationship between lapsing a policy and being male, or being black, or having a college degree.

From a life cycle perspective, we see a relationship among respondents who are age 75 and older and not lapsing a policy. Of particular interest is the highly significant difference among respondents in the age 60 to age 64 group, suggesting a univariate relationship between this age group that is often associated with the beginning of retirement (Brown, 2013) and the decision to lapse.

We also observe univariate differences in two of our shock variables, those who are newly retired and those with more kids living with them. This suggests that both of these shocks are related to the decision to voluntarily lapse a policy.

We now turn our attention to the multivariate analysis using logistic regression to better understand the life insurance voluntary lapse decision by older individuals.

Table 3 – Univariate Difference for Lapses of Life Insurance between 2008 and 2010

Differences in Means of Demand Determinants for Individuals Lapsing Life Insurance				
Explanatory Variables		**(1) Lapse = 0**	**(2) Lapse = 1**	**Diff (1) - (2)**
# of Individuals		8411	384	
Cognitive Ability				
Episodic Memory Quartiles (# Correct)	< 25th Percentile	0.3481	0.2943	0.0538 **
	25th to 50th Percentile	0.2337	0.2318	0.0020
	50th to 75th Percentile	0.2133	0.2318	-0.0185
	> 75th Percentile	0.2049	0.2422	-0.0373 *
Numeracy Quartiles (# Correct)	< 25th Percentile	0.2318	0.1536	0.0782 ***
	25th to 50th Percentile	0.3770	0.3854	-0.0084
	50th to 75th Percentile	0.3189	0.3594	-0.0405 *
	> 75th Percentile	0.0723	0.1016	-0.0293 **
Economic Factors				
Income Quartiles ($)	< 25th Percentile	0.2518	0.2109	0.0409 *
	25th to 50th Percentile	0.2499	0.2526	-0.0027
	50th to 75th Percentile	0.2500	0.2474	0.0026
	> 75th Percentile	0.2482	0.2891	-0.0408 *
Net Worth Quartiles ($)	< 25th Percentile	0.2473	0.3281	-0.0808 ***
	25th to 50th Percentile	0.2519	0.1901	0.0618 ***
	50th to 75th Percentile	0.2526	0.1953	0.0573 **
	> 75th Percentile	0.2481	0.2865	-0.0383 *
Log Total Debt		5.2279	6.2421	-1.0142 ***

[a] 2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

Note: Data from the 2010 Health and Retirement Study. A t-test is used for difference of means of the variables. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.

Table 3 (Continued) – Univariate Difference for Lapses of Life Insurance between 2008 and 2010

Differences in Means of Demand Determinants for Individuals Lapsing Life Insurance				
Explanatory Variables		**(1) Lapse = 0**	**(2) Lapse = 1**	**Diff (1) - (2)**
# of Individuals		8411	384	
Financial Knowledge				
Financial Respondent		0.7029	0.7057	-0.0028
Bequest Factors				
Married in Current Wave		0.6270	0.6432	-0.0162
Has Living Children		0.9289	0.9271	0.0018
Demographic Factors				
Age in 2010	Less than 60	0.1682	0.1797	-0.0115
	60 to 64	0.1686	0.2240	-0.0554 ***
	65 to 69	0.1549	0.1484	0.0065
	70 to 74	0.1952	0.2109	-0.0157
	75 to 79	0.1504	0.1198	0.0306 *
	80 and Higher	0.1626	0.1172	0.0455 **
Male		0.4336	0.4818	-0.0482 *
Race	White	0.8189	0.7917	0.0273
	Black	0.1571	0.1901	-0.0330 *
	Other	0.0240	0.0182	0.0058
Education	Less than HS Degree	0.1531	0.1224	0.0307 *
	High school	0.3667	0.3307	0.0359
	Some college	0.2385	0.2318	0.0067
	College	0.2416	0.3151	-0.0735 ***
Health problems	Zero Problems	0.1028	0.1068	-0.0040
	One Problem	0.2098	0.1979	0.0119
	Two Problems	0.2636	0.2682	-0.0046
	Three Problems	0.2257	0.2318	-0.0061
	Four or More Problems	0.1981	0.1953	0.0028
Estate Tax Vulnerable				
Net Worth over Current Exemption [a]		0.0072	0.0182	-0.0110 **
Shocks or Major Changes				
Newly Retired Since 2008		0.1172	0.1589	-0.0416 **
Income Shock (Decline) of > 10% Compared to 2008		0.4033	0.4271	-0.0238
Additional Kids Residing at Home Since 2008		0.0487	0.0781	-0.0294 ***
Marriage Ended Since Last Wave		0.0414	0.0521	-0.0107
Health Shock (2+ Add'l Health Issues) Since Last Wave		0.0314	0.0313	0.0001

[a] 2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.

Note: Data from the 2010 Health and Retirement Study. A t-test is used for difference of means of the variables. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.

5.3 Logistic Regression Model Analysis

We present in two tables our logistic regression analyses of the decision to voluntarily lapse a life insurance policy, using separately the two measures of cognitive ability. The regression incorporating episodic memory is presented in Table 4a and the regression incorporating numeracy is presented in Table 4b.

In each table we present the results of three regression analyses from the same model to explore the relationships that various independent variables have on the decision to voluntarily lapse a policy. The first two regressions are shortened forms of the model. Regression 1 in each table is the simplest form of each model where we examine the relationship of only our independent variable of interest, cognitive ability, with the decision to voluntarily lapse a policy. In Regression 2, we add variables representing household economic factors and bequest motives from life insurance theory, and financial knowledge from prior literature (Mulholland et al., 2013). Regression 3 includes our full model with all specified control variables.

For our variable of interest, cognitive ability, we see clear differences between the use of episodic memory and numeracy as the measure for this important respondent trait. Both variables in the Regression 1 analyses show a positive relation between the level of cognitive ability and the probability of lapse. Numeracy indicates higher levels of significance and probability. While numeracy maintains its high significance in all three forms of the model, episodic memory quickly loses significance as a predictor of voluntary lapse with the introduction of other independent variables. Numeracy maintains consistent direction and magnitude of effect in each form of the model. In addition, using the pseudo R^2 values as a measure of relative model strength, we see that the models using numeracy consistently display higher strength of association. Based upon our statistically significant numeracy quartiles in our model, we reject

our null hypothesis and conclude that cognitive ability is an important factor in the ownership decisions of existing life insurance policies. We also conclude that numeracy is a better measure of cognitive ability when modeling lapse decisions. Our findings are consistent with the prior research that explores the appropriate measure of cognitive ability in relation to financial decisions (Christelis et al., 2010; Smith et al., 2010).

We observe a consistent pattern across both analyses using the different measures of cognitive ability. Higher levels of income, when compared to the lowest quartile of income, is not predictive of voluntary lapse while greater net worth is a significant predictor of a reduced likelihood to voluntary lapse a policy when compared to those respondents in the lowest quartile of net worth. Total household debt is also a significant predictor of voluntary lapse, indicating that increasing debt increases the likelihood of policy lapse. For both net worth and total debt, the magnitude and direction of the effect is consistent between the reduced model in Regression 2 and the full model in Regression 3.

We find no difference in likelihood to lapse a policy based upon the respondent's household financial knowledge as proxied by whether or not they were the identified financial respondent for answering household financial questions in the survey.

Table 4a – Logistic Regressions - Cognitive Ability Measured with Episodic Memory

Wave 10 - 2010	**Dependent Variable: Lapse = 1**					
N =8,795	**384 respondents reported lapse**					
	Reg 1		**Reg 2**		**Reg 3**	
	Odds Ratio	**Pr > ChiSq**	**Odds Ratio**	**Pr > ChiSq**	**Odds Ratio**	**Pr > ChiSq**
Intercept	-3.255	<.0001***	-3.266	<.0001***	-3.446	<.0001***
Explanatory variables						
Cognitive Ability: Episodic Memory (ref = TWR Quartile with Lowest Ability)						
TWR Quartile with 2nd Lowest Ability	1.173	0.2703	1.130	0.4063	1.105	0.5073
TWR Quartile with 2nd Highest Ability	1.285	0.0831*	1.202	0.2171	1.163	0.3379
TWR Quartile with Highest Ability	1.399	0.0192**	1.269	0.1184	1.229	0.2145
Economic Factors						
Income Quartiles (ref = Lowest Quartile)						
2nd Lowest Quartile			1.295	0.1133	1.288	0.1294
2nd Highest Quartile			1.194	0.3129	1.139	0.4812
Highest Quartile			1.298	0.1730	1.173	0.4517
Net Worth Quartiles (ref = Lowest Quartile)						
2nd Lowest Quartile			0.525	<.0001***	0.540	<.0001***
2nd Highest Quartile			0.530	<.0001***	0.533	0.0002***
Highest Quartile			0.782	0.1199	0.737	0.0801*
Log Total Debt			1.031	0.0053***	1.023	0.0412**
Financial Knowledge						
Financial Respondent			1.063	0.6250	0.985	0.9079
Bequest Factors						
Married			1.042	0.7625	1.018	0.9036
Has Living Children			0.984	0.9365	0.959	0.8380
Demographic Factors						
Age in 2010 (ref = Ages 60 to 64)						
Less than 60					0.851	0.3451
65 to 69					0.781	0.1651
70 to 74					0.920	0.6174
75 to 79					0.730	0.1148
80 and Higher					0.720	0.1193
Male (ref = Female)					1.248	0.0533*
Race (ref = White)						
Black					1.261	0.1083
Other					0.758	0.4801
Education (ref = Less than HS Degree)						
High school					1.177	0.3741
Some college					1.192	0.3790
College					1.604	0.0229**
Health Problems (ref = Zero Problems)						
One Problem					0.942	0.7642
Two Problems					1.100	0.6262
Three Problems					1.136	0.5304
Four or More Problems					1.118	0.6020
Estate Tax Vulnerable						
Net Worth over Current Exemption [a]					2.078	0.0799*
Shocks or Major Changes						
Newly Retired Since 2008					1.410	0.0197**
Income Decline > 10% from 2008 (Real $)					1.082	0.4863
Additional Kids Residing at Home Since 2008					1.533	0.0334**
Marriage Ended Since Last Wave					1.354	0.2361
Health Shock Since Last Wave					0.895	0.7171
Pseudo R^2 =	0.0023		0.0167		0.0298	

[a] 2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.
Note: Data from the 2010 Health and Retirement Study. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.

Table 4b (Continued) – Logistic Regressions - Cognitive Ability Measured with Numeracy

Wave 10 - 2010	**Dependent Variable: Lapse = 1**					
N =8,795	**384 respondents reported lapse**					
	Reg 1		**Reg 2**		**Reg 3**	
	Odds Ratio	**Pr > ChiSq**	**Odds Ratio**	**Pr > ChiSq**	**Odds Ratio**	**Pr > ChiSq**
Intercept	-3.498	<.0001***	-3.414	<.0001***	-3.547	<.0001***
Explanatory variables						
Cognitive Ability: Numeracy (ref = Numeracy Quartile with Lowest Ability)						
Numeracy Quartile with 2nd Lowest Ability	1.543	0.0057***	1.585	0.0041***	1.600	0.0050***
Numeracy Quartile with 2nd Highest Ability	1.701	0.0008***	1.719	0.0014***	1.684	0.0045***
Numeracy Quartile with Highest Ability	2.120	0.0004***	2.024	0.0020***	1.867	0.0113**
Economic Factors						
Income Quartiles (ref = Lowest Quartile)						
2nd Lowest Quartile			1.234	0.1990	1.265	0.1597
2nd Highest Quartile			1.113	0.5433	1.108	0.5790
Highest Quartile			1.206	0.3285	1.146	0.5205
Net Worth Quartiles (ref = Lowest Quartile)						
2nd Lowest Quartile			0.511	<.0001***	0.533	<.0001***
2nd Highest Quartile			0.502	<.0001***	0.523	<.0001***
Highest Quartile			0.724	0.0437**	0.718	0.0576**
Log Total Debt			1.029	0.0082***	1.022	0.0506*
Financial Knowledge						
Financial Respondent			1.007	0.9586	0.961	0.7586
Bequest Factors						
Married			1.008	0.9550	1.013	0.9314
Has Living Children			0.992	0.9687	0.951	0.8085
Demographic Factors						
Age (ref = Ages 66 to 75)						
Less than 60					0.850	0.3409
65 to 69					0.784	0.1719
70 to 74					0.918	0.6071
75 to 79					0.727	0.1091
80 and Higher					0.713	0.1008
Male (ref = Female)					1.171	0.1632
Race (ref = White)						
Black					1.365	0.0348**
Other					0.796	0.5618
Education (ref = Less than HS Degree)						
High school					1.062	0.7472
Some college					1.044	0.8308
College					1.383	0.1281
Health Problems (ref = Zero Problems)						
One Problem					0.927	0.7043
Two Problems					1.082	0.6885
Three Problems					1.118	0.5849
Four or More Problems					1.095	0.6723
Estate Tax Vulnerable						
Net Worth over Current Exemption [a]					2.085	0.0781*
Shocks or Major Changes						
Newly Retired Since 2008					1.430	0.0153**
Income Decline > 10% from 2008 (Real $)					1.074	0.5293
Additional Kids Residing at Home Since 2008					1.518	0.0381**
Marriage Ended Since Last Wave					1.372	0.2174
Health Shock Since Last Wave					0.895	0.7176
Pseudo R^2 =	0.0063		0.0208		0.0331	

[a] 2010 Exemption was $0 but was retroactively changed to allow an election of $5,000,000. This variable set at $5,000,000.
Note: Data from the 2010 Health and Retirement Study. Statistical significance at 0.10, 0.05, and 0.01 levels is denoted by *, **, and ***, respectively.

Demographic control variables display similar effect patterns and magnitudes but with shifting significance with the change in cognitive ability measure. Men, blacks, and those with college degrees appear more likely to lapse. As suggested in the univariate analysis, we use those in the typical pre-retirement or early retirement years, ages 60 to 64, as our reference group for the multivariate analyses. While falling just outside the traditional levels of significance, policyholders 75 and older appear to be nearly 30 percent less likely to lapse their existing policies than the reference age group.

The presence of health problems was not indicative of a change in likelihood to voluntarily lapse a policy.

When considering estate tax vulnerability of the household, we find that those respondents with household net worth in excess of the $5 million estate tax exemption level are significantly more likely to lapse a policy than those with less than this level of net worth. Those from the vulnerable households are about twice as likely to lapse a policy. Given prior research that suggests life insurance is a tool to improve the efficient transfer of the estate upon death (Milevsky, 2006) and is used as such (Mulholland et al., 2013), we initially find this result puzzling. We will address this puzzling result in the next section.

Finally, two important shock variables indicate a significant increase in likelihood to lapse a policy in the presence of these shocks. Newly retired respondents are over 40 percent more likely to lapse a policy. In a new finding, we see that the addition of a child to the household of these older respondents increases the likelihood of lapsing a policy by over 50 percent.

Overall, our results suggest numeracy as a measure cognitive ability is a significant predictor of life insurance policy lapse decisions.

6. Discussion and Conclusions

The purpose of this study is to further explore the microeconomic determinants of life insurance lapse by introducing an additional variable into a model of lapse behavior. Cognitive ability has been shown in prior research to be an important factor in financial decision-making (Christelis et al., 2010; Smith et al., 2010). We find evidence that cognitive ability, when using numeracy as its measure, is a determinant in the decision to voluntarily lapse a life insurance policy, thus we reject our hypothesis. In addition, we find that specification of the correct measure of cognitive ability is important as seen in the lack of significant relationship when using episodic memory as the measure of cognitive ability, but a highly significant relationship when using numeracy as the cognitive ability measure. We conclude that numeracy is the appropriate measure of cognitive ability to include when modeling lapse behavior. Our results are statistically significant.

Numeracy may be related to the ability of the policyholder to perceive the value of lapsing a policy at the appropriate time, such as when a term policy is no longer needed to hedge against the loss of labor income flows at retirement or a permanent policy is no longer needed after a loss of a bequest motive. It is important to note here that we are not able to comment on the specific rationality of the individual respondent's decision to lapse a life insurance policy. With limitation in the data as to the specific reason the lapse decision is being made, such as loss of bequest motive, income shock, or health shock (Fang & Kung, 2012), we can only comment in general on the rationality of the decisions made by older policyholders.

Our results support prior literature in several ways. In the area of life cycle theory, we find that a greater proportion of policyholders are making the decision to lapse life insurance in the time frame surrounding when we see U.S. workers transition from the labor force to retirement, typically in the age 60 to age 64 timeframe (Brown, 2103). Our results suggest, though just beyond the typical level of significance, that in comparison, policyholders who are well into their retirement years are less likely to lapse their policies, possibly to meet bequest or end-of-life expenses.

While it is not the focus of our study, we find some evidence supporting the EFH. While controlling for cognitive ability, we find policyholders have an increased likelihood of lapsing a policy in the face of rising household debt. Conversely, we find that those policyholders with higher levels of net worth are less likely to lapse a policy. Income level is not significant in our model. We do not find evidence that income shock at the level we specify impacts the decision to lapse a policy, which is likely a result of the level of shock chosen. It is in the presence of very large income shocks that prior literature finds income shock to be a significant factor in life insurance lapse (Fier & Liebenberg, 2012; Liebenberg et al., 2012).

Our findings in this model indicate that those individuals with household net worth above the 2010 tax exemption limit of $5 million are twice as likely to lapse their policy as those with net worth below the exemption limit. This result is counter to prior research that finds estate tax-vulnerable households are more likely to own cash value life insurance (Mulholland et al. 2013). While on the surface this may be a puzzling result, we suggest this result may be an artifact of the data. In the prior study, Mulholland et al. use multiple years of cross-sectional data incorporating multiple waves of the Survey of Consumer Finances (SCF) to explore the

relationship of life insurance demand to estate tax vulnerability. The 2010 wave of the SCF was one of seven waves used. In contrast, our study uses only the 2010 cross section of the HRS. This is important because 2010 was a unique year for estate tax laws in the U.S. The EGTRRA-2001 eliminated the estate taxes in 2010 while also making all assets subject to capital gains taxes. This changed the tax rates for estate transfers. For those households that were vulnerable to estate taxation, this may have encouraged them to re-optimize their life insurance coverage, an area of life insurance lapse theory covered by the PRH. This is an area that should be considered for future study.

We also find new evidence that policyholders who had one or more children recently move home to live with them are much more likely to lapse a policy. Certainly there may be an added expense component in the household and we suggest this is very similar to an income shock. But this raises some interesting questions due to of the nature of the "expense shock." Are parents foregoing a typical bequest desire in exchange for current joint utility associated with helping their child? If the child knew about the exchange of utility by the parent and the impact it is having on the child's own present and future utility, would the saliency of that exchange affect the child's decision to move home? Finally, if there are other children that would have benefited from the life insurance proceeds, the loss of their share of the death benefits is effectively a 100 percent tax on their proceeds by their sibling that moved home. Understood in this manner, would the parent make the same choice or would they have sought policy support from the other siblings? The interplay of policy stakeholders in the lapse decision is an area of possible future research that may reveal some interesting results.

Our results are important to the various life insurance actors we discuss earlier in this article. For insurance companies, making tools available to policyholders and advisors that are targeted to the different levels of numerical ability may improve policyholder decision-making as they evaluate their current policies. For those policyholders with lower numerical ability, the current in-force ledger illustrations may confuse them to the point that they see lapse as their best, or only, option. It is a similar issue for regulators who are charged with protecting consumers. Mandating education and protection tools that are sensitive to the policyholder's cognitive ability should provide better protection for consumers.

For advisors, a better understanding of the cognitive ability of their clients or prospects should allow the advisor to tailor the advice to better meet the consumer's ability to understand it. If consumers are better informed, the advisors are less likely to the face legal issues like those that Glenn Neasham was forced to endure.

We caution that while understanding that numerical ability is important for financial decisions like the ownership of life insurance, the questions used in the HRS should not be viewed as the best way to measure numeracy among policyholders. We leave that research to those studying financial literacy, which Huston (2010) conceptualizes as having two dimensions, understanding and use. These are similar to the dimensions Smith et al. (2010) use in their definition of crystallized intelligence – knowledge and experience. Since numeracy is a form of crystallized intelligence, there may be improved life insurance decisions with improved financial literacy about life insurance.

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