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Households: The Impact of Information**

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Dementia Risk and Financial Decision Making by Older Households: The Impact of Information

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Abstract

The knowledge and reasoning ability needed to manage one's finances is a form of human capital. Alzheimer's disease and other dementias cause progressive declines in cognition that lead to a complete loss of functional capacities. In this paper we analyze the impact of information about cognitive decline on the choice of household financial decision-maker. Using longitudinal data on older married couples, we find that as the financial decision maker's cognition declines, the management of finances is eventually turned over to his cognitively intact spouse, often well after difficulties handling money have already emerged. However, a memory disease diagnosis increases the hazard of switching the financial respondent by over 200% for couples who control their retirement accounts (like 401ks) relative to those who passively receive retirement income. This is consistent with a model of the value of information: households with the most to gain financially from preparation are most responsive to information about cognitive decline.

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1 Introduction

Alzheimer's disease (AD) and other dementias cause progressive, largely irreversible, declines in cognition that lead to a complete loss of functional capacities. Such declines may pose enormous financial risk to all members of a household. First, dementia is associated with high costs of care, including the costs of identifying and paying for nursing home services and home care; second, cognitive impairment of a financial decision-maker can lead to financial mismanagement. The financial risks highlight the potential benefits of preparing for the loss of functional capacities and raise the questions: do households change how they manage their assets when such cognitive difficulties set in? And, do they respond to signs of cognitive impairment and medical diagnoses of a memory-related disease?

Older individuals often have difficulties handling money, for example, forgetting to pay bills, participating in fraudulent schemes, and signing contracts they don't understand.¹ These difficulties often later give way to a diagnosis of Alzheimer's, as well as serious financial problems. Indeed, medical research has shown that such problems are an early sign of dementias like AD.

The emergence of difficulties handling money can be extremely problematic if one does not have assistance with this task. Married individuals could potentially rely on their cognitively intact spouses to assume responsibility of finances. Using the Health and Retirement Study (HRS), a longitudinal, nationally representative study of older Americans, we employ survival analysis and other regression methods to examine if and when financial responsibility is transferred from one spouse to another as a result of cognitive decline. We find that as the cognition of the primary financial decision-maker declines, the management of finances is eventually turned over to the unimpaired spouse. However, the switch often does not occur until well after the impaired spouse reports difficulties handling money. This suggests that a cognitively impaired individual often continues to make financial decisions even after he is aware of his difficulties handling money or has even received a diagnosis of a memory-related disease.

To understand the variation in the responsiveness of the switch to a diagnosis of a memory related disease, we analyze an economic model of the value of information about future cognitive impairment. There is surprisingly little consensus among medical professionals—let alone patients and loved ones—about the value of early diagnosis of Alzheimer's. On one hand, given the irreversibility of AD, a diagnosis may introduce unnecessary emotional trauma. On the other hand, a diagnosis allows couples to alter their plans and prepare for the future, which can be financially beneficial. Our theoretical model

¹ Anecdotal accounts can be found in a series of *New York Times* articles on aging, AD (Kolata, 2010a, 2010b).

highlights both the emotional cost of new information and the financial benefits of using that information to re-optimize for the future.

Based on the model, we hypothesize that couples whose financial assets require a high level of individual oversight face greater gains from re-optimization and therefore greater incentive to respond to signs of cognitive impairment. In their model about forms of human capital that are useful for the management of wealth, Delavande et al. (2008) show that the benefits of financial competence are proportional to the amount of wealth one manages. Households who rely on fixed income sources, such as pensions and Social Security, need only a modest amount of day-to-day oversight of finances relative to those who actively manage wealth, such as savings in 401(k) accounts. Protecting household finances against mismanagement by a cognitively impaired husband may involve establishing trusts, assigning power-of-attorney, or otherwise transferring financial responsibility to the wife.

We find that couples who actively manage their retirement accounts transfer responsibility more quickly after the emergence of money difficulties and at higher levels of cognition. A diagnosis increases the hazard function of switching the financial respondent by a factor of 2.4 for couples who control their retirement accounts relative to those who passively receive retirement income. These results hold even after controlling for wife's cognition, education, wealth, and stock ownership. This is consistent with an economic model of the value of information: households with the most to gain financially from preparation are most responsive to information about cognitive decline.

The next section provides additional background information on cognitive impairment and diagnoses, financial capacity, and the household division of labor. Section 3 presents empirical patterns of financial responsibility, financial capacity, subjective expectations of future cognitive decline, and diagnoses over the full spectrum of cognition. In Section 4, we provide a theoretical framework for thinking about the potential variation in the value of a diagnosis of a memory-related disease like Alzheimer's disease, and how they might alter their choices and behaviors in light of new information given by a diagnosis. We hypothesize that households with individually managed retirement wealth are more responsive to a diagnosis than those who do not manage their wealth. Section 5 presents regression analyses tests the hypothesis with respect to the household division of labor for financial decision-making tasks, and Section 6 concludes.

2 Background

In this section, we will provide some background on the issues at hand. We will begin with a description of declines in cognition that may result in the diagnosis of a memory related disease, the

relationship between cognitive impairment and financial capacity, and impact of impairment on the division of labor. In particular, we focus on the management of finances and the financial vulnerability of older persons. Lastly, we discuss the value of a diagnosis of AD, a form of information about cognitive impairment.

2.1 Cognitive impairment, dementia, and functional capacity

Dementia is defined as the loss of cognitive and mental functions severe enough to impair a person's daily functioning. These losses reflect declines from a previous baseline, and they must include the impairment of memory and at least one other cognitive function.² One of the earliest signs of dementia is forgetfulness, which is often accompanied by functional difficulties in areas like language, social skills and reasoning skills. Estimates show that nearly 15 percent of Americans over the age of 70, or 3.4 million individuals, suffer from some form of dementia (Plassman et al. 2007).

Dementia represents a set of symptoms, characterized by reduced functional capacity, that can be caused by a number of diseases or conditions. Alzheimer's disease is the most common form of dementia and accounts for an estimated 60 to 90 percent of all dementia cases (Brookmeyer et al., 2011; Alzheimer's Association, 2011). Individuals with dementias like Alzheimer's suffer progressive declines in cognition that worsen continuously over a period of years.³

Dementing disorders are distinct from normal aging in that dementia is characterized by diminished functional capacity. A person experiencing typical aging will be largely independent in his daily activities, in spite of possible complaints about memory loss. A person aging with dementia becomes dependent on others for activities necessary for daily living and will begin behaving in socially inappropriate ways. Under typical aging, a person may complain about memory loss but can generally recount in detail these bouts of forgetfulness, whereas a demented person would generally be unable to recall these incidents (American Medical Association, n.d.).

² These functions are, as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, cited in Holsinger et al. (2007): agnosia, failure to recognize or identify objects despite intact sensory function; aphasia, deterioration of language function (impairment); apraxia, impaired ability to execute motor activities despite intact motor abilities, sensory function, and comprehension of the required task; delirium, a disturbance of consciousness that is accompanied by a change in cognition that cannot be better accounted for by a preexisting or evolving dementia; executive functioning, the ability to think abstractly and to plan, initiate, sequence, monitor, and stop complex behavior.

³ For simplicity, we use Alzheimer's interchangeably with dementia. Other common forms of progressive dementia include vascular dementia, dementia with Lewey bodies, or Parkinson's disease, although it is now commonly accepted that most dementia is mixed vascular and Alzheimer's (Langa et al., 2004). In this respect, it is possible that actions taken that reduce risk factors for stroke, would reduce the risk of AD as well the risk of vascular dementia.

Doctors assess a patient's cognition using neuropsychological tests, including tests for memory, problem-solving skills, and thinking and reasoning skills. One of the more widely used (and commonly studied) tests for screening and assessing the severity of dementia is the Mini-Mental State Examination (MMSE), which covers a number of cognitive functions in about ten minutes (Holsinger et al., 2007).

Health professionals rely on a standardized list of activities, known as the Activities of Daily Living (ADLs), to determine the functional status of patients. Basic ADLs include walking, bathing, toileting and other requirements of personal care and hygiene. Instrumental ADLs (IADLs) refer to more complicated tasks, like those involved in managing a household and its finances. Pérès et al. (2008) find that individuals who are eventually diagnosed with dementia perform more poorly on IADLs than those who do not develop dementia.

At this time, Alzheimer's and most other forms of dementia are progressive and have no cure.⁴ While research on the prevention, treatment, and early detection of AD is underway, reactions to the value of early diagnosis are quite varied.

2.2 Cognition and functional capacity in financial management

Financial management can be a very complex task that generally requires high cognitive function. This task has become more complicated as regular streams of retirement income from defined benefit pensions have been replaced by retirement plans that need to be actively managed. Some studies have found that older consumers make poorer financial choices than middle-aged consumers, which may be attributed to aging related cognitive decline (Agarwal, et al., 2009, and Korniotis and Kumar, 2011) find evidence that older investors “exhibit worse stock selection ability and poor diversification skill,” which the authors attribute to aging-related cognitive declines. Reduced cognitive function predicts both low asset accumulation as well as less participation in the financial markets (Benjamin et al., 2006). Other studies have found similar patterns with respect to numeracy and the accumulation of wealth (Banks and Oldfield, 2007; Banks et al., 2010; Smith et al., 2010).

Declines in financial capacity, the productivity of financial human capital, have been detected in Alzheimer's patients. Studies have shown that those with mild and moderate cases of Alzheimer's have significantly impaired financial abilities (Marson et al., 2000), even though their basic calculation skills may still be intact (Martin et al., 2003). Studies have also found particularly rapid declines in financial

⁴ Some dementias are brought about by a single event, such as cardiac arrest or brain injury; these dementias are static but are also generally irreversible. Others with certain causes, like infection, nutritional deficiencies, or drug interactions, may be reversible. A meta-analysis of dementia studies showed that less than ten percent of cases were potentially reversible and only 0.6 percent of cases reversed at least partially (Clarfield, 2003). Current treatments include drugs that can help manage the cognitive symptoms of AD for a limited period of time (http://www.alz.org/alzheimers_disease_standard_prescriptions.asp).

skills among AD subjects, particularly in their susceptibility to simple fraud (Martin et al., 2008). The worsening of financial abilities can occur even prior to the onset of dementia and AD. Triebel et al. (2009) detect declining financial skills in patients with mild cognitive impairment (MCI) in the year before developing AD.⁵

Financial vulnerability of older Americans

Regardless of cognitive status, older Americans are more financially vulnerable than the general population. Not only have most of the elderly left the labor market, but they face greater medical costs in their declining health, and they are frequently targets of financial abuse. At the same time, their financial tasks can be quite complex. These tasks include budgeting, managing credit and debt, dealing with bills (including medical bills), managing retirement wealth, planning for medical or nursing home care, bequests, and so on. Even seemingly minor oversights can lead to large problems: the *New York Times* describes a former lawyer who forgot to pay his bills, and then later stopped paying creditors altogether. By the time his wife noticed something was wrong, most of their money had vanished (Kolata, 2010a). Financial abuse and exploitation is endemic among older Americans.⁶ In 2004, financial exploitation was one of the most common forms of elder abuse investigated and substantiated by Adult Protective Services (Teaster et al., 2006).

Self-awareness of impairment

Knowing that preparation and protection against the financial vulnerability of cognitive impairment is necessary requires some awareness of one's current or future cognitive status. Lack of self-awareness of one's cognitive capacity is a common symptom among AD patients. For example, when asked to self-assess their ability to pay bills, Williamson, et al. (2010) find that AD patients rate themselves significantly higher than their actual performance warrants whereas normal controls provide realistic self-assessments. Other studies confirm that those with mild cognitive impairment (Okonkwo et al., 2008) and dementia (Van Wieringen et al., 2004) are not fully aware of their deteriorating financial skills, and their proxy informants or caregivers also systematically misjudge the financial abilities of patients (Okonkwo et al., 2008). This lack of awareness can lead to increased financial vulnerability if the impaired individual continues to make financial decisions, and suggests that a diagnosis of a memory-related disease in itself may provide the impetus for taking action.

⁵ While not all individuals with mild cognitive impairment convert to AD, cross-sectional studies have shown that individuals with MCI also have impaired financial abilities (Griffith et al., 2003; Okonkwo et al., 2008).

⁶ Examples of financial abuse include cashing an older person's checks without permission; forging his signature or coercing him into signing a contract, will or other document; and stealing or misusing an older person's financial resources (Teaster et al., 2006).

2.3 Who Should Manage the Household's Money?

Family economics has long emphasized the gains from a family division of labor in which spouses specialize in different activities according to their comparative advantage (Becker, 1991). The gains from the division of labor are magnified by the potential of each spouse to enhance their knowledge and skills by investing in human capital through learning-by-doing, self-study or even formal training. Managing the family finances is one such task and financial knowledge and the functional capacity to use such knowledge may be regarded as forms of human capital.

In older households containing spouses in good health, it is likely that one spouse will have specialized in acquiring the knowledge and skills needed to manage the family's finances and make good decisions about the family's finances. An important implication of human capital theory is that the marginal value of improving these skills is approximately proportional to the amount of money under management, so that household's with greater financial resources will also invest more in financial knowledge (Delavande, et. al., 2008). On the other hand, having more money under management also exposes the household to the risk of larger losses in the event of incompetent financial decision making. A division of labor may be efficient, but only if the union is intact and if both members continue to hold the mental and physical abilities required by their responsibilities. Hsu (2011) discusses the role of widowhood in the division of labor, but what happens if one member of the couple begins to lose skills due to a dementing disease such as AD? The death of a spouse necessarily disrupts the division of labor, but cognitive decline can have consequences that are even more severe.⁷ Wise financial management and decision-making become even more important given the high costs of care associated with AD, including the complexity of identifying and paying for nursing home services and home care.

Furthermore, while the onset of widowhood is instantaneous and impossible to ignore, the cognitive decline associated with dementias like Alzheimer's occurs progressively and disrupts division of labor in a more subtle way. Individuals might be physically able to continue the division of labor, but cognitive impairment makes it harder to do certain tasks well, especially if the tasks require thinking and reasoning. Declines in ability lead to declines in productivity of human capital and consequently the loss of comparative advantage in tasks that require high cognitive function. Therefore, one way to mitigate the impact of Alzheimer's on a patient's family is to restructure the division of labor such that a person who is cognitively intact is responsible for cognition-intensive tasks. In the next section, we describe the

⁷ The analysis in Hsu (2011) focuses on women, who tend not to be the primary financial decision maker in the household (the household's CFO) but are more likely than men to become widows. While more women than men have dementia (Alzheimer's Association, 2011), this gap is attributable to gender differentials in mortality. Indeed, mild cognitive impairment is more prevalent among men than women (Petersen et al., 2010). The same issues regarding dementia and financial decision-making arise regardless of the gender of the financial CFO.

extent to which older households restructure their division of labor in the face of cognitive impairment. Using the notation of the theoretical model introduced later in Section 4, this is one example of an action, y , that might be influenced by p , beliefs about one's subjective risk of AD.

3 Descriptive analysis of cognition and financial management

3.1 Empirical approach and data

Our goal is to analyze the impact of new information about dementia risk on the financial behavior of older married couples. The new information may take the form of the observation of the “signs and symptoms” of cognitive decline by an individual or spouse, children or friends or it may take the form of seeking a medical diagnosis. We focus our attention on the degree to which cognitive decline influences a shift in financial responsibility between spouses. To do so, we make use of cross-sectional and longitudinal data from the Health and Retirement Study (HRS),⁸ a nationally representative longitudinal survey of Americans over the age of 50 and their spouses. We define a longitudinal sample consisting of the respondent who was designated in the baseline survey to be the “financial respondent” based on a question about which member of the couple is most knowledgeable about household finances, including family assets, debts and retirement planning. We then examine how changes in the cognitive status of this person affect the likelihood that the HRS designates the other spouse as financial respondent in a subsequent wave.⁹

We first establish that a 27-point scale of cognitive capacity provides a valid measure of the dementia status of respondents. We then restrict our analysis to couples with the goal of analyzing changes in the division of labor—the choice of the household's financial decision-maker—which is one of the choices a household can make to protect against financial mismanagement in the face of cognitive impairment. We show how cognitive capacity is related to receiving memory disease diagnoses, the awareness of difficulties in handling money, and the decision to switch the financial respondent. The use of the cognition scale as “analysis time” helps us determine whether respondents are learning or acting, and “when” these changes occur on the cognition scale.

Since the first wave of the HRS in 1992, follow-up surveys have been conducted approximately every two years. New cohorts are added every six years to maintain the steady state design. In the 2008

⁸ The HRS (Health and Retirement Study) is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. Some variables were provided by the RAND HRS Data file. See <http://hrsonline.isr.umich.edu> for more information.

⁹ While this measure was designed for survey management purposes, rather than as a direct measure of financial decision-making, the financial respondent measure is the best measure available in the data. Financial respondents typically do not switch back and forth repeatedly across waves.

wave, the HRS interviewed over 18,000 individuals. The survey content includes individual- and household-level information about family demographics, health status, cognition, functional limitations, assets, debts, and others. The analysis sample is restricted to waves in which the cognition score was collected, waves 1998 through 2008.

The HRS is supplemented by the Aging, Demographics, and Memory Study (ADAMS), a national population-based study of dementia (Langa et al., 2005). A sample of 856 HRS respondents over the age of 70 participated in an extensive in-home cognitive assessment and received a diagnosis of normal, 'cognitive impairment, not demented' (CIND), or dementia based on the judgments of an expert panel of neuropsychologists and neurologists. Follow-up assessments were conducted for those diagnosed with CIND, or whose diagnoses were unclear at baseline. These diagnoses can be linked to HRS cognition data to verify the validity of HRS measures.

3.1.1 Key measures used in the empirical analysis

Cognitive status

A 27-point cognitive scale is administered to self-respondents who are 51 and older. The scale includes a ten-word immediate and delayed recall test (0-20 points) that measures episodic memory, a serial 7s test that measures working memory (0-5 points), and a backwards counting test that measures mental processing speed (0-2 points).¹⁰ These tasks were derived from the Mini-Mental State Examination commonly used by physicians and other well-validated scales, and they display “satisfactory psychometric properties” (Herzog and Wallace, 1997; Herzog and Rodgers, 1999).

Crimmins et al. (2011) determined cut points of the cognitive scale that would generate the same population prevalence of dementia and CIND among the HRS sample as that found in the ADAMS. Scores between 12 and 27 points are considered normal, 7-11 points CIND, and 0-6 points correspond to dementia. Those who have proxy respondents are scored based on proxy assessments of memory, proxy assessment of IADL limitations, and interviewer assessments of cognitive impairment. These three assessments combine for a nine point scale (prior to 2000) and an eleven-point scale (2000 onward), which can be mapped to the same categories of the above full 27-point scale. For the pre-2000 (2000 onward) scale, normal scores are 0-2 (0-2) points, CIND scores are 3-4 (3-5) points, and demented scores are 5-9 (6-11).¹¹ Proxy interviews are generally triggered by low scores on a more basic cognition test.

¹⁰ Scores from waves from 2006 and earlier include imputations for missing data (Fisher et al., 2009), while those from 2008 are raw scores and do not include imputations.

¹¹ This classification of cognitive function was developed by Mohammed Kabeto and David Weir. Coding proxy interviews as zeros does not influence the empirical results.

Information: memory disease diagnoses

Beginning in 1998, the HRS has asked each respondent at each interview, “Has a doctor ever told you that you have a memory-related disease?” It is our primary source of information about the medical assessment of cognitive decline. We also include a variable on insurance coverage, which takes a value of 1 if the respondent is covered by a current or previous employer plan, by a spouse’s current or previous employer plan, or a government plan like Medicare or Medicaid, given that those without insurance will face much greater barriers and costs to receiving a diagnosis.

Awareness of financial capacity: Money IADL

The HRS asks respondents about their ability to perform both ADLs and Instrumental ADLs (IADLs). One such IADL question asks the respondent, “Because of a health or memory problem, do you have any difficulty with managing your money—such as paying your bills and keeping track of expenses?” If a respondent answers “yes,” “don't do,” or “can't do,” he is coded as having difficulties handling money. This money IADL variable can thus be used as an indicator for having problems handling money. This variable is an indicator of self-awareness of one’s own financial capacity, or a source of information.

Awareness of risks of future cognitive decline: subjective expectations

In 2006 and 2008, the HRS asked respondents: “Assuming that you are still living at X, what are the chances [on a 0 to 100 scale] that you will be free of serious problems in thinking, reasoning or remembering things that would interfere with your ability to manage your own affairs?” where “X” is an age between 11 and 15 years ahead. Answers to this question can be interpreted as the subjective probability of future cognitive decline.

Behavioral outcome: changes in financial respondents

A measure of financial responsibility in the household in the HRS is the “financial respondent,” who answers all survey questions related to household finances and wealth. This person is selected when the couple enters the study, in accordance with the question about the person most knowledgeable about household finances, including family assets, debts and retirement planning. During the introductory section of each wave's interview, the interviewer determines whether or not the financial respondent assignment needs to be changed. A new financial respondent can be seen as a strong signal that the previous financial respondent is no longer the most knowledgeable about household finances. The financial respondent in a couple tends to have higher financial literacy than the spouse, and in most cases is the husband (Hsu, 2011). The financial respondent also tends to either singly or jointly make the major financial decisions for the household.

3.2 Descriptive analysis

All analysis in this paper is conducted at the household level from the perspective of the member who was the financial respondent when the couple entered the HRS. Because there can only be one financial respondent in the couple, each couple only has one observation per wave. Table 1 reports summary statistics from of the couple's initial financial respondent the first year a couple appears in the analysis sample. Most financial respondents at baseline are male. Likewise, they are older than their spouses and are more educated than their spouses.

The bottom of Table 1 summarizes the cognition of baseline financial respondents and their spouses, measured during the first year the couple appears in the analysis sample. Most respondents have cognition scores in the normal range. About 11 percent of initial financial respondents and 14 percent of spouses have scores in the CIND range, and 3 percent and 5 percent in the dementia range, respectively. In about 90 percent of couples, the baseline financial respondent has a cognition score in the same or better range than his spouse (see Table 2). Few respondents (less than 2 percent) report having been diagnosed with a memory disease. About 5 percent of initial financial respondents and 10 percent of spouses report having problems handling money.

Our sample is subject to left censoring; due to the design of the HRS, members of different cohorts entered the study at different ages. Therefore, some couples are young during the first wave of analysis, while others are older. If some couples switched financial decision-makers prior to the onset of the survey, or if they passed on responsibility to an adult child, our analysis will not capture these events. Right censoring can also emerge if a spouse dies, or if the marriage otherwise dissolves. We use survival analysis methods to deal directly with these issues.

3.2.1 Validation of cognition measures: Cognition scores and actual diagnoses of dementia or CIND

The use of the 27-point cognition scores and the cutoffs for CIND and dementia can be validated using the ADAMS. ADAMS respondents were administered the same cognitive tests as all other HRS respondents together with additional assessments, resulting in a determination by an expert panel of whether the respondent is normal, CIND, or demented. Figure 1 displays a box plot of cognition scores for ADAMS respondents who were found to be normal, CIND, or demented as of the most recent wave available of the ADAMS. The scores reported were the most recent scores from the core HRS interview available at the time of the ADAMS diagnosis. Because cognition tends to decline with age, the scores may be slightly higher than what the respondents would have achieved if measurement of the tests occurred at the same time as the ADAMS assessment. As seen in Figure 1, over 80 percent of ADAMS

respondents with a normal outcome have cognition scores in the normal range (greater than 12, or above the topmost red horizontal line). The interquartile range of CIND respondents is mostly in the CIND cognition score range, though the median is at 11 points, the upper cutoff of the range. Those with a dementia diagnosis have scores that span both the CIND and the dementia score ranges, and again the median at the dementia/CIND threshold. The cognition scores and the cutoffs proposed by Crimmins et al. (2011) are largely consistent with the diagnostic conclusions from ADAMS, which validates the use of these 27-point scores alone for all respondents.

3.2.2 Patterns over the 27-point cognition scale

Do baseline financial respondents turn over responsibility for finances at the same level of cognition that they report having difficulties managing money or receive a diagnosis of a memory related disease? In other words, do respondents undertake changes in behavior before or after the emergence of signs and symptoms? To investigate such changes, we restrict the analysis to the baseline financial respondent in couples, since all uncoupled individuals are necessarily financial respondents and cannot turn over responsibility to a spouse. Figure 2 plots for coupled baseline financial respondents the following:

1. the proportion of respondents who are financial respondents,
2. the proportion of respondents who do not report problems handling money,
3. the proportion of respondents who do not report receiving a diagnosis, and
4. the subjective expectation that the respondent will be free of cognitive impairment in the future

over the 27-point cognition scale. These plots are based on lowess estimates, and with the exception of the financial respondent plot, all look very similar if the full HRS sample is used (for example, by including singletons and spouses who were not financial respondents at baseline). The subjective expectations were only asked in two waves, but the remaining variables are drawn from all waves of the survey.

As seen in Figure 2, virtually all respondents report not having any difficulty handling money until cognition scores reach the CIND range at which point there is linear decline to about 20-60 percent reporting no difficulties in the dementia range of scores. While this suggests that people have some awareness of their cognitive difficulties, it also seems likely that many of the cognitively impaired respondents are either not aware of problems they have in managing money or are not willing to tell an interviewer about their problems.

The incidence of self-reported memory disease diagnoses increases as the cognition score declines. Figure 2 shows that almost no respondents report having received a diagnosis of a memory problem if their cognitive score falls within the normal range of 11-27 and only about 5 percent report a diagnosis within the CIND range of 7-11. Even among those with scores within the dementia range of 0-6, only 25 percent of respondents with dementia-range cognition scores report a memory disease diagnosis. One possible explanation is that some of the remaining 75 percent do indeed have such a disease, but never received a diagnosis from a doctor, perhaps due to lack of insurance. Alternatively, these may be false negatives in the sense that the respondents were once diagnosed but either are unaware of the diagnosis or have forgotten. Thus, unless there is severe underreporting of diagnoses, it appears that relatively few people have received (or perhaps even sought) a medical diagnosis for memory problems and that those who have probably have quite severe cognitive impairment.¹²

The lower the cognition score, the less likely an individual is to be a financial respondent, which indicates that the spouse is now the financial respondent. However, even in demented ranges, over 80 percent of these baseline financial respondents *still remain* financial respondents. Given the much lower proportions of respondents reporting being free of problems handling money or being free of a memory disease diagnosis, it must be that in many couples, the financial respondent continues to be responsible for the finances in spite of information indicating difficulties with the task. A possible reason for this discrepancy—that a person remains the financial respondent in spite of having problems handling money or a diagnosis—is that the spouse may be even worse off. In this case, the baseline financial respondent may retain his comparative advantage even in light of his difficulties handling money. The regression analyses will address this issue.

The evidence presented so far suggests that most people do not have medical diagnoses of cognitive problems that are revealed by poor performance on objective tests on the HRS and that many may be unaware that they have lost some of their capabilities in handling money. However, it does appear that people's beliefs about the risk of future impairment are quite sensitive to their current level of performance on these tests. As can be seen in Figure 2, the subjective probability that a person believes that he will be able to think and reason well enough to live independently ten years in the future falls linearly from 80 percent among people with the highest cognitive scores to between 40 and 50 percent for people whose scores fall in the CIND or dementia range. This suggests that there is considerable scope for cognitively intact individuals to recognize that they face a significant risk of experiencing a significant

¹² To our knowledge, no studies have examined the reasons for the low rates of self-reported memory disease diagnoses, but studies about rates of undiagnosed dementia find results ranging between 35 percent and more than 90 percent (Olafsdottir et al., 2000).

risk of serious cognitive impairment in the future and, if they choose, to take steps to deal with that risk. However, it does not explain why many who already have diagnoses still do not act.

To summarize, declining cognitive ability is associated with reporting difficulties handling money, couples switching financial respondent to the cognitively intact spouse, and reporting memory disease diagnoses. Second, difficulties handling money are more common than memory disease diagnoses, which in turn are more common than changing the financial respondent. A majority of respondents in the demented range of cognition do not report a memory disease diagnosis. This could be due to underdiagnosis or misreporting. Third, respondents frequently claim to have difficulty handling money before a memory disease diagnosis, consistent with the medical studies described earlier, and both before switching financial respondent. Finally, respondents who report memory disease diagnoses often remain the financial respondent.

3.3 An explanation: variation in the value of a diagnosis

These descriptive results are consistent with heterogeneity in household responses to a diagnosis of a memory related disease like AD. Such variation across individuals can be seen in the debate on the value of early detection of AD. In an article about advances in the early diagnosis of Alzheimer's, the author asks: "Does it help to know you are likely to get a disease if there is nothing you can do?" (Kolata, 2010b) Readers who thought that early detection held little value emphasized the idea that there is nothing one can do with such information.¹³ Early detection is seen as merely delivering "devastating knowledge" (Winer, 2010), given the inevitability of decline with AD. The question above hinges on the idea that one may not be able do anything with this information—with no cure, a diagnosis provides only emotional costs and no benefits. The role of psychological costs, including anxiety and fear, have been emphasized in research about HIV testing (see Thornton, 2008) and behavioral research on decision-making, including health decisions (for example Caplin and Leahy, 2001; Koszegi, 2003; Frank, 2004), both of which have parallels to the case of AD diagnoses.

Others, in spite of the incurability and irreversibility of Alzheimer's, see value in this information, precisely because they would take action as a result of a memory disease diagnosis. One reader states: "I most definitely do want to know if [AD] is in store for me so that I can begin to plan the rest of my life

¹³ Some examples: "...what good does that knowledge do? There is no drug that cures the disease, only ones that mitigate the symptoms at an early stage. My wife died four years ago from Alzheimer's at age 69. She and her family suffered with the disease for seven years after the initial diagnosis. Had we known earlier, everyone would have suffered even longer." (Eisen, 2010) A doctor's perspective, in an Op-Ed: "Until we have a more definite idea about what causes Alzheimer's, early-detection tests may do patients more harm than good." (Pimplikar, 2010) However, in experimental Module 3 in HRS-2010, a majority of respondents agreed with the statement "You would like to know your chances of someday getting Alzheimer's."

while I am still 'in charge.' Most important, I would invest my savings in a supportive, long-term living arrangement, one that I would choose, on my own terms. And I would decide myself what to do with all my 'stuff' - my books, collections, clothing and furniture.” (Bloom, 2010)¹⁴

Armed with foreknowledge about one's cognitive decline, a planner can begin preparation for a state of cognitive impairment. One retirement planning magazine suggests gathering a group of experts in a number of areas: financial, legal, and medical or day-to-day care, among others (Garland, 2010). While the suggestion may not be feasible for all households dealing with dementia, it highlights that one can take actions. In this paper, we will focus on the first of these areas.

Sharing financial responsibilities with a cognitively intact spouse or loved one (and eventually delegating responsibilities completely to that person) can be a key form of preparation. Problems understanding or remembering to pay bills are frequently cited in anecdotal accounts and academic studies of dementia and AD (Kolata, 2010b; Loewenstein et al., 2001; Okonkwo et al., 2006; Martin et al., 2008; Okonkwo et al., 2008; Griffith et al., 2003), so for some, altering financial planning may also be as basic as ensuring that bills are paid correctly and on time.¹⁵

Households who manage their own investments tend to have more assets to protect, which makes turning over financial responsibilities even more important. One *New York Times* reader comments: “By the time [my father's] dementia became manifest, I was forced to learn the entire universe of money-management without benefit of his experience and expertise ... Please, if you have assets to protect, make sure your family understands the details before it's too late.”¹⁶ These households will also be more vulnerable to financial abuse, since they have assets that can be exploited.

In summary, the value of information—in this case information with a large negative emotional cost—is determined largely by what individuals can do with such information. There is no cure that can

¹⁴ A geriatric psychiatrist agrees: “... if the Alzheimer's disease is diagnosed early (providers can do this today with a skillful history and clinical exam), [people with memory loss] can actively plan for their future. The real emotional trauma comes when patients and families are confronted with incomprehensible personality changes, memory lapses and difficulty functioning that are unrecognized by their medical providers.” (Czapiewski, 2010)

¹⁵ Households may also want to alter their financial plans well before functional capacities are lost. Expenditures on goods and leisure activities might be re-allocated to earlier ages when a person still has normal cognition and functioning, or cancelled outright in favor of saving for expensive care in old age. Dementias like AD are progressive and expensive to manage, so the most direct financial implication of foreknowledge is to ensure access to care. Additionally, if a spouse is present, one may want to ensure that the spouse's financial needs are taken care of during the period of cognitive impairment. Furthermore, a spouse is also commonly the caretaker and may be in a position to monitor behavior, such as how the patient handles money, as cognition declines. A financially involved spouse may notice the danger signs and know when it is optimal to assume responsibility of finances.

¹⁶ Susan, Chester County PA, October 31st, 2010, 10:24 am, Comments to Kolata (2010b), <http://community.nytimes.com/comments/www.nytimes.com/2010/10/31/health/healthspecial/31finances.html?sort=oldest&offset=2>

be applied after this information is revealed, so the utility value of information is derived from changes in one's own behavior and planning. In this paper, we focus on adjustments to financial decision-making that might reduce the financial costs of Alzheimer's.

4 Theoretical framework

The diagnosis of a memory-related disease like AD is a source of information about the trajectory of one's cognition and functional capacity and, therefore, is of potential value in planning how to manage a household's financial affairs during old age. Conventional diagnostic tests¹⁷ can be used to evaluate whether a person is cognitively impaired, assess the degree of impairment (mild, moderate, severe) or in an ambiguous status called CIND (cognitively impaired, not demented)—see Okura, et al. (2011). In addition to determining the individual's current cognitive status, the test outcome indicates the risk of following a future trajectory of cognitive decline. In this section, we present a simple model describing the utility value of such a diagnosis.

As a point of departure, consider a model first proposed by Booser & Philipson (2000) to analyze the value of HIV tests. An individual is one of two types, each with its own utility function. In our context, one type undergoes normal aging and has utility function, $U^N = U^N(y(p)) + E_N(p)$ where p is the individual's subjective probability of developing AD, y is a vector of and current and future actions (e.g., choice of a particular consumption good, saving, time use, insurance product, etc.) that may be functions of p and $E_N(p)$ is the positive emotional impact of foreknowledge that one will continue to experience normal cognitive aging. The other type is a person who develops Alzheimer's disease and has utility function, $U^A = U^A(y(p)) - E_A(p)$ where $E_A(p)$ is the “emotional trauma” (Pimplikar, 2010) of foreknowledge that one will experience accelerated cognitive decline, ending with a complete loss of cognitive function prior to death. Thus, expected utility is

$$(1) \quad V(y, p) = p(U^A(y(p)) - E_A(p)) + (1 - p)(U^N(y(p)) + E_N(p)).$$

¹⁷ Although new tests for Alzheimer's that would provide for a diagnosis before any symptoms are evident are being developed by pharmaceutical companies, such tests are not currently available outside clinical trials. There are genetic variations, most notably the ApoE4 allele, that are associated with late-onset Alzheimer/mixed dementia (Cedazo-Minguez A, et al, 2001). With genetic testing, it is possible (but expensive) to determine whether one has this allele and thus faces a relatively high risk of becoming demented.

For simplicity, we interpret (1) as the expected utility of an individual and will refer to decisions and actions as if they are taken by the individual alone.¹⁸

Cognitive testing and diagnosis provides information that may help a person plan for the future. Assume, for simplicity, that the diagnostic test is either positive, indicating that the risk of AD is relatively high (p^+) or negative (p^-) indicating a low risk. The relation between the individual's prior belief and these possible diagnoses is given by,

$$(2) \quad p_0 = \alpha p^+ + (1 - \alpha) p^-,$$

where α reflects the person's own subjective optimism or pessimism about his own risk of having AD and p^+ and p^- are interpreted as "objective" probabilities of AD based on data covering a large probability sample of the population. For example, if the diagnostic test is perfect so that $p^+ = 1$ and $p^- = 0$, then $p = \alpha$. Assuming that the prevalence rate of AD in the population is α^* , an individual may be said to be optimistic about his risk of AD if $\alpha < \alpha^*$ and pessimistic if $\alpha > \alpha^*$. Note that optimism or pessimism need not indicate that the person's beliefs are biased; it is possible that he possesses private information that makes him more or less likely to get AD than a randomly chosen person in the population.

As Boozer and Philipson (2000) show, the value of diagnostic information depends on the "information elasticity" of the choices that people make with respect to changes in their disease risk. Using our notation, the utility benefit of a positive test result is $U^A(y(p^+)) - U^A(y(p_0))$ and of a negative result is $U^N(y(p^-)) - U^N(y(p_0))$. Clearly, there would be no benefit if AD risk has no effect on the actions that a person might choose because, in this case, $y(p^+) = y(p^-) = y(p_0)$. Since current medical treatments cannot affect the course of the disease to any substantial degree, the medical value of early diagnosis is near zero.

In contrast, a number of actions involving long term consumption decisions, financial planning and financial management are likely to be quite information elastic. This suggests that a diagnosis may be valuable for important non-medical. If c denotes the pecuniary cost in units of utility of acquiring a diagnosis, the value of information supplied by a diagnosis is positive if

¹⁸In many situations that are of particular relevance in analyzing the behavioral and welfare effects of AD it is critical to consider the family context in which the individual is embedded. This includes consideration of the preferences and behavior of each member of a married couple as well as the potential availability of children, step children or others as caregivers and as recipients of bequests. (See Pezzin et al., 2007, 2009).

$$(3) \quad p_0 V(y(p^+), p^+) + (1 - p_0) V(y(p^-), p^-) - c > V(y(p_0), p_0),$$

where the left-hand side is the net utility gained from the information, and the right-hand side is the utility gained if a person behaved in accordance with his prior.

Plugging in for V and rearranging shows that one would take the test if:

$$(4) \quad \frac{\overbrace{p_0 [U^A(y(p^+) - U^A(y(p_0)))] + (1 - p_0) [U^N(y(p^-) - U^N(y_0))]}^{\text{Benefit from preparation}} > \overbrace{[p_0 [(E_A(p^+) - E_A(p_0))] + (1 - p_0) [E_N(p_0) - E_N(p^-)]] + c}^{\text{Emotional and pecuniary cost of test}}$$

The two expressions on the left hand side represent the increased utility from improved choices of information-elastic behaviors and the right hand side measures the utility value of the emotional and pecuniary costs of a diagnosis.

Boozer and Philipson (2000) show that the greatest gains from test results are reaped by those who would be surprised by those results, perhaps those who are unaware of their risks. Figure 3 plots the costs and benefits of the information that would be gained from a diagnostic test by p_0 , the person's subjective prior belief about AD risk under the simplifying assumption that the test is perfectly accurate. If the emotional and monetary costs of a positive diagnosis are low, only individuals with p_0 very close to 1 or 0 would fail to gain utility from seeking a diagnosis. With higher costs, the test would be chosen only by people with intermediate values of p_0 who are quite uncertain about whether or not they have the disease.

The benefit curve in Figure 3 shifts up as the gain from changing actions in response to a diagnosis increases. This implies, for example, that someone with a large amount of 401(k) wealth would derive more value from a diagnosis than a person with a fixed retirement income of equal present value, who has low potential benefits of re-optimizing. If he finds that he has a high likelihood of suffering a progressive loss of cognitive capacity, he may be motivated to take steps to take to protect himself and his family from loss of wealth due to mismanagement. One such step that we will investigate empirically is to shift wealth management duties to his spouse.

5 Empirical analysis of variation in information elasticity

The consequences of incompetent financial decision-making or financial abuse will vary across households. The extent of a household's vulnerability to either risk depends on the volatility and exposure of their assets and any future potential income. If a household's retirement income comes primarily from wealth that is individually managed, then the household will be exposed to the risk of poor investment decisions. In such a case, it would be possible to quickly squander wealth that was meant to last months or even years.¹⁹

Others may have fewer assets under their direct control. Those who depend primarily on regular streams of income that are not actively managed may be less likely to incur severe losses as a result of incompetent decision-making. Active decisions are generally not required to receive streams of income like defined benefit pensions or Social Security income. Furthermore, individuals whose income is limited to such streams do not have direct access to future income that could be spent unwisely or exploited in scams. The problems these individuals face are likely to be limited to cash flow issues—leaving enough money each month for necessities, refraining from buying items they would not otherwise buy if they were cognitively intact, knowing how to access the money, or remembering to pay the bills.

Variation in the benefits of preparation: individually managed wealth

Our data allows us to determine if households have retirement wealth that is individually managed. The HRS asks of those who report participating in defined contribution pension or retirement plans: “Are you able to choose how the money in your account is invested?” We create an indicator that takes the value of one for the first wave at which the couple reports holding at least one account that allows the holder to choose how the money is invested, and each wave thereafter.²⁰ In doing so, our measure is not contaminated by moving assets out of individually controlled accounts as a form of preparation. As seen in Table 1, approximately 1/3 of couples have retirement accounts for which they can choose their investments. About 63 percent of households do not hold any wealth in stock.

Using lowess plots and Kaplan-Meier plots over the 27-point cognition scale, we investigate graphically whether those who manage their own retirement wealth are more responsive to a diagnosis or the emergence of problems handling money. We then proceed with regression models—probit and survival models—to analyze how the choice of financial respondent relates to cognitive decline over time,

¹⁹ For example, an older doctor somehow became the director of several clinics; one used his name to engage in fraudulent billing, and another took out mortgages without his knowledge. By the time his son noticed, the doctor's savings had been completely emptied out by a scammer, and all that was left was his Social Security income (Kolata, 2010a).

²⁰ Using the nature of retirement wealth at baseline enables us to avoid any re-allocation of assets in response to cognitive decline that could potentially contaminate our analysis.

the emergence of problems handling money, and most importantly the diagnosis of a memory-related disease. Because these are analyses of couples, we consider characteristics of both members of each couple. The theoretical model predicts that the financial respondent switch should occur more quickly for households whose wealth is individually managed. Because the speed of cognitive decline varies across individuals, we use cognition as analysis time in survival analysis to examine how low cognition falls before a failure occurrence.

5.1 Descriptive analysis by nature of retirement wealth

5.1.1 Difficulties handling money and financial responsibility

Figure 4 displays two graphs; both include a lowess curve of being the financial respondent as well as a lowess of the absence of money difficulties plotted on the 27-point cognition scale. Both of these graphs only include individuals in couples who were the financial respondent at the baseline. The first graph includes those who do not have retirement investments that are individually chosen, while the second graph includes respondents who do. In both cases, although the proportion of respondents without money problems begins to decline at the lower end of the normal cognition range and drops sharply in the CIND and dementia ranges, the proportion of individuals who are financial respondents remains quite stable until the CIND-dementia threshold. For those in the dementia range a larger proportion of individuals are financial respondents than report no difficulties handling money. This suggests that some of these financial respondents may make financial decisions in spite of reporting difficulties handling money. Furthermore, the slope for being free of problems is steeper than that of financial respondents, showing that the financial respondent switch is much less responsive to cognitive decline than functional capacity. However, the gap between the two lines is much narrower, and slopes much closer, for those who can choose how their retirement wealth is invested, so fewer households are exposed to the risk of bad financial decisions. This also provides some suggestive evidence that the decision to switch the financial respondent is different for the two groups.

5.1.2 Information elastic behavior: memory disease diagnoses and financial responsibility

Receiving a diagnosis of a memory-related disease is a strong indication from a medical professional that one's cognition is declining. Being able to recall and report this diagnosis to an interviewer demonstrates self-awareness of cognitive decline. How do rates of being financial respondents and of memory disease diagnoses change as cognition declines? We know that memory disease diagnoses rise (learning) and financial respondents fall (acting) in the dementia range of cognition scores, but do these changes track each other?

Figure 5 displays lowess estimates of being the financial respondent and not having a memory disease diagnosis, plotted against the cognition score. The upper graph includes respondents who have retirement accounts that are individually managed, and the lower graph includes those who do not have such accounts. In both cases, when respondents are in the normal cognition range, the two lines are parallel. Regardless of the nature of retirement accounts, some individuals with a memory disease diagnosis serve as financial respondents, and this proportion is fairly constant throughout the range.

The pictures diverge for those in the dementia range. Among those without individually managed retirement accounts, the proportion of individuals who are financial respondents is much higher than the proportion of respondents without a memory disease diagnosis, and the gap increases the lower the cognition score. However, the opposite is the case for respondents with retirement investments that are individually chosen. Among those in the dementia range, a much smaller proportion of individuals are financial respondents than have not had memory disease diagnoses. This suggests that how the financial respondent decision relates to a memory disease diagnosis depends on the nature of financial decisions being made—namely, whether or not retirement wealth needs to be individually managed—and reflects variation in the potential benefits to changing $y(p)$.

Kaplan-Meier estimation

Kaplan-Meier survival estimates (Figure 6) show that those with accounts that are individually managed have a greater hazard of switching the financial respondent as cognition declines than those who do not; a log-rank test rejects the null that these hazard functions are equal (log rank test: $\chi^2(1)=26.86$; $Pr > \chi^2=0.0000$). However, having individually managed retirement accounts does not increase the hazard of reporting problems handling money (log rank test: $\chi^2(1)=1.57$ $Pr > \chi^2=0.2109$). Individuals tend to report difficulties with money at the same levels of cognition, regardless of the nature of their retirement wealth.

In summary, cognition scores negatively correlate with having a memory-related disease diagnosis and having problems handling money in the expected manner. In particular, the lower the cognition score, the higher the likelihood of reporting a diagnosis and problems handling money. The emergence of financial incapacity with low cognition is consistent with medical research on AD. Couples do switch financial respondents when the original respondent's cognition declines, but many log-cognition respondents remain the financial respondent for their households. In general, among those with cognition in the CIND or dementia range, the proportion who are financial respondents exceeds the proportion who retain their financial capacity. Therefore, some low-cognition individuals are financial respondents even

while they report having problems handling money. However, the gap between rates of problems handling money and being the financial respondent is much smaller for those who have individually controlled retirement accounts. At dementia ranges of cognition, rates of being the financial respondent exceed of having no memory disease diagnosis if retirement wealth is *not* individually controlled. This implies that some demented individuals are serving as the financial respondent in spite of suffering from a memory-related disease. The reverse is true for couples who do have individually controlled investments. The next section uses regression techniques to further understand these patterns.

5.2 Regression analysis

We analyze how the financial outcomes, financial capacity and financial responsibility (a choice of financial decision maker embedded in action y) are affected by cognition (a sign and symptom) and learning about a memory disease diagnosis. As before, the unit of analysis is a couple, and each observation will contain attributes of both the first financial respondent and his or her spouse. The reference point of the observation is the person who was designated the most financially knowledgeable when the couple first entered the survey. Where we refer to “own education” or “own cognition,” we mean the characteristics of the financial respondent at baseline; we refer to the other member of the couple as “the spouse.”

Couples exit the sample when one spouse dies, or the couple otherwise dissolves—this is a source of censoring, which will be addressed using survival analysis. Another source of right-censoring comes from couples who are still intact, with no reports of money difficulties or switching of the financial respondent, during the most recent 2008 wave of the HRS.

The regression analysis employs the following variables (see Section 3.1.1 for more details):

- Individual-level cognition: cognition scores, indicators for having a cognition score in the CIND or dementia range, self-reported diagnoses of memory-related diseases, and self-reported difficulties handling money of both members of the couple, and
- Individual-level demographics of both members of the couple: gender, age, and education,
- Household financial characteristics: tercile of household assets held in stock (zero if the household owns no stock), natural log of total wealth,²¹ and an indicator for holding health insurance.

²¹ These two variables are based on wealth calculations drawn from RAND HRS Data (2010). First, we use the natural log of total wealth (net value of total wealth, not including secondary home), with households with negative wealth coded as zero. Second, we use the tercile of share of wealth held in stock; those who do not own any stocks are coded as zero.

Summary statistics of all variables used in the regression are presented in Table 3. Here, statistics are presented for the full analysis sample—multiple observations over time of the 7,829 couples described at baseline in Table 1.

5.2.1 Bivariate probit regression

The fact that the two financial responsibility outcomes—difficulties handling money, and no longer being the financial respondent—should be correlated suggests the use of bivariate probit analysis. The descriptive analysis above shows that people develop difficulties handling money before they turn over being the financial respondent to the spouse. If the financial respondent switch occurs at the same time as the original respondent reports difficulty handling money, then the coefficients should be the same for both equations. If a particular coefficient is larger in the equation estimating difficulties handling money, then the decision to switch financial respondents is less responsive.

Table 4 presents coefficients from a bivariate probit regression of two financial outcomes: difficulties handling money for the initial financial respondent in column (1), and switching the financial respondent in column (2). Standard errors are clustered at the household level. The reference point is the member of the couple who was the financial respondent at baseline. Having a memory disease diagnosis is strongly associated with difficulties with money, but the effect of a diagnosis on switching the financial respondent is much smaller in magnitude and not statistically distinguishable from zero. However, the interaction effect of the memory disease diagnosis and an indicator of retirement wealth that can be individually managed is positive and statistically significant for the financial respondent switch. This interaction effect has a negative, statistically insignificant effect on the probability of having problems managing money.

This means that while a memory disease diagnosis is associated with switching the financial respondent (though the coefficient is indistinguishable from zero), the effect is even larger for households in which investments in retirement wealth can be individually controlled. It is precisely those couples that are more potentially more exposed to poor financial decisions that are more responsive to memory disease diagnoses in terms of switching the financial respondent; they face greater benefits from re-optimizing y , and their behavior is information elastic.

The probability of switching the financial respondent is less responsive to the respondent being CIND than is the probability of reporting having problems handling money. Column (3) reports χ^2 tests for the difference in each coefficient across the two equations. For both the CIND and dementia indicators, the coefficients for the money IADL outcome are larger in magnitude than those of the switching financial respondent outcome, and for CIND the difference is statistically significant. This

provides additional evidence that some individuals who have difficulties handling money have not yet been replaced as the financial decision-maker.

It may be the case that those who have health insurance are more likely to be in a position of receiving a doctor's diagnosis. Insurance coverage (which includes coverage through Medicare, Medicaid, and other government plans) is high, and restricting the analysis to those with insurance coverage does not change the results. Those who see a doctor may also already have exhibited other signs of cognitive impairment, and the bivariate probit regressions do control for cognitive status. In addition, in our data, conditional on having a low cognition score, receiving a diagnosis is not correlated with nature of one's retirement wealth, and therefore should not impact our interpretation of the results.

5.2.2 Survival analysis: competing risks regressions

Our discussion suggests that couples may want to respond to changes in cognitive function. We analyze survival models with cognition scores as analysis time in order to directly investigate the progression of cognitive decline across survey waves, rather than the current cognitive state as in the bivariate probit. Also, while a bivariate probit model explicitly assumes the two financial outcomes are correlated, it does not address right censoring caused by widowhood or divorce. Furthermore, couples who have not yet switched their financial respondents may still do so in the future, creating another source of right censoring. Survival models treating the two outcomes as "failures" account for such censoring and explicitly model durations so we can compare how time to reporting problems handling money relates to the time to changing financial respondents. Unlike bivariate probit models, standard survival models assume the two outcomes are independent.

Survival models in this context would traditionally use calendar age as analysis time.²² Here, we treat the 27-point cognition score itself as the "time scale." This would allow us to how much cognition deteriorates before the occurrence of the two failures-developing problems handling money, and switching the financial respondent. Using cognition scores as analysis time in a survival framework is a transformation similar to operational time (Lee and Whitmore, 2006). To use these scores as analysis "time," cognition scores should decline monotonically with age. Table 5 tabulates the wave-to-wave changes in cognitive status among HRS respondents. About 83 percent of wave-to-wave changes in cognition remain within the same cognitive status: for example back-to-back scores in the normal range. Most of these within-status changes are small, and on average they are declines in scores. Approximately 10 percent are transitions into worse cognitive states, from normal to CIND or dementia, and CIND to dementia. The average change in cognition scores is a 6.5 point decline. Only six percent of wave-to-

²² Results using calendar age as analysis time are similar and are reported in the sensitivity checks in the Appendix.

wave changes are improvements from one cognition category to another. Of these, the vast majority are CIND to normal transitions. Cognition scores are negatively monotonic for the most part (particularly after a respondent has moved out of the normal range), so they can be treated as analysis time. Some individuals receive the same cognition score in multiple waves, so we perturb scores²³ in order to deal with the fact that survival analysis cannot deal with multiple observations at the same point in “time.”

Another source of censoring (in addition to the lack of failure during the most recent measurement) is reaching the lowest cognition score. Cognition scores are on a 27-point scale and cannot take values outside this range, so in this framework, censoring occurs when a person has reached a score of zero, or has been replaced with a proxy respondent in the survey. Therefore a more appropriate model would be a competing risks survival model. Here, we estimate competing risks regressions where the failure object of interest is the switching of financial respondents within a couple or the emergence of problems handling money, and the competing risk is the attainment of the lowest cognition score. The third and fourth columns of Table 6 report results from the competing risks regressions.

As seen in the bivariate probit regression, the effect of a memory disease diagnosis has a strong impact on the financial respondent switch for those who are most vulnerable to financial mismanagement. The interaction effect of a diagnosis and controlling one's investments is large and statistically significant; if one has accounts that are individually invested, being diagnosed with a memory disease more than doubles the hazard of switching the financial respondent (hazard ratio of 2.4), even though this interaction term has no effect on problems handling money. This result is consistent with the idea that those with much to gain from preparing for cognitive decline—those with assets that are at risk of being mismanaged by the original financial respondent—prepare by switching the financial respondent more quickly.

Spousal cognition and functional status also matter. Having a spouse who has cognition in the CIND or dementia range reduces the hazard of switching the financial respondent to 52% and 39% respectively. The hazard responds similar to the spouse reporting difficulties handling money.

Holding a greater share of wealth in stock and log wealth have very little effect on the hazard of switching the financial respondent. While this is inconsistent with the intuition of the theoretical model that wealthier individuals have more to lose from poor financial decision-making, it confirms the most important factor is whether or not assets are individually controlled. Therefore, the indicator for holding

²³ If an individual receives the same cognition score in two waves, we subtract 0.01 from the more recent score. If an individual receives the same cognition score in three waves, we add 0.01 to the first measurement and subtract 0.01 from the most recent measurement. For four waves with the same cognition score, we subtract 0.01 from the oldest score and 0.03 from the second score, and we add 0.03 to the third and 0.01 to the fourth to achieve four equidistant scores. Alternatively, dropping duplicate scores yields similar results.

retirement wealth that is individually controlled is not merely a proxy for portfolio allocation or wealth. These results are confirmed in estimates of alternative model specifications, and these are reported in the Appendix.

6 Conclusion

How one prepares for cognitive decline and how responsive one is to a diagnosis of a memory related disease depends on how much one has to gain through such preparation. For example, poor financial decisions may have a smaller impact for someone who is living on predictable streams of income than for those with retirement wealth that needs to be individually managed. Therefore, we expect variation in responses to diagnoses of memory-related diseases like Alzheimer's disease. In this paper, we analyze how the person in the couple serving as the financial respondent changes as cognition declines to impaired and demented levels.

We find that households tend to wait until cognition has fallen quite low to make the switch. In particular, this switch often occurs well after the original financial respondent has reported having difficulties handling money. Over a third of coupled respondents with cognition in the dementia range are financial respondents, and their cognitive impairment may prevent them being able to provide accurate data on financial holdings.

To analyze how this financial respondent switching behavior varies according to the nature of their retirement wealth, we use a number of econometric methods which all yield the same story. We find variation in how quickly financial respondents switch in response to cognitive decline, memory disease diagnoses, and even the emergence of problems handling money. After controlling for wealth, those with individually managed retirement accounts switch financial respondents more responsively to memory disease diagnoses—in all specifications of survival models, the hazard ratio is between 2 and 2.2. They also switch at higher levels of cognition, before suffering too much decline, and sooner after reporting problems handling money.

Such heterogeneity is consistent with an economic model of the value of information about current and future states. If information about future cognition enables re-optimization and preparation by have someone else manage retirement wealth, then learning such information is useful and leads to beneficial action. If one does not have the ability to prepare, for instance, if one holds no individually managed retirement wealth that can be handed over to a spouse, then the information is not helpful. This is not just an effect of higher wealth, which has a small, positive but imprecisely estimated effect on the financial respondent switch in all specifications. While Oster et al. (2011) emphasize the role of

emotional costs (anticipated utility in their framework), we analyze the variation in potential *benefits* of acting on information that arise from different types of retirement wealth.

Spousal characteristics are also important and influence the decision to switch financial respondents in the expected direction. The decision depends not only on how poor one's cognition is, but how poor is the cognition of the spouse to whom one might potentially turning over the finances. This provides evidence that the most important factor is one of comparative advantage relative to one's spouse.

Another option we cannot observe in our data is passing on responsibility of finances to an adult child. Having adult children nearby may enhance monitoring; these children may more easily notice poor decision-making. On the other hand, frequent contact with children may make it more difficult to notice changes in cognition in the parent. If children only see their parents during major holidays, the time distance between visits makes cognitive decline more noticeable. Indeed, including child proximity measures in the regressions does not influence the effect explanatory variables of interest, cognition and memory disease diagnoses; furthermore, the sign of their coefficients is extremely sensitive to the specification and is never statistically significant, and there were dropped from our analysis. Future research will enable us to examine in greater detail the nature of the division of labor within older couples as well as the role of their adult children.

7 References

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9 Appendix: Robustness checks using alternative regression specifications

9.1 Survival analysis using age as analysis time: Cox Proportional Hazards models

Here, durations are measured in calendar time, using the baseline financial respondent's age at each wave of observation. Table A1 reports results from Cox proportional hazards models; column (1) treats reporting difficulties handling money as the failure, and column (2) treats switching the financial respondent as the failure. The main effect of a memory disease diagnosis is much larger for reporting difficulties managing money than for the financial respondent switch, increasing the hazard by a factor of 2.66 and 2.27, respectively. However, the interaction of a memory disease diagnosis with choosing one's own retirement investments has a large, statistically significant positive impact on switching, doubling the hazard, and virtually no impact on having problems managing money. This is consistent with the idea that those with more to lose—those with individually managed retirement accounts—do indeed respond more elastically to a memory disease diagnosis above and beyond those who do not choose their own investments.

Having a cognition score in the CIND range more than doubles the hazard of problems handling money relative to being in the normal cognition range. However, a CIND score only increases the hazard of switching the financial respondent by less than a factor of 1.04. This suggests that the hazard of switching is less responsive to declines in cognition to CIND than the hazard of difficulties handling money, as shown in the descriptive analysis. Given that the evidence in medical research shows that financial capabilities suffer when cognitive declines are still mild, the lack of responsiveness to being in the CIND range can pose problems to the household. Dementia increases the hazard of difficulties handling money to 426 percent, and the hazard of switching the financial respondent responds by an increase of 258 percent, so when declines are severe, families do adjust.

Having a spouse in the CIND or dementia range reduces the hazard function of money difficulties. Again, the switching of financial respondents is much more responsive to the spouse being in the dementia range than in CIND. If the baseline financial respondent is female, the hazard of having problems handling money only increases by a factor of 1.01, while the hazard of switching the financial respondent to the spouse more than doubles. Therefore, the characteristics of both members of the couple are important.

This analysis assumes the two “failures”—money difficulties and the financial respondent switch—are independent. Column (3) of Table 7 reports the results of a Cox proportional hazards model that restricts the analysis to those who have reported difficulties handling money, and treats the financial

respondent switch as the failure. Note that this sample size is quite small (1739 couple-wave observations) so estimates are not precise, but qualitatively the results are the same: the interaction of choosing investments and memory disease diagnosis has a large positive effect on the hazard of switching the financial respondent.

9.2 Survival analysis using cognition as analysis time: Cox Proportional Hazards models

The first two columns of Table 6 report the results of the estimation of Cox proportional hazards models, one for each failure—problems managing money, and the financial respondent switch. While the main effect of a memory disease diagnosis increases the hazard of having problems managing money by a precisely-measured factor of 1.94, it does not increase the hazard of switching the financial respondent. However, the interaction of a diagnosis and controlling investments has no effect on the hazard of difficulties handling money but increases the hazard of switching the financial respondent to 160 percent of the baseline hazard, with a p-value of 0.09.

10 Figures and Tables

Figure 1: Cognition score of ADAMS respondents, by eventual outcome

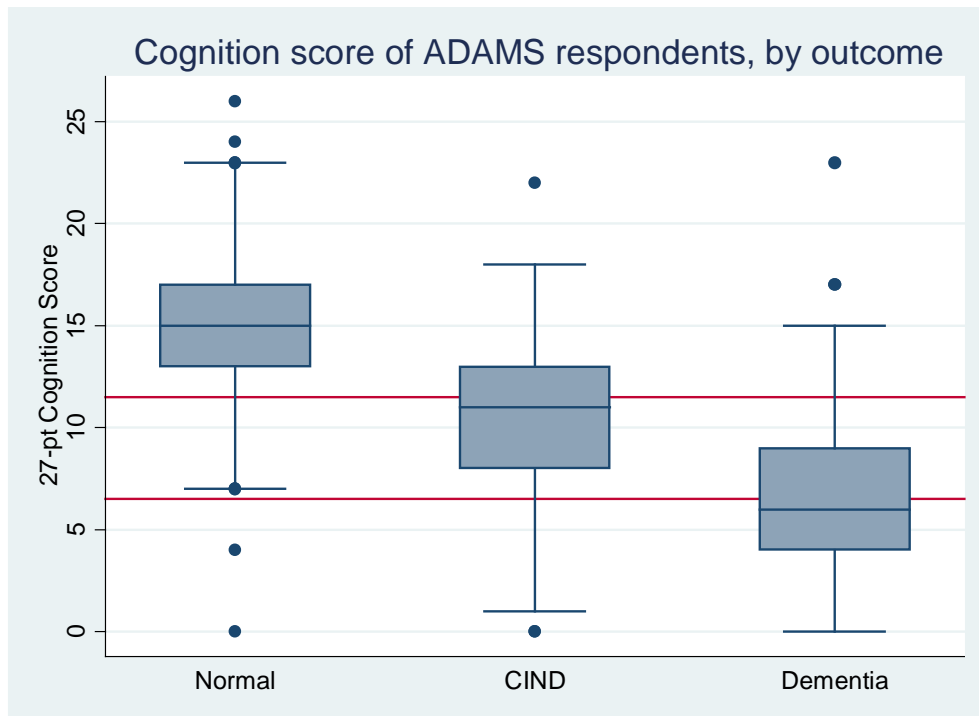


Figure 2: Financial respondents, self-reported problems handling money, subjective expectation of thinking and reasoning in 10 years, and memory disease diagnoses, by cognition score (coupled respondents who were initial financial respondents)

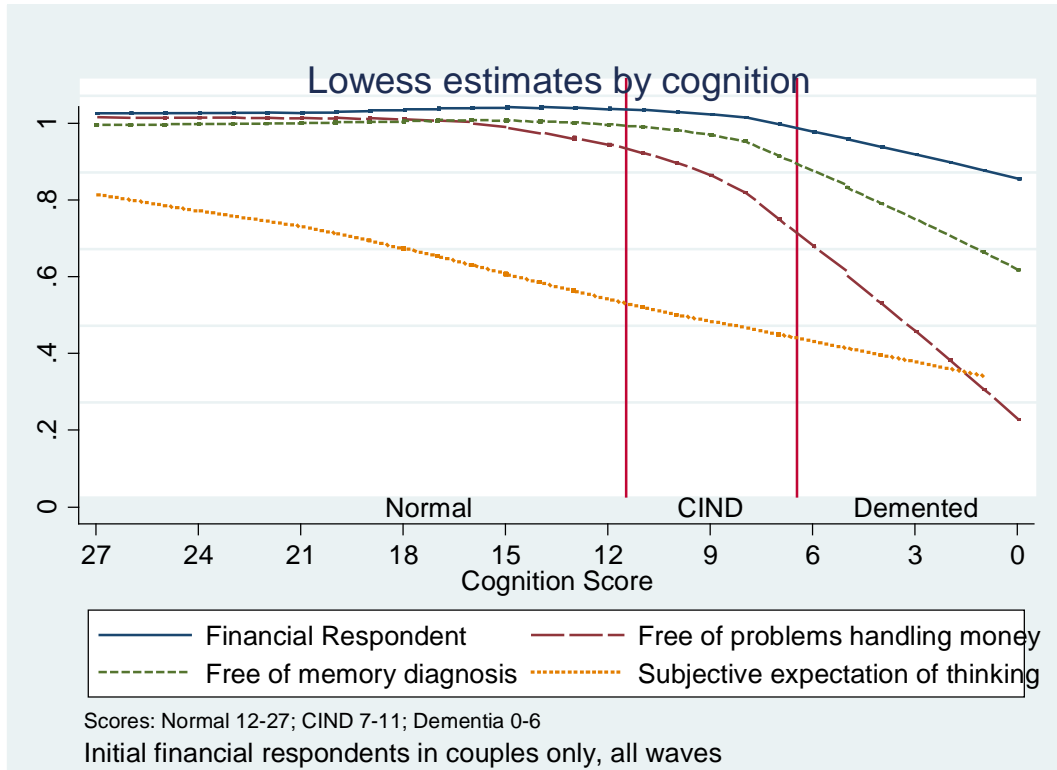
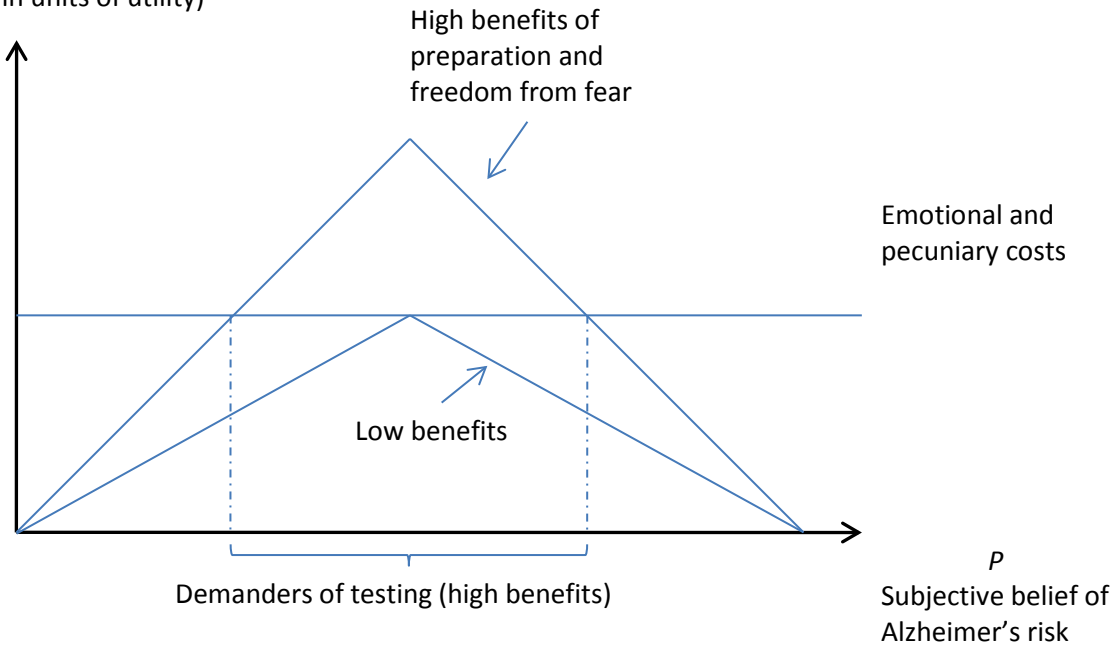


Figure 3: Value of information as a function of subjective risk of Alzheimer's disease

Costs and benefits of testing
(in units of utility)



Graph adapted from Figure 3 of Boozer and Philipson (2000).

Figure 4: Financial respondents and the absence of difficulties handling money by cognition score, separated by nature of retirement wealth

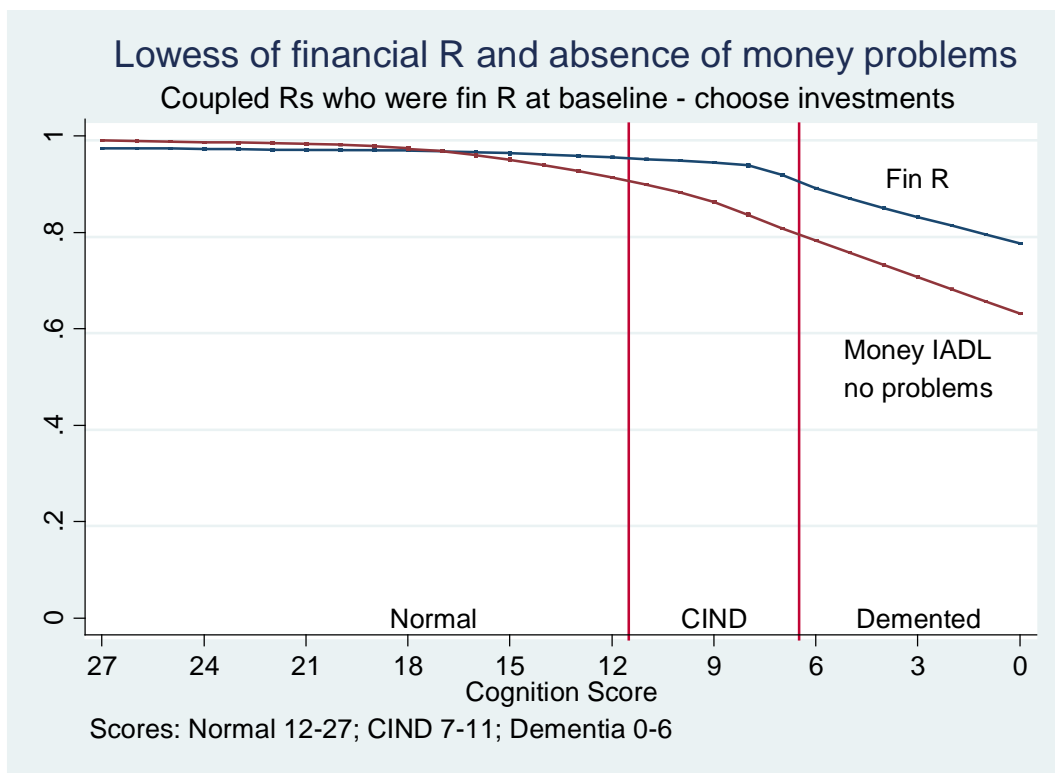
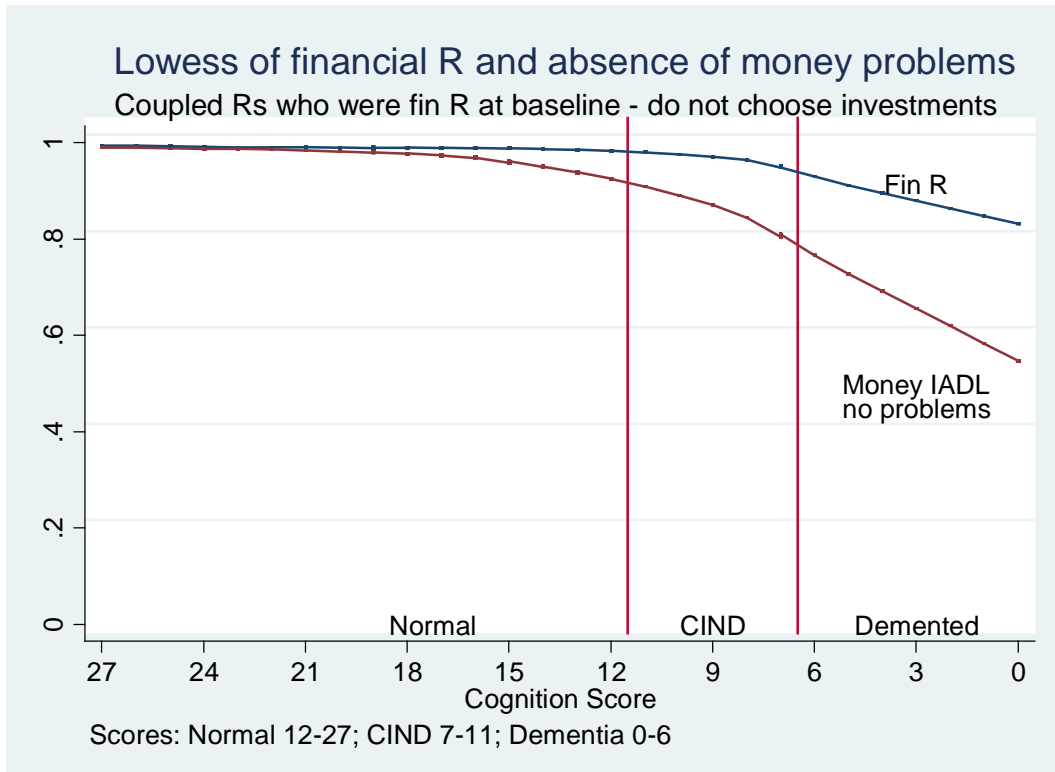


Figure includes all respondents in couples who were financial respondents during the baseline wave.

Figure 5: Financial respondents and memory diagnoses over cognition scores, separated by nature of retirement wealth

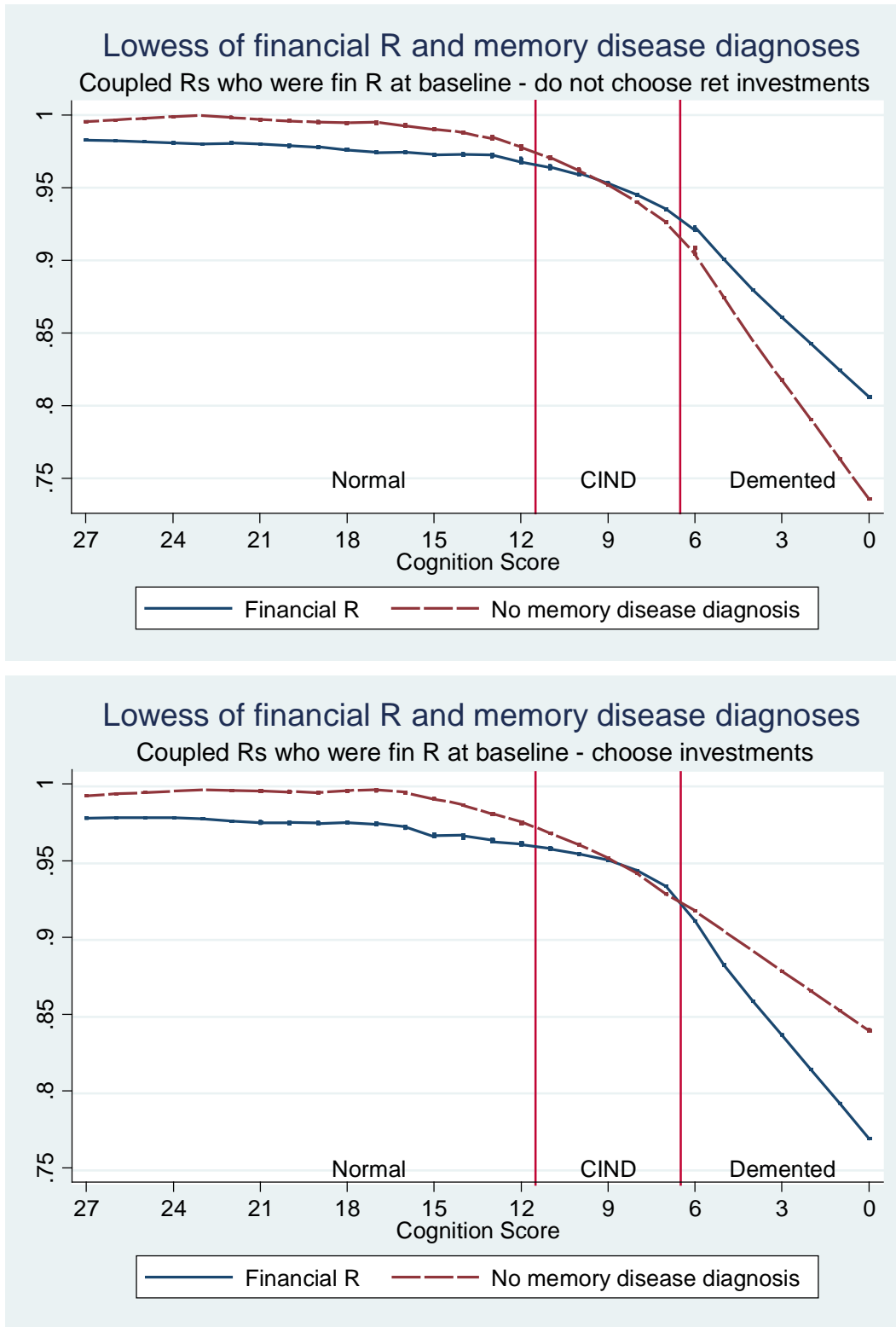


Figure includes all respondents in couples who were financial respondents during the baseline wave.

Figure 6: Kaplan-Meier survival estimates of problems handling money and being the financial respondent, separated by nature of retirement wealth

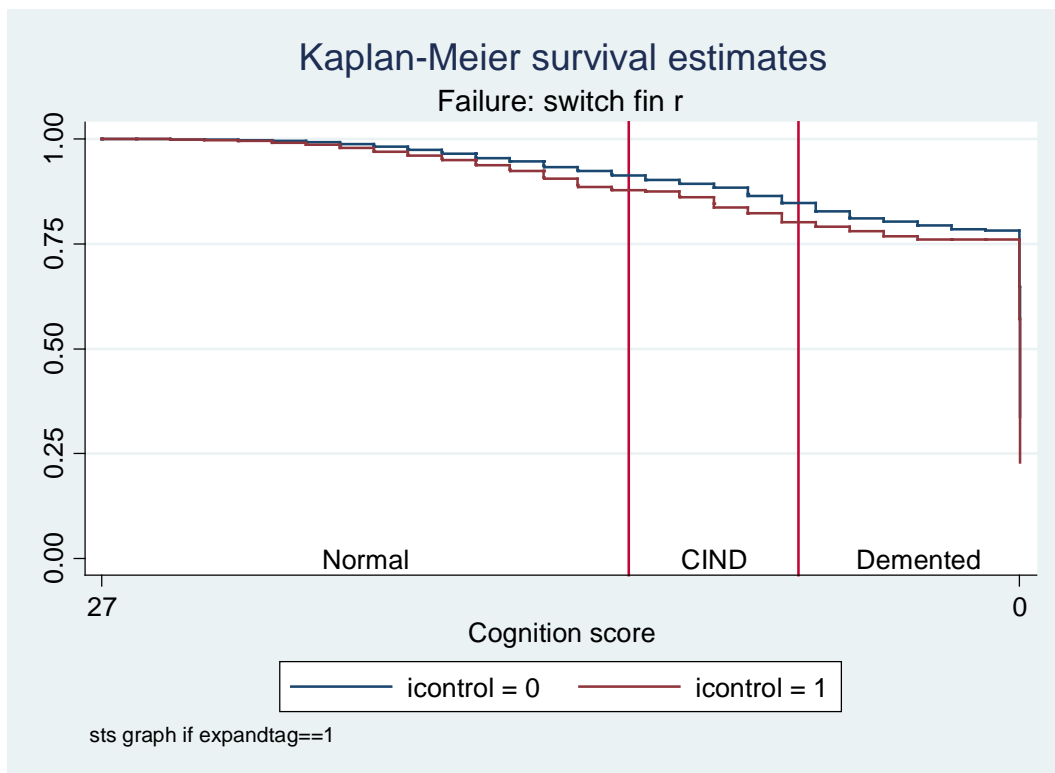
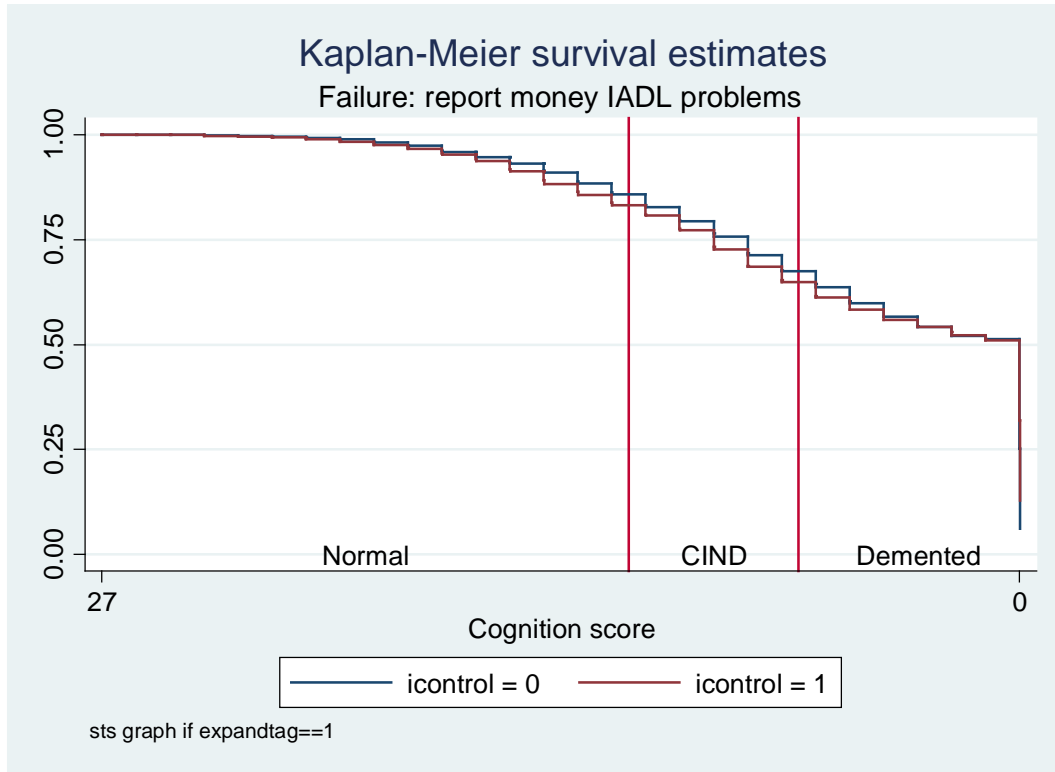


Figure includes all respondents in couples who were financial respondents during the baseline wave. Icontrol is equal to 1 if respondents choose investments for their retirement accounts and 0 otherwise.

Table 1: Summary statistics for baseline wave only

Variable	mean	sd	min	max	N (households)
Female	0.3781	0.4849	0	1	7,829
Age	62.54	10.08	31	96	7,829
Spouse's Age	61.96	10.64	25	98	7,829
Own education	12.66	3.24	0	17	7,829
Spouse's education	12.11	3.26	0	17	7,829
Stock share tercile	0.7230	1.0762	0	3	7,829
Log total assets	11.49	2.76	0	18.27	7,829
Health insurance	0.8810	0.3239	0	1	7,829
Control investments	0.3143	0.4643	0	1	7,829
Own cognition in normal range	0.8663	0.3404	0	1	7,829
Own cognition in CIND range	0.1058	0.3076	0	1	7,829
Own cognition in Dementia range	0.0280	0.1649	0	1	7,829
Own problems handling money	0.0467	0.2111	0	1	7,829
Own memory disease diagnosis	0.0132	0.1140	0	1	7,829
Spouse's cognition in normal range	0.8103	0.3921	0	1	7,829
Spouse's cognition in CIND range	0.1359	0.3427	0	1	7,829
Spouse's cognition in Dementia range	0.0538	0.2256	0	1	7,829
Spouse's problems handling money	0.1008	0.3011	0	1	7,829
Spouse's memory disease diagnosis	0.0240	0.1531	0	1	7,829
Number of waves in analysis sample	3.9470	1.872501	1	6	7,829

Table 2: Cross-tabulation of cognition of respondent and spouse

	Spouse's cognition			Total
	Normal	CIND	Demented	
Own cognition				
Normal	72.96	10.21	3.46	86.63
CIND	6.63	2.49	1.46	10.58
Demented	1.44	0.89	0.46	2.8
Total	81.03	13.59	5.38	100

Table 3: Summary statistics of regression variables for the full analysis sample

Variable	mean	sd	min	max	N (obs)
Female	0.3653	0.4815	0	1	30,901
Age	65.78	9.61	31	102	30,901
Spouse's Age	65.10	10.10	25	100	30,901
Own education	12.81	3.17	0	17	30,901
Spouse's education	12.24	3.20	0	17	30,901
Stock share tercile	0.7181	1.0725	0	3	30,901
Log total assets	11.81	2.64	0	18.43	30,901
Health insurance	0.9214	0.2691	0	1	30,901
Control investments	0.3509	0.4772	0	1	30,901
Own cognition in normal range	0.8553	0.3518	0	1	30,901
Own cognition in CIND range	0.1161	0.3204	0	1	30,901
Own cognition in Dementia range	0.0285	0.1665	0	1	30,901
Own problems handling money	0.0543	0.2267	0	1	30,901
Own memory disease diagnosis	0.0160	0.1253	0	1	30,901
Spouse's cognition in normal range	0.7993	0.4005	0	1	30,901
Spouse's cognition in CIND range	0.1497	0.3568	0	1	30,901
Spouse's cognition in Dementia range	0.0510	0.2199	0	1	30,901
Spouse's problems handling money	0.1085	0.3111	0	1	30,901
Spouse's memory disease diagnosis	0.0234	0.1512	0	1	30,901

The analysis sample consists of 7,829 couples measured in multiple waves.

Table 4: Bivariate probit regressions with outcomes "Difficulties handling money" and "no longer financial respondent"

	(1) Failure: Problems Handling Money	(2) Not Financial Respondent	(3) Chi-squared test (p-value)
Female	-0.124* (0.050)	0.236** (0.076)	16.39 (0.0001)
Age	0.014** (0.005)	0.012 (0.007)	0.04 (0.8338)
Spouse's Age	-0.004 (0.004)	0.011 (0.007)	3.62 (0.0572)
Own education	-0.019* (0.008)	-0.024 (0.013)	0.15 (0.6952)
Spouse's education	-0.011 (0.009)	0.047*** (0.013)	15.48 (0.0001)
Own cognition: CIND	0.528*** (0.048)	0.131 (0.078)	21.54 (0.0000)
Own cognition: dementia	1.400*** (0.077)	0.769*** (0.112)	29.90 (0.0000)
Spouse's cognition: CIND	-0.131* (0.052)	-0.234** (0.074)	1.38 (0.2729)
Spouse's cognition: dementia	-0.021 (0.105)	-0.366** (0.129)	4.54 (0.0331)
Control investments	-0.078 (0.046)	0.062 (0.065)	3.17 (0.0748)
Memory disease diagnosis	1.052*** (0.094)	0.214 (0.120)	33.48 (0.0000)
Control X Diagnosis	0.087 (0.190)	0.604** (0.211)	4.59 (0.0322)
Spouse diagnosis	0.059 (0.114)	-0.056 (0.161)	0.35 (0.5569)
Spouse's problems handling money	-0.098 (0.060)	-0.547*** (0.094)	17.00 (0.0000)
Stock share tercile	-0.006 (0.019)	-0.009 (0.025)	0.01 (0.9207)
Log total assets	-0.047*** (0.006)	-0.010 (0.014)	5.57 (0.0183)
Health insurance	0.148* (0.075)	-0.063 (0.106)	2.68 (0.1019)
cons	-1.611*** (0.196)	-3.933*** (0.315)	39.52 (0.0000)
athrho			
cons	0.267*** (0.046)		
N households	7,829		

Coefficients reported. Estimation uses HRS household level weights, with standard errors clustered at the household level.

Table 5: Changes in cognition over time

	Mean	SD	Pct
Normal to Normal	-0.224	3.243	69.56
Normal to CIND	-5.008	2.747	8.27
Normal to Dementia	-10.566	3.927	1.01
CIND to Normal	4.670	2.602	6.01
CIND to CIND	-0.136	1.783	6.85
CIND to Dementia	-4.327	2.124	2.23
Dementia to Normal	8.864	2.668	0.37
Dementia to CIND	3.697	1.842	1.29
Dementia to Dementia	-0.209	1.440	4.41
Total	-0.431	3.772	100.00
N			103426

All HRS respondents included, regardless of coupleness status, to validate that cognition tends to decline with age for all individuals.

Table 6: Competing risks regressions using cognition as analysis time

	(1)	(2)
	Failure: Problems Handling Money	Not Financial Respondent
Female	0.762*** (0.058)	1.757*** (0.233)
Age	0.987* (0.006)	1.003 (0.011)
Spouse's Age	1.011* (0.005)	1.018 (0.011)
Own education	1.014 (0.011)	0.980 (0.021)
Spouse's education	1.003 (0.012)	1.124*** (0.029)
Spouse's cognition: CIND	0.756*** (0.061)	0.524*** (0.094)
Spouse's cognition: dementia	0.701** (0.090)	0.393** (0.139)
Control investments	0.895 (0.072)	1.193 (0.163)
Memory disease diagnosis	0.950 (0.109)	0.587* (0.136)
Control X Diagnosis	1.221 (0.263)	2.433* (0.845)
Spouse diagnosis	1.133 (0.191)	0.618 (0.384)
Spouse's problems handling money	1.059 (0.104)	0.336*** (0.101)
Stock share tercile	1.023 (0.036)	0.971 (0.058)
Log total assets	0.973* (0.011)	1.017 (0.026)
Health insurance	1.229 (0.169)	0.943 (0.212)
N households	7,829	7,829
N failures	1,020	326
N competing risk	5	17

Hazard ratios reported.

Table A1: Cox Proportional Hazards models using age as analysis time

	(1)	(2)	(3)
	Problems Handling Money	Not Financial Respondent	Not fin R Conditional on Problems handling money
Female	1.323*** (0.077)	2.894*** (0.300)	1.887* (0.561)
Spouse's Age	0.935*** (0.003)	0.950*** (0.006)	0.982 (0.023)
Own education	1.002 (0.009)	0.978 (0.019)	0.993 (0.042)
Spouse's education	0.990 (0.009)	1.110*** (0.023)	1.083 (0.053)
Own cognition: CIND	2.138*** (0.141)	1.040 (0.156)	1.387 (0.476)
Own cognition: dementia	4.256*** (0.331)	2.582*** (0.438)	4.660*** (1.557)
Spouse's cognition: CIND	0.782*** (0.055)	0.595*** (0.092)	0.785 (0.267)
Spouse's cognition: dementia	0.778* (0.082)	0.364** (0.123)	0.253 (0.200)
Control investments	1.158* (0.071)	1.552*** (0.173)	1.143 (0.353)
Memory disease diagnosis	2.659*** (0.238)	2.273*** (0.496)	1.149 (0.426)
Control X Diagnosis	1.031 (0.164)	1.604 (0.501)	1.985 (1.103)
Spouse diagnosis	1.093 (0.150)	0.907 (0.397)	0.000 (.)
Spouse's problems handling money	1.030 (0.083)	0.345*** (0.086)	1.019 (0.452)
Stock share tercile	0.926** (0.026)	0.927 (0.044)	0.840 (0.106)
Log total assets	0.945*** (0.007)	0.985 (0.020)	1.079 (0.053)
Health insurance	0.934 (0.108)	0.546** (0.110)	1.249 (0.934)
N households	7,829	7,829	729
N failures	1,679	455	78

Hazard ratios reported.

Table A2: Cox proportional hazards using cognition as analysis time

	(1) Problems Handling Money	(2) Not Financial Respondent
Female	0.803*** (0.050)	1.718*** (0.194)
Age	0.997 (0.005)	1.006 (0.010)
Spouse's Age	1.006 (0.004)	1.029** (0.010)
Own education	1.005 (0.009)	0.980 (0.019)
Spouse's education	0.998 (0.010)	1.127*** (0.024)
Spouse's cognition: CIND	0.722*** (0.050)	0.537*** (0.083)
Spouse's cognition: dementia	0.728** (0.076)	0.319*** (0.108)
Control investments	1.037 (0.064)	1.394** (0.155)
Memory disease diagnosis	0.957 (0.086)	0.624* (0.138)
Control X Diagnosis	1.163 (0.185)	2.132* (0.664)
Spouse diagnosis	1.002 (0.140)	0.942 (0.417)
Spouse's problems handling money	1.029 (0.084)	0.339*** (0.085)
Stock share tercile	0.999 (0.028)	0.965 (0.047)
Log total assets	0.975*** (0.008)	1.017 (0.022)
Health insurance	1.273* (0.143)	0.855 (0.168)
N households	0.803***	1.718***

Hazard ratios reported.