Early-Life Schooling and Cognition and Late-Life Financial Literacy in the Wisconsin Longitudinal Study

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ABSTRACT

Using the Wisconsin Longitudinal Study, a sample of Wisconsin high school graduates from the class of 1957, we unpack the relationship between general human capital and late-life financial literacy. In short, we examine the links between cognition and financial literacy. We find that those with lower early-life cognitive functioning, especially those without college degrees, have lower levels of financial literacy in late life. We also find that cognition in late life, controlling for early life cognitive functioning, is also linked to financial literacy.

Introduction

Two decades ago most retirement financial management was relatively straightforward. Retirees had an income stream in retirement, which was comprised of Social Security and a defined benefit from their former employers. In essence, financial management in retirement involved keeping a balanced checking account The shift towards defined contribution pension plans and individual retirement accounts, however, means that the responsibility for saving, investing, and managing retirement income now falls largely on individuals. Younger cohorts have a far more complicated array of defined contribution plans, IRAs, and other private savings vehicles, which requires hands on management throughout retirement. Unlike older cohorts, retirees now have little guarantee of what their monthly income may look like from year to year, and sometimes from month to month. Though these assets could be invested in a simple annuity, which would provide a more certain income stream, few seniors take this option due to their high costs. Though Social Security now provides the only certain retirement income source for many, proposals to privatize the program further the potential for complexity. Given these changes, there is a large and growing literature exploring individuals' capacity to effectively manage their finances in this context. This research, however, and larger policy debates over policy proposals such as privatizing Social Security, has devoted little attention to the potential for cognitive problems, which are common in late life, to influence the capacity of individuals to effectively manage and navigate an increasingly complicated financial world effectively.

Consequently, this paper focuses on the relationship between cognitive functioning in late life and older adults' ability to effectively manage their finances. Specifically, we consider the basic question of how aware older adults are of their own financial situation. Do they know the value of their financial resources? In order to make decisions regarding spending, and in some cases continued investment activities, older adults need to have a general sense of their financial resources. We then examine the links between cognitive functioning, both in early and late life, and older people's knowledge of their individual financial resources.

Changing Nature of Retirement Income

Retirement income has long been conceptualized as a three-legged stool, with three distinct sources of support (Social Security, employer-provided pensions, and personal savings). Social Security and employer provided defined benefit pensions required little to no management on the part of individuals. Individuals pay payroll taxes throughout their working years and then simply receive a benefit. The major choice involves when to start collecting benefits once an individual reaches age of eligibility (age 62). Defined benefit plans also require little to no management. Employers set aside money for workers and then individuals receive steady and consistent payments for as long as they live. The third leg, savings, requires that individuals

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invest and manage their resources on their own. Unlike Social Security and defined benefit plans, there is no benefit guarantee. If individuals make poor decisions, either investing poorly or spending money too quickly in retirement, these resources are not protected. This traditional three legged stool thus had two relatively stable income streams and one more potentially volatile stream.

Now, however, the balance has changed. Unlike in the past, when most employer-provided pensions were in the form of defined- benefit plans, managed by employers with benefit amounts fixed regardless of changing economic conditions or individual decisions, today most employment-related pensions are in the form of defined contributions, which are managed by the employee. Whereas in 1975, only 26 percent of recipients of a private sector employer-based pension were in a defined-contribution plan, by 2005, this number had risen to 64 percent EBRI, 2009).   The proportion of the workforce covered only by defined-benefit plans dropped from 62 percent in 1979 to 10 percent in 2004 (EBRI 2004). Defined contribution plans more closely resemble private savings. Thus, the employer-provided-pension leg now places the risk on the individual, just as the personal-savings leg does. The value of this type of pension, like the value of personal savings, is linked to the ups and downs of the stock market and the individual's ability to invest and spend those resources wisely.

Financial Literacy and Cognition

This reconfiguration of retirement has significant implications for the financial well-being of older Americans. For prior generations, even if one lost the majority of private savings, over 60 percent of ones' income was still available. For current and especially future cohorts of older Americans, mistakes managing their defined contribution plans and private savings and can lead to true financial disaster affecting as much as 70 percent or more of their income.

And there is considerable evidence that many Americans lack the skills to effectively complete this task. Surveys of what's termed, financial literacy, find that most respondents do not understand basic financial concepts necessary for retirement financial management, including topics such as bonds, stocks, mutual funds, compound interest, loans, and mortgages (Agnew and Szykman 2005; Bernheim 1994, 1998; Hogarth and Hilgert 2002; Mandell 2004, 2007; Moore 2003; National Council for Economic Education 2005).

Financial literacy skills are not only important for retirement planning, they are just as important during retirement. Previous cohorts had little to manage in retirement. They mostly relied on a stable monthly Social Security and defined benefit pension benefits. Recent and future retirees have a much more complicated income stream. They have a complex array of defined contribution plans, private individual retirement accounts, and general stock market investments that must be managed throughout retirement. They must make decisions, sometimes

on a daily basis, regarding how much they have to spend and whether to move money between varying investments. These calculations are dependent upon individuals' abilities to estimate their life expectancy and the performance of their investments . While individuals could simplify their retirement income streams by purchasing an annuity, which can provide a fixed and stable income stream, very few individuals actually purchase annuities. Estimates are that fewer than 6 percent of households participate in an annuity (Inkman et al. 2010). Participation in annuities is largely among those with high educational attainment, long life expectancies and large amounts of wealth.

The consequence of this complexity is that there are high cognitive demands associated with these tasks. This is potentially problematic as cognitive abilities decline at older ages. Intelligence is comprised of crystallized and fluid intelligence. Fluid intelligence is the general capacity to think logically and solve problems in novel situations, while crystallized intelligence is the depth and breadth of an individual's knowledge and his or her ability to actually use that knowledge. Most evidence demonstrates that it is fluid intelligence that declines with age. Though estimates vary, there is some evidence that cognitive decline in fluid intelligence may begin as early as 30 (Salthouse 2010). And there is no dispute regarding the reality of cognitive decline at older ages past 50. Though estimates vary, recent data indicate that the incidence of cognitive impairment without dementia is 22 percent for those aged 70 and over (Plassman et al. 2008). And declines accelerate rapidly as people age. The prevalence of 'normal' cognitive functioning falls from 90 percent for those aged 65-74, to 70 percent for those aged 75-84, and then to 40 percent for those aged 84 and older (DeCarli 2003).

So we look at an alternative outcome and also have early and late life cognitive functioning measures. The existing literature, which is itself quite small, focuses on how cognition affects broader wealth accumulation. But wealth accumulation is a different question. That is, how are ordinary people managing the resources that they have IN retirement, not in preparation for retirement? Wealth is a cumulative measure of financial skills. It may take considerable time before age related cognitive decline begins to impact overall wealth. So these studies likely underestimate the impact of cognitive functioning on financial outcomes. Nonetheless, this literature generally demonstrates links between cognition and wealth accumulation (Cole and Shastry 2010; Korniotis and Kumar 2007; Agarwal et al 2007; Zagorsky 2007; Christelis, Jappelli, and Padula 2006)

Another issue with the existing literature, including the wealth literature, is that studies have not controlled for childhood cognitive abilities. A few studies have employed existing cognitive functioning, measures that are meant to capture age related declines in cognitive function. But there is considerable evidence that childhood cognitive ability has a profound influence on cognitive functioning at older ages, explaining as much as 80 percent of the

variation.   Consequently, this study examines the link between early and late life cognitive ability and financial knowledge among older adults.

DATA AND METHODOLOGY

There are no better data available in the United States than the Wisconsin Longitudinal Study (WLS) to test the links between early-life schooling experiences and cognition, and financial skills in late life. The WLS encompasses a cohort of 10,317 Wisconsin high school graduates mainly born in 1939. The sample is generally representative of white, non-Hispanic high school graduates across the United States. Survey data were collected in 1957, 1964, 1975, 1992/3, and 2003/5. It is the longest-running longitudinal sample in the United States, with the first wave of data collected when the respondents were seniors in high school in 1957 and the most recent wave of data collected in 2004 when the respondents were in their mid-60s.

It is the only United States data set with administrative and prospective data that allows one to explore the links between early-life schooling and cognition and financial literacy. While surveys such as the HRS collect measures at multiple time points for a sample of older Americans, the WLS includes a broad array of early-life schooling characteristics (including years of schooling, course content, and school performance and interest) and cognitive measures not included in other studies of older Americans.

One weakness with the WLS, however, is that it is a homogenous sample of white Wisconsin high school graduates from 1957. While this has obvious disadvantages, a relatively homogenous sample can help rule out unobserved variable effects that would arise from birth cohort, education level, and geographic area correlates. Though many observed variables can be accounted for, such as sex, there are numerous correlates, such as cultural differences, which are harder to account for but which are still potential confounders.

While the original WLS sample contains over 10,000 respondents, this study analyzes just over half of that original sample (6,276 cases). Cases lost to follow-up include almost 1300 respondents who had died by 2004; approximately 1400 cases who refused to answer the phone survey in 2004, in which key questions for our analysis were asked. The remaining missing cases were lost due to information missing on key covariates (educational attainment and course content) or on the outcome measure. Finally, the main cognitive measures from 2004 were asked of a random 80% subsample of respondents. An additional measure was employed on a 50% subsample. Because these are random subsamples, the results are still generalizable to the general sample. The WLS has been ongoing for over 50 years, making sample retention an obvious challenge. Yet, compared to the Panel Study of Income Dynamics (PSID), which lost 50% of its sample to attrition over a period of 21 years between 1968 and 1989 (Fitzgerald, Gottschalk, and Moffitt 1998), the WLS has had strong sample retention.

Outcome Measures

While there is not a clear consensus regarding how to measure financial literacy (Remund 2010), the measures fall broadly into two groups, knowledge based and behavior based (Huston 2010). Knowledge-based measures include things such as whether individuals can calculate compound interest or know the difference between a stock and a bond (Applied Research & Consulting LLC 2003; Hilgert, Hogarth, and Beverly 2003; Holden, Kock, and Mohan 2010; Lusardi 2008, 2008; Lusardi and Mitchell 2007a, 2007b, 2007c; Moore 2003; National Council for Economic Education 2005; van Rooij, Lusardi, and Alessie 2007). This approach to measuring financial literacy assumes that if consumers have basic tools, they can use them to make better financial decisions.

Alternatively, measures can be behavior based, measuring whether individuals exhibit good financial behaviors (ANZ Bank 2008; Lusardi and Tufano 2009; Moore 2003). These kinds of measures capture things such as levels of financial debt, participation in pension plans, or adequacy of retirement savings. Some studies have examined the validity of the knowledge-based measures by using them to predict behaviors like retirement savings and debt levels (Lusardi and Mitchell 2009; Lusardi and Tufano 2009). Although there is evidence that they are correlated, there is variation,

We utilize a measure of financial literacy that supplements these existing measures with the virtue of being drawn from questions that are asked on many surveys; it does not depend on 'financial literacy'-specific variables. In short, we attempt to capture an individual's knowledge of his or her own financial situation. Our survey measures how knowledgeable individuals are regarding their own assets, their retirement savings, and their immediate financial resources. We know of only one other study that has attempted this approach (Gustman and Steinmeier 2004).

Having knowledge of one's own finances is a prerequisite for making good financial decisions. Further, unlike a more general knowledge-based measure, this measure gets at the knowledge individuals require to manage their own finances. Our measures reflect the efforts individuals have made to be precise and active in their financial life. There are likely many who formally understand compounding but, even though on the verge of retirement, do not know how much their pension will be worth. Of course having complete knowledge of one's existing financial situation does not guarantee good financial decisions. Nonetheless, it is very challenging to make good financial decisions if one is not aware of one's basic financial resources.

Finally, our measure is appropriate to the age of the sample respondents. It is arguably less important for 30 year olds to know the value of their pension accounts, for example. The key is that they are making consistent deposits into those accounts. But for individuals near or actually in retirement, it is very important to have a clear sense of one's resources to make

appropriate decisions regarding spending and potentially alternative investments.

Consequently, we developed a set of measures to establish whether or not individuals exhibit good financial skills and knowledge of their individual finances. We defined three measures based on the 2003/5 survey data. Descriptions of the variables are presented here. Appendix A discusses additional details regarding sensitivity analyses to test the validity of these measures.

These measures are: 1) Percent of asset questions to which the respondent gave an answer; and 2) Knowledge of the value of retirement accounts. The first measure is intended to capture the respondent's overall awareness of his or her current financial situation. This WLS-constructed measure is a simple accounting of the percent of total asset categories held by the respondent (and spouse, if married) for which the respondent can provide a dollar amount when asked in a series of 12 questions. Asset categories include property, account balances in retirement plans, and life insurance cash values. We include in our sample only those cases that completed the full series of asset questions. Respondents who refused to answer at least one asset question comprised about 10% of the full sample and were excluded from our analyses. As noted above, we discuss the implications of this in Appendix A.

The second measure intends to capture day-to-day financial awareness. We construct a binomial variable from the answer to the question, 'If you added up all of your and your spouses' checking accounts, savings accounts, or money market funds, about how much would they amount to right now?' The variable is coded as 1 if respondents provided a value and 0 if they stated that they did not know the amount. About 7% of the sample refused to answer this question and were thus excluded from these analyses. We discuss the implications of this in Appendix A.

Covariates

This first set of independent variables is intended to capture basic cognitive ability and the early acquisition of skills that are likely to enhance the ability of individuals over their lifetimes to read about, understand, rigorously critique, and act on complex information.

Childhood Cognitive Ability/IQ

These scores, available through school district administrative records, are derived from the Henmon-Nelson Test of Mental Ability, which was administered to high school students in Wisconsin. The Henmon-Nelson test is considered a general measure of intelligence, but a recent analysis indicated that, although it captures both fluid and crystallized intelligence, it is more strongly correlated with crystallized intelligence (Pallier, Roberts, and Stankov 2000). It is important to note that although high school rank and IQ are correlated (r=0.58), there is still meaningful variation. Due to evidence of nonlinearity, we ran this variable as a series of three splines. The first was for IQ scores below 100; the second spline was for IQ scores from 100 to

120; and the third spline was for IQ scores above 120.

Adult Cognitive Ability

In 2003-2005 the survey collected the following measures intended to capture age related cognitive decline:

(a) *Verbal fluency.* For category fluency, respondents are given sixty seconds to name as many kinds of either foods or animals as they can (Herzog and Rodgers 1999; Jöreskog 2000; Kozora and Cullum; Schooler, Mulatu, and Oates 1999). Answers were transcribed from recordings and scored by coders later. Category fluency is especially useful in predicting Alzheimers (Cerhan et al. 2002; Clark et al. 2009).

(b) *Verbal memory, delayed.* Participants are read a list of ten high-frequency words at a rate of one word per two seconds. They are asked immediately afterward to recall words they can. Approximately 10 minutes later, after answering unrelated intervening items, they are asked to recall these words again. Two different counterbalanced word lists from HRS are used (Jöreskog, Sörbom, and Inc 1996a).

(c) *Working memory.* We use a digits ordering task, in which participants are read a series of digits at a rate of one per 1.5 seconds and asked to repeat these digits in ascending numeric order. Series begin with three digits and increase until participants successfully complete a series of eight digits or fail twice on a level. Working memory is a bit like short term memory. One relies on working memory to solve a complex math problem for example (Nelson Cohen 2009).

Educational Attainment

This measure calculates years of schooling derived from the highest degree attained and number of years of higher educational attainment. The measure ranges from 12 to 20 years, with 12 being a high school graduate and 20 indicating the attainment of a PhD. Other forms of this measure did not lead to different results.

Confounding Covariates

This set of variables includes those that, if excluded, would lead to biased estimates of the influence of the previous set of covariates. This could be either because they are themselves causal of skill acquisition attributes or because the confounding variables enhance the contributions of those skills. The most straightforward example would be parents of high socioeconomic status with their own financial skills who teach those to their children; as adults, those children would be more financially literate regardless of their high school course selections, which would also be influenced by their parents' expectations.

Parental Socioeconomic Status

The parental socioeconomic status measure is a WLS-created factor-weighted score

ranging from 1 to 97. The score is based on: 1) highest number of years of schooling for respondent's mother and father, 2) Duncan SEI occupational score for respondent's father's occupation, and 3) four-year average of parental income between 1957 and 1960, based on Wisconsin tax records.

Adult Socioeconomic Status

These measures include current income and asset levels. Asset values and income values are imputed for those who did not report on these measures.

Basic Demographics

These measures control for the sex, age, marital status (married, divorced, widowed or never married) and race of the respondent, although there is little variation by age and race.

<div align="center">Analytic Techniques and Models</div>

The analyses include logit and ordinary least square (OLS) regressions. Because of differences in the relationship between the outcomes, covariates, and whether or not individuals had college degrees, we ran separate models for those with at least a college degree and those without a college degree. An OLS model was estimated of the predictors of the percentage of asset questions respondents answered. A logit model was employed for the binary outcome measures regarding whether individuals know the value of their pension accounts and whether or not they know the value of their checking accounts. The models included parental socioeconomic status (measured in 1957), basic demographics, childhood IQ (measured in 1955–57), high school rank (measured in 1957) and coursework variables (measured in 1957), and years of schooling (a composite measure based on reports in 1974, 1992/3, and 2004).

<div align="center">RESULTS</div>

The key findings from the analyses are 1) cognition is only linked to financial knowledge for those without college degrees; 2) late life measures of cognitive functioning are correlated with financial knowledge for those without college degrees, but their effects weaken substantially after accounting for childhood cognitive functioning.

Table 1. The Relationship between Cognition and Knowledge of Assets and Pension Values
among those without a College Degree in the Wisconsin Longitudinal Study

	Assets			Pensions		
IQ in 1956						
IQ Spline (70-100)		0.0028 ***				0.0007
IQ Spline (100-120)		0.002 ***				0.0038 ***
IQ Spline (120+)		0.0014				0.0065
Cognition in 2004						
Digit Ordering 2	0.0199 *	0.0069		0.0216	0.0095	
Digit Ordering 3	0.0116	-0.0059		0.0149	-0.0042	
Digit Ordering 4	0.0389 ***	0.0201 *		0.0629 ***	0.0454 *	
Digit Ordering 5	0.0294 **	0.0101		0.0667 ***	0.0499 *	
(reference is lowest quintile)						

*All models control for sex, marital status, childhood SES, years of schooling, health, (imputed) asset totals, and income.

Table 1 presents analyses that examine the relationship between digit ordering and financial knowledge of assets and pension values. Digit ordering was positively correlated with both asset knowledge and pension knowledge. Individuals who scored in the highest quintiles of digit ordering scores were able to answer about 3-4 percent and 6-7 percent more asset values questions and pension values respectively than those in the lowest quintile. The relationship between digit ordering and assets and digit ordering and pension value knowledge was reduced 50-90 percent and 25 percent respectively after accounting for early life cognitive functioning.

Table 2. The Relationship between Cognition and Knowledge of Assets and Pension Values
among those without a College Degree in the Wisconsin Longitudinal Study

	Assets			Pensions		
IQ in 1956						
IQ Spline (70-100)		0.0029 ***				0.0014
IQ Spline (100-120)		0.002 ***				0.0038 ***
IQ Spline (120+)		0.0015				0.0061
Cognition in 2004						
Delayed Recall 2	0.0243 **	0.0194 *		0.046 *	0.0424 *	
Delayed Recall 3	0.0316 **	0.0207 *		0.0564 **	0.044 *	
Delayed Recall 4	0.0307 *	0.0222 ^		0.0564 **	0.0509 *	
Delayed Recall 5	0.0187	0.0133		0.0134	0.0078	
(reference is lowest quintile)						

*All models control for sex, marital status, childhood SES, years of schooling, health, (imputed) asset totals, and income.

Table 2 presents analyses that examine the relationship between delayed recall and financial knowledge of assets and pension values. Delayed recall was positively correlated with both asset knowledge and pension knowledge. Individuals who scored in the highest quintiles of

delayed recall scores were able to answer about 3 percent and 5.5 percent more asset values questions and pension values respectively than those in the lowest quintile. The relationship between delayed recall and assets and digit ordering and pension value knowledge was reduced by 30 percent and 15 percent respectively after accounting for early life cognitive functioning.

Table 3. The Relationship between Cognition and Knowledge of Assets and Pension Values among those without a College Degree in the Wisconsin Longitudinal Study

	Assets		Pensions	
IQ in 1956				
IQ Spline (70-100)		0.0029 ***		0.0005
IQ Spline (100-120)		0.0017 **		0.0034 **
IQ Spline (120+)		0.0021		0.0093
Cognition in 2004				
Category Fluency 2	0.0297 *	0.0247 *	0.0233	0.0199
Category Fluency 3	0.0318 *	0.0219 ^	0.0529 *	0.0418
Category Fluency 4	0.0359 **	0.0257 *	0.0548 *	0.0431
Category Fluency 5	0.0451 ***	0.0298 *	0.0731 *	0.0539 ^
(reference is lowest quintile)				

*All models control for sex, marital status, childhood SES, years of schooling, health, (imputed) asset totals, and income.

Table 3 presents analyses that examine the relationship between category fluency and financial knowledge of assets and pension values. Category fluency was positively correlated with both asset knowledge and pension knowledge. Individuals who scored in the highest quintiles of category fluency scores were able to answer about 3-5 percent and 5-7 percent more asset values questions and pension values respectively than those in the lowest quintile. The relationship between category fluency and assets and digit ordering and pension value knowledge was reduced by 25-30 percent and 20 percent respectively, in addition to increasing the standard errors substantially, after accounting for early life cognitive functioning.

IMPLICATIONS AND CONCLUSIONS

The main findings from this paper are that cognition, measured both early and late in life, do have a relationship with late-life financial literacy, though this only holds true for those without a college degree. In this paper, we have defined financial literacy as the level of knowledge one has regarding one's own personal finances. We use data that are often collected in surveys and thus can provide insight into financial knowledge across populations, even when financial literacy is not targeted in a survey. It seems reasonable to argue that these questions reflect levels of financial literacy required by individual circumstances: 1) Can you precisely identify all of your assets and their value?; 2) Can you identify the value of assets most immediate to day-to-day financial transactions, such as your checking accounts?; and 3) Can you

identify the value of assets important to life-course planning, such as your retirement savings accounts?

The effects of early-life cognition and late-life cognition were significant, but confined to those without college degrees. Generally the effects were strongest towards the bottom of the early life IQ distribution, though in some cases the effects were strongest for those in the middle of the IQ distribution.   The distribution for later life measures was less clear. In some cases, it was somewhat linear, in other cases the strongest differences were between the top and the bottom quintiles.

One thing that was quite clear was the failing to control for childhood cognition leads to the overestimation of contemporaneous cognitive functioning in an older sample. It's not just cognitive functioning problems in late life that is a problematic for financial knowledge, early life cognitive functioning continues to play a role, above and beyond current cognitive functioning.

It is important to keep in mind that education has demonstrable effects on cognitive scores (Blair et al. 2005). Consequently, it is not clear the extent to which differences in cognition may reflect environmental differences, such as school quality, versus genetic differences. That said, we have controlled for important family background characteristics, which are also correlated with IQ measures, in particular parental socioeconomic status. Indeed, sensitivity tests employing a broader range of family socioeconomic status measures than included in the models in this paper did not demonstrably alter the findings. Whether or not cognitive differences are the result of genetic or environmental characteristics, the fact that there is such a strong association, controlling for educational attainment, remains an important finding.

There are some caveats to this study that should be addressed. Overall, this is a relatively well educated sample and thus has relatively high levels of financial literacy as measured in this study. That said, the relatively high educational attainment of this sample makes the cognitive findings striking. Even amongst the most capable, there are large differences in financial literacy based on cognition. Thus, these analyses cannot tell us how those without high school degrees fare, although the link between lower cognitive scores and financial literacy gives some indication of what that relationship may look like.

It's also important to keep in mind that this is a single cohort. Analysis of this cohort is valuable for understanding influences on financial knowledge of younger individuals.   In short, members of the WLS cohort, like younger cohorts, face a complicated array of choices surrounding retirement savings. As is the case with younger cohorts, retirement income is dependent on how careful and knowledgeable individuals are as they face a financial landscape that has changed significantly over the last 20 years with the shift towards defined contribution pension plans and individual retirement accounts and away from defined benefit plans. The

responsibility for saving and investing wisely for retirement falls largely on individuals. As already noted, about 80% of the sample had defined-contribution retirement savings plans (like 401(k)s).

Another caveat regards the sample selection. All of the analyses excluded those who refused to answer. In Appendix A, we describe, in detail, analyses employed to test the consequence of excluding those who refuse. In short, we actually find evidence that excluding refusals, especially among women, may mean that our estimates are conservative. Among women, it appears that those refusing to state the value of things like assets may actually be indicative of a lack of knowledge. Thus, the basic pattern of findings appears to remain the same regardless of excluding the refusals.

The second issue with sample selection regards the fact that in the case of the pension variable about 20% of the overall sample did not have such an account. Clearly, these individuals are a select group, with those having accounts also more likely to have characteristics that affect the probability of their knowing account values. Those who do not have pension accounts are more likely to be women, to have low incomes, and to have low educational attainment. These findings about financial knowledge predictors must be understood to reflect relationships only for individuals who are likely to have these kinds of market-based, individualized (defined contribution) retirement savings accounts. However, it is important to understand how those with the most complicated financial lives are coping and the sources of variation in terms of their skills. So the findings are important, but must be understood in the context of the specific population.

It is also important to consider that the interpretation of these measures and analyses must vary depending on the respondent's age. For example, an individual age 40 being unsure of the value of a retirement account is less policy problematic than is a 60-year-old individual contemplating retirement. It is only as retirement approaches that having significant knowledge of these accounts has a more immediate impact on individuals' financial situation. One advantage of the WLS data is that it avoids this variation—these are all retirement-age individuals.

The final caveat is that while we see these associations between cognition and late-life financial literacy, we cannot claim these are entirely causal relationships. However, our childhood measures are prospective and in some cases (like for cognition) based on administrative data. So the study does provide a unique contribution for understanding the links between early-life factors and late-life outcomes.

Policy Implications

More generally, the results demonstrate the problems that older adults face today, and especially among younger cohorts in future years. As the complexity of peoples' financial lives

grow, the importance of cognitive functioning in determining financial outcomes is also likely to grow. The tasks that older people need to engage in to manage their financial lives are complex in ways that will pose real challenges for those with more limited cognitive functioning. If this effect is to be weakened, policymakers will need to develop strategies to help simplify older Americans' financial lives.

APPENDIX: THE VALIDITY OF THE FINANCIAL LITERACY OUTCOME MEASURES

Our financial literacy measures are based on three key assumptions, which we will test in this section. One assumption is that individuals providing an exact response do actually know the exact value of their assets. A second is that those who respond 'I don't know' are indicating lack of awareness of amounts even within some reasonable margin of error, rather than simple uncertainty about the exact value of accounts at the time of interview. Finally, we exclude from our variable definition those who refuse to answer necessary questions. The implicit assumption is that these refusals are randomly distributed across the sample rather than being more likely to have characteristics correlated with the outcome variable. The results discussed below provide some assurance that these are assumptions that, at least, do not lead to biased results.

We provide a range of estimates to help validate that individuals are giving accurate answers if they provide an exact value of their assets. Because we do not currently have administrative data to do a clear test, we perform a few sensitivity analyses to test the potential accuracy of the responses. First, the fact that women are much less likely to report specific asset values as compared to men helps confirm that individuals are answering honestly. Tests of financial knowledge (i.e., how to calculate compound interest), like the findings presented here, indicate that women are much less likely than men to exhibit strong financial literacy skills (Lusardi and Mitchell 2008). Second, the IQ findings also provide some assurance regarding response validity. Again, as do prior studies that test financial knowledge, we find that those with lower cognition levels are much less likely to report specific asset values.

We also test whether men, perhaps not wanting to appear unknowledgeable, report values even if they do know the values of varying assets. To test this hypothesis we utilized a measure of masculinity. Respondents were asked in the 2004 follow-up mail survey, 'To what extent do you agree that a man should always try to project an air of confidence even if he doesn't really feel confident inside?' Responses ranged from strongly agree to strongly disagree. The response distribution was a normal bell curve. We reran models only on men and included this measure to test the hypothesis that men, especially those with very traditional notions of what constitutes being a man, may report values for assets categories even when they do not know them. We found no evidence to support the hypothesis. This measure showed no ability to predict whether respondents reported a value versus reporting that they don't know. We would have expected that those who always felt like they had to 'project an air of confidence even if [they don't] really feel confident' would be less likely to report that they don't know the value of an asset (such as their pension value or checking account value). We found no evidence that this was true.

In addition to concerns about inaccurately reporting specific asset values, another issue is whether those who respond 'I don't know' are actually indicating a lack of awareness of amounts rather than simple uncertainty about the exact value of accounts at the time of interview. Again,

our findings regarding gender differences and cognitive factors so closely parallel prior studies predicting financial literacy; this provides some assurance that we are getting at a true lack of knowledge. But we also performed some additional analyses to further test the validity of this concern. In particular, we explored differences between those who reported that they did not know the value of their checking accounts or their retirement accounts and those who initially reported that they did not know but then provided answers in the form of bracketed values or within a certain range of values. A similar pattern of findings held across these groups, but the differences were much wider between those who never provided an answer versus those who provided an exact answer, compared to those who provided an answer through bracketing versus those who provided an exact answer. Those with lower IQs, women, and those with more limited educational attainment were more likely to provide no values at all or values through bracketing than to provide a specific value.

Finally, we explored the implications of excluding from the analyses those who refused to answer. In particular, we wanted to be certain that those who refuse are actually distinct from those who say that they don't know the value of their asset categories. It is possible, for example, that some individuals simply reported that they don't know as a polite way to refuse to respond. Thus, we compared those who refused to answer with those who said they don't know the value of their 'retirement plans that accumulate an account balance,' those accounts including IRAs, 401(k)s, and profit-sharing plans, and their checking account values.

Table A1 shows the basic differences in the descriptive relationships between the covariates and those who refused to answer versus those who reported that they don't know the value of their varying assets. In short, the table demonstrates that the main differences (gender, cognition, and educational attainment) we saw between those who reported that they didn't know the value of their assets and those who reported a specific value were much larger than when comparing the differences between refusals and those who provided an exact asset value.

(Insert Table A1 about here)

Indeed, we ran subsequent regression analyses to further explore the descriptive differences presented in Table A1. The first set of analyses was for a sample that included respondents who either reported a specific value of their retirement account balance or refused to answer. We estimated the probability of refusal. An identical analysis was done for a sample that included only those who either reported a value of these accounts or reported they did not know that value. The test was whether the predictive variables were similar—implying refusals and don't knows are virtually the same answer—or different, which would imply the validity of their distinct treatment. Gender played an important, different, and expected role in these sensitivity analyses. First and foremost, the predictive value of gender was much smaller for a refusal than a 'don't know' response. This is consistent with the literature that finds women possess lower

financial literacy than do men. This leads us to conclude that our 'don't know' predictors do predict knowledge, while refusals are caused by wealth-related factors. Refusing to answer questions on financial measures is disproportionately high among those with very high asset levels (Juster and Smith 1997).

These gender differences inspired us to run these sensitivity models separately for men and women. For men, IQ and academic measures were not predictive of refusal to answer asset questions. In contrast, for men, education and IQ was predictive of 'don't' know' answers, and in the expected direction. Among women, however, we found a more complicated story. We found evidence of reporting bias in the opposite direction than what we initially assumed. It appears women may have been more likely to refuse when they did not know asset amounts. Women who refused to answer had lower IQ scores and were less likely to have taken advanced math courses in high school. In sum, the evidence of these sensitivity analyses indicates, that if anything, our exclusion of refusals from our sample may actually underestimate the effects of early-life schooling, especially for women.

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