

WORKING P A P E R

Defining and Measuring Financial Literacy

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1. Introduction

Current economic conditions have raised serious concerns about Americans' financial security, especially for those who lack the skills and resources to withstand financial market downswings and take advantage of upswings. Individuals are taking responsibility for a growing number of financial decisions, the two most important arguably being the purchase and financing of a home and preparing for retirement. As these choices are becoming more complex, the stakes are also being raised: the current financial crisis, for example, has brought to light the consequences of making far-reaching decisions without adequate tools. The sub-prime mortgage experience has provided three cautionary lessons about consequences for the economy at large. First, poor financial decision making may be a surprisingly widespread phenomenon. Second, such problems may build unnoticed for a long time before a crisis is reached. Third, the systemic effects and the costs of preserving stability may be sizable, as demonstrated by the ensuing financial market turmoil and subsequent interventions.

Looking beyond the financial crisis, these lessons leave individuals and policymakers with new concerns as they look to the future, particularly as the Baby Boom generation prepares (or not) for retirement. Poor savings and investment decisions may be less visible, but carry serious implications for long-term financial security for major parts of the American population². With the shift to defined-contribution (DC) pension plans and uncertainty about government Social Security, American households are being increasingly called upon to undertake their own financial planning for retirement. Research in behavioral finance suggests that many households do not in fact make optimal savings and investment decisions, and the realization that these choices may well lead to unacceptable standards of living has also increased economic anxiety.

Recent evidence suggests an underlying, more fundamental problem that has heightened such concerns: large segments of the US population have low levels of financial literacy. The less financially literate may be more likely to unknowingly commit financial mistakes, less likely to engage in recommended financial practices, and less likely to be able to cope with sudden economic shocks. Lusardi and Mitchell (2007a, b, c) point out that these decisions are far from simple, requiring consumers to gather, process, and project data on compound interest, risk diversification, inflation, and the asset universe. In other words, individuals need substantial knowledge and a large analytical toolkit simply to avoid making mistakes (Ferguson, 2002).

Significant debate continues about the role of financial literacy, the extent of the problem it truly represents, and the best way to address it. This debate arises for several reasons: First, real knowledge gaps persist about fundamental relationships between literacy, education and behavior, partly because researchers lack the appropriate data. Few studies have been able to construct sophisticated measures of financial literacy and definitively establish causal links between financial education, literacy and behavior in the U.S.

² Indeed, data from the 2001 Survey of Consumer Finances suggest that U.S. consumers are much *more* well-informed about mortgages than saving patterns and general financial management.

population. Researchers to date found that various segments of the U.S. population lack various types of financial skills (Hilgert, Hogarth and Beverly, 2003; Lusardi and Mitchell, 2007a, b).³ In 2004, only half of adults close to retirement age and older were able to correctly answer two simple questions regarding compound interest and inflation, and only one-third correctly answered these two questions and a question about risk diversification (Lusardi and Mitchell, 2006, 2007b). Furthermore, large discrepancies in measured financial literacy exist, potentially placing some economically vulnerable groups (the poor, the less-educated, and minority households) at further disadvantage. These measures have been linked to suboptimal behavior – Hilgert, Hogarth and Beverly (2003) find that individuals with more financial knowledge are more likely to engage in a wide range of recommended financial practices, while Lusardi and Mitchell (2006, 2007a) find that among older adults, those who displayed better financial knowledge were more likely to plan, to succeed in planning, and to invest in complex assets

However, other researchers argue that financial literacy is a secondary concern when it comes to decision making, partly because evidence on financial education programs has been mixed. Early evaluations, notably by Douglas Bernheim and a series of coauthors, suggested that workplace financial education initiatives increased participation in savings plans (Bayer et al., 1996; Bernheim 2003), while financial education mandates in high school significantly increased adult propensity to save (Bernheim et al., 2001). However, more recent research has found minimal impacts, particularly when benchmarked against other factors, including peer-effects and known behavioral biases like inertia (Duflo and Saez, 2004). This lack of consensus reflects the fact that, as noted in the 2006 report of the Financial Literacy and Education Commission, “a systematic method of evaluation of financial literacy programs does not exist.”

A large part of this debate may be linked to the fact that a great deal of variation continues to exist in how researchers define and measure financial literacy itself. Previous surveys that are purposively designed to measure financial literacy (such as the Washington Financial Literacy Survey, the Jump\$tart Coalition Survey, or the Survey of Consumer Finances 2001 module) rarely also collect sufficiently detailed information on individuals’ financial education and variables related to financial decision making. In some instances (notably in the 2004 Health and Retirement Survey), more complete information has been successfully obtained, but the sample has been restricted to particular subgroups such as adults over 50, young people, or the subject pool for a particular program evaluation. In the policy and research literature, previous studies relating literacy to education and/or behavior have therefore been constrained either to the use of rudimentary literacy measures or to samples that are not population-representative. While a “consensus” definition has been provided by PACFL (2008), it is unclear how widely accepted this definition is.

³ Findings of widespread financial illiteracy are also reported in studies on smaller samples or specific groups of the population (Agnew and Szykman, 2005; Bernheim 1995, 1998; Mandell, 2004; Moore, 2003).

2. Defining financial literacy

In order to enhance comparability and consistency across the evidence base, core concepts must be clearly defined. However, as happens in many research areas, different researchers and organizations have defined financial literacy in many different ways. This section examines the breadth of existing conceptual and operational financial literacy definitions, compares financial literacy to other related but distinct concepts, and concludes with a discussion of the domain over which financial literacy applies.

PACFL provides a “consensus” definition

The Presidents Advisory Council on Financial Literacy (PACFL, 2008), convened to “improve financial literacy among all Americans,” defines financial literacy and financial education as follows:

- **Financial literacy:** the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being.⁴
- **Financial education:** the process by which people improve their understanding of financial products, services and concepts, so they are empowered to make informed choices, avoid pitfalls, know where to go for help and take other actions to improve their present and long-term financial well-being.⁵

Other conceptual definitions continue to be used

However, it is unclear how widely the PACFL definition is accepted. One of the striking things about the literature is that financial literacy has been variably defined as (a) a specific form of *knowledge*, (b) the *ability* or skills to apply that knowledge, (c) *perceived knowledge*, (d) good financial *behavior*, and even (e) financial *experiences*.

Table 1 illustrates the breadth of conceptual definitions, drawn from a number of studies and placed in chronological order. The most common basis for the definitions is knowledge (or understanding), with some definitions merely requiring familiarity (arguably a limited form of knowledge). Still others, such as those provided by Mandell (2007) and Lusardi and Tufano (2008), emphasize a judgment and decision-making aspect of financial literacy. Lusardi and Tufano also focus on a specific form of financial literacy – debt literacy. Moore (2003) goes so far as to include practical experience, on the argument that it provides the basis for knowledge and other aspects of financial literacy.

⁴ This definition is based on the definition of financial literacy from the JumpStart Coalition: <http://www.jumpstart.org/guide.html>.

⁵ OECD (2005) defines financial education as “the process by which financial consumers/investors improve their understanding of financial products and concepts and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being” (p. 26). Lusardi and Mitchell (2007c) use the OECD definition as the basis for their review of financial literacy.

Table 1. Conceptual definitions of financial literacy

Source	Conceptual Definition ^a
Hilgert, Hogarth, & Beverley (2003)	Financial <i>knowledge</i>
FINRA (2003)	“The <i>understanding</i> ordinary investors have of market principles, instruments, organizations and regulations” (p. 2).
Moore (2003)	“Individuals are considered financially literate if they are competent and can demonstrate they <i>have used knowledge</i> they have learned. Financial literacy cannot be measured directly so proxies must be used. Literacy is obtained through practical <i>experience</i> and active <i>integration of knowledge</i> . As people become more literate they become increasingly more financially sophisticated and it is conjectured that this may also mean that an individual may be more competent” (p. 29).
National Council on Economic Education (NCEE) (2005) ^b	“ <i>Familiarity</i> with basic economic principles, knowledge about the U.S. economy, and <i>understanding</i> of some key economic terms” (p. 3).
Mandell (2007)	“The <i>ability</i> to evaluate the new and complex financial instruments and <i>make informed judgments</i> in both choice of instruments and extent of use that would be in their own best long-run interests” (pp. 163-164).
Lusardi and Mitchell (2007c)	[<i>Familiarity</i>] with “the most basic economic concepts needed to make sensible saving and investment decisions” (p. 36).
Lusardi and Tufano (2008)	Focus on debt literacy, a component of financial literacy, defining it as “the <i>ability to make simple decisions</i> regarding debt contracts, in particular how one <i>applies basic knowledge</i> about interest compounding, measured in the context of everyday financial choices” (p. 1).
ANZ Bank (2008), drawn from Schagen (2007)	“The <i>ability to make informed judgments</i> and to take effective decisions regarding the use and management of money” (p. 1).
Lusardi (2008a, 2008b)	“ <i>Knowledge</i> of basic financial concepts, such as the working of interest compounding, the difference between nominal and real values, and the basics of risk diversification” (p. 2).

^a Italics have been added throughout to emphasize key definitional components.

^b This study labels the construct economic literacy.

In many studies, however, financial literacy is not conceptually defined at all. In some of these studies it is possible to infer a definition from the given text, but in other studies the reader is left to infer what the authors meant from how financial literacy was measured.

Research often fails to distinguish financial literacy from related concepts

Many concepts, such as *numeracy*, share features with financial literacy. For example, financial literacy clearly benefits from comfort with numbers. To the extent that financial literacy involves skills, rather than just knowledge, these skills likely depend on the ability to work with numbers. However, numeracy applies much more broadly than to just financial matters and represents a much more basic skill set – one more closely aligned to more general cognitive abilities. Hence, we argue that it is more productive to keep general numeracy distinct from financial literacy, instead treating it as a supporting construct. We describe other concepts below, along with proposed relationships to financial literacy:

- As noted by the PACFL (2008), *financial education* is a process through which financial knowledge and skills are gained, rather than the knowledge and skills themselves. Hence, financial education should be considered a concept that promotes financial literacy.
- Whereas financial knowledge is often considered central to financial literacy (see Tables 1 and 2), it should be distinguished from *general knowledge*. As we will discuss below, there may be benefits to specificity. For example, Parker et al. (2008) found that finance-specific knowledge outperformed general knowledge when predicting performance on a hypothetical investment task. Still, a large body of literature has demonstrated that different forms of knowledge and other cognitive abilities tend to be mutually supporting (Stanovich & West, 2000; Jensen, 1998).
- As with numeracy and general knowledge, more *general cognitive abilities*, such as those involved in fluid and crystallized intelligence (Cattell, 1941, 1987; Horn, 1988), likely support financial literacy.
- Recent research has focused on more behaviorally-proximal cognitive skills, including *decision-making competence* (Bruine de Bruine et al., 2007; Parker & Fischhoff, 2005; Finucane et al., 2005; Levin et al., 2007). The relationship between decision-making competence and financial skills may be analogous to the relationship between financial and general knowledge. There may be benefits to specialized financial measures, but the general positive relationships among such variables may represent mutual support that could add explanatory power.
- Finally, financial literacy should be distinguished from *financial attitudes*, which logically derive in part from underlying preference.⁶ To the extent that self-reports include endorsements of certain behaviors or concepts that are at least in part preference-based, this should be distinguished from knowledge, skills, or behavior that can be judged against a normative standard.

⁶ Eagly & Chaiken (1993) define an attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (p. 1).

Strategies for measuring financial literacy

As would be expected from the diversity of conceptual definitions, the methods used to measure financial literacy also vary quite substantially. Even though the PACFL report is not an empirical study, the authors do provide a list of concepts that a person exiting a financial education program should *understand* in order to be considered financially literate. These include, for example, understanding the capital market system and financial institutions, household cash flow, reasons for having an emergency fund, and the fundamentals of credit granting. This list of knowledge has definite implications for what might be measured under the label of financial literacy.

Table 2 illustrates how financial literacy has been actually measured (i.e., the operational definitions), across several empirical studies placed in chronological order. It also includes details on measurement strategies (whether scores are from a self assessment or performance test) and content domains (including saving, investment, and debt). Across studies, both performance tests and self-report methods have been employed to measure financial literacy. Performance tests are primarily knowledge-based, reflecting the conceptual definitions in Table 1. In contrast, many self-reports assess perceived knowledge or confidence in knowledge (i.e., how much you think you know). However, consumers often think that they know more than they actually do (OECD, 2005) – a common finding that has been demonstrated not just in financial matters, but across a wide range of knowledge and abilities (Alba & Hutchinson, 2000; Lichtenstein, Fischhoff, & Phillips, 1982; Yates, 1990). And whereas actual and perceived knowledge are often correlated, this correlation is often moderate at best. For example, Agnew and Szykman (2005) found correlations between actual and perceived financial knowledge that ranged from .10 to .78 across demographic groups (the median correlation was .49 across 20 categories). Similar variation has been documented in non-financial knowledge domains (e.g., Alba & Hutchinson, 2000). Hence, caution should be taken when using perceived knowledge as a simple proxy for actual knowledge.

Table 2. Strategies for measuring financial literacy.

Publication	Operational Definition ^c	Measurement Strategy ^a		Content Domain ^b		
		SA	PT	S	I	D
Volpe, Chen, & Pavlicko (1996)	<i>Percent correct</i> on 10 multiple-choice items ^d		X		X	
Chen & Volpe (1998)	<i>Percent correct</i> on 36 multiple-choice items		X	X	X	X
Volpe, Kotek, & Chen (2002)	<i>Correct responses</i> on 10 multiple-choice items ^d		X		X	
Hilgert, Hogarth, & Beverley (2003)	<i>Percent correct</i> on a knowledge test		X	X	X	X
FINRA (2003)	<i>Correct responses</i> to 10 true/false items	X	X			
Moore (2003)	Financial knowledge: <i>Number of correct responses</i> to 12 binary-choice items. Financial experiences: <i>Report having financial experiences</i> across 14 items. Financial behavior: <i>Report engaging in positive and negative behaviors</i> across 15 items. Debt confidence: Responding “completely” or “very confident” regarding debt considerations	X	X	X	X	X
Mandell (2004)	<i>Percent correct</i> on a 31-item knowledge test		X	X	X	X
Agnew & Szykman (2005)	<i>Number of correct responses</i> to 10 multiple choice and true/false items. Also, self-rated investment knowledge relative to others on 1-10 scale.	X	X		X	
National Council on Economic Education (NCEE) (2005)	<i>Percent correct</i> on 24-item knowledge test		X	X	X	X
Lusardi & Mitchell (2006, 2008); Mexican version in Hastings & Tejada-Ashton (2008)	<i>Correct responses</i> to 3 multiple-choice and true/false items		X	X	X	

Lusardi & Mitchell (2007a)	<i>Correct responses</i> to 3 computational items		X		X	
Lusardi & Mitchell (2007b)	<i>A single weighted average of correct/incorrect responses</i> (based on factor analysis) of 5 multiple-choice basic financial literacy items and 8 multiple-choice sophisticated financial literacy items. Separately considered a 7-point item on perceived knowledge.	X	X	X	X	
Mandell (2007)	<i>Percent correct</i> on a knowledge test		X	X	X	X
van Rooij, Lusardi, & Alessie (2007)	<i>Two weighted averages of correct/incorrect responses</i> (based on factor analyses) for (a) 5 multiple-choice basic financial literacy items and (b) 11 multiple-choice sophisticated financial literacy items. Separately considered a 7-point item on perceived knowledge.		X	X	X	
Lusardi & Tufano (2008)	<i>Correct responses</i> to 3 individual multiple-choice items	X	X			X
ANZ Bank (2008)	<i>Mean score, based on target responses</i> to 26 questions derived from an operational framework	X	X	X	X	X

^a SA = Self Assessment, PT = Performance Test

^b S = Savings, I = Investment, D = Debt, N = Numeracy

^c Italics have been added throughout to emphasize key definitional components.

^d This study labels the construct investment literacy.

Nevertheless, emerging evidence suggests that perceived knowledge, or confidence, may have predictive ability of its own, above and beyond actual knowledge. This phenomenon may derive from the fact that individuals do not usually know the extent of their actual knowledge. They must instead decide on courses of action (e.g., to collect more information, to make an educated guess) based on how much they think they know (Lusardi & Mitchell, 2007b).⁷ And given the modest correlation between knowledge and confidence, the latter is able to add predictive validity. For example, Parker, Yoong, Bruine de Bruin, and Willis (2008) found that confidence in knowledge predicts self-reported retirement planning and savings, as well as performance on a hypothetical investment task, independently of the effect of actual knowledge.^{8,9} These results suggest that whereas actual knowledge promotes such behavior, so does perceived financial knowledge (even if it does not reflect actual knowledge).

Similar to the distinction between actual and perceived knowledge, warnings are warranted against conflating knowledge, ability, and behavior. Knowledge of how financial systems work is likely an important underpinning for other financial skills (e.g., negotiating mortgage terms, navigating an investment website) and performance behavior (e.g., mutual fund fee minimization). However, skills and behavior are also likely to be influenced by other factors, such as access to resources, social networks, etc. Therefore the distinctions among actual knowledge, perceptions of knowledge, the ability to use that knowledge, and actual behavior are non-trivial.

Finally, it should be noted that some studies have explicitly included numeracy as a component of financial literacy tests (Lusardi & Mitchell, 2007a, 2007b; ANZ Bank, 2008; NCEE, 1999). As explained above, we consider numeracy, or basic number skill (Lipkus, Samsa, & Rimer, 2001; Peters et al., 2006), to be a distinct construct that is related to and supports financial literacy.

Towards a composite definition of financial literacy

It is tempting to accept the PACFL definition. However, that definition largely rests on the ability to use knowledge and skills towards achieving financial well-being, and is hence quite behaviorally based. While practically relevant, such a focus limits insight into mechanisms for impacting financial literacy. We would argue that financial knowledge, skills, and behavior, as well as their mutual relationships, should all be considered in an overarching conceptualization of financial literacy. In particular,

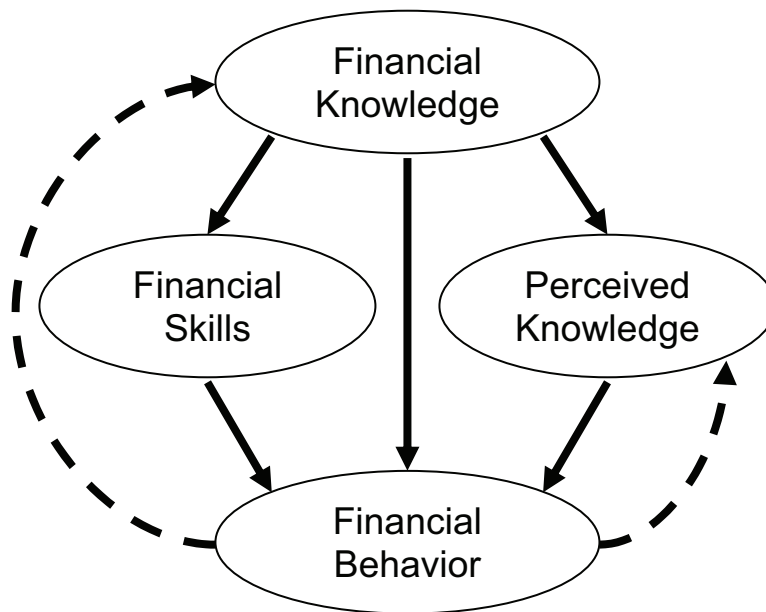
⁷ Thus, accurate confidence in knowledge can be thought of as one decision-making competency (Bruine de Bruin, Parker, & Fischhoff, 2007; Parker & Fischhoff, 2005)

⁸ Lusardi and Mitchell (2007a, 2007b, 2008) also showed that actual financial knowledge influences planning behavior.

⁹ Lusardi and Mitchell (2007b) and van Rooij et al. (2007) report strong correlations (based on tabular data, rather than a correlation coefficient) between perceived and actual financial literacy, taking this as validation of the actual financial literacy factor score (arguably a questionable assumption). Lusardi and Mitchell (2007b) then show parallel regressions predicting retirement planning with actual and perceived financial literacy. No attempt is made, however, to show marginal predictive power when considering both of these two measures simultaneously (i.e., in the same equation). van Rooij et al. (2007) do provide regressions including both perceived financial literacy and actual financial literacy (but only the basic financial literacy index, leaving out actual sophisticated financial literacy), with both measures predicting stock-market participation.

financial knowledge represents a particularly basic form of financial literacy (likely the reason that it is so well represented in Tables 1 and 2). Financial knowledge, in turn, is reflected in perceived financial knowledge and influences financial skills that depend on knowledge. Actual financial behavior, in turn, depends on all three (actual knowledge, perceived knowledge, and skills). Finally, the experience gained through financial behavior feeds back to both actual and perceived financial knowledge. Still, the relationships are likely to be imperfect, as each also depends on other factors internal and external to the individual (e.g., attitudes, resources). Figure 1 presents these logical relationships among financial literacy components.

Figure 1. Conceptual Model of Financial Literacy



Accordingly, a composite definition of financial literacy that builds off of those given by PACFL (2008) and various researchers (Table 1) is:

Financial Literacy: knowledge of basic economic and financial concepts, as well as the ability to use that knowledge and other financial skills to manage financial resources effectively for a lifetime of financial well-being.

Being precise about what is meant by financial literacy, including which components are being considered, will help clarify research and ultimately lead more fluidly to practical interventions. For example, lessons learned through a focus on financial knowledge will help inform knowledge-based financial education, but be only one factor to consider in designing behavioral interventions. Those are more likely to depend on other financial skills, perceptions of knowledge, attitudes, and environmental factors. Similarly, measures should accurately reflect conceptual definitions, and conclusions should be restricted to financial-literacy components that are actually measured.

It may also be usefulness to consider specific knowledge domains, such as saving, investment, or debt (Table 2). Lusardi & Mitchell (2007a) find that, of 3 financial literacy questions, the one most predictive of financial planning was one on compounding interest. The other two were less investment related – one on disease likelihood and one on lotteries. Lusardi & Tufano (2008) developed an instrument to focus specifically on debt literacy. A useful empirical exercise would be to compare how specific instruments perform relative to a more general instrument.

3. Empirical Study: Validating Financial Literacy

Nunnally and Bernstein (1994) identify three broad stages toward validating a concept and its measurement – a process called *construct validation*. These stages are (1) defining the domain of observables related to the construct, (2) establishing the extent to which this set of observables tend to measure the same thing (and do so reliably), and (3) verifying the construct’s relationships to other conceptually-related constructs. Above we have taken the first steps by defining what we mean by financial literacy, by talking about what components it contains, and by distinguishing it from other related constructs. To address (2) and (3), we next take advantage of a unique dataset provided by RAND’s American Life Panel (ALP).

The ALP presently consists of over 2000 respondents, recruited from among individuals age 18 and older who are respondents to the monthly Survey of Consumers conducted by the University of Michigan's Survey Research Center (SRC). Respondents in the panel either use their own computer to log on to the Internet or a Web TV, which allows them to access the Internet using their television and a telephone line. The technology allows respondents who did not have previous Internet access to participate, addressing the issue of selective Internet access among the general population. With the use of available sampling weights, the ALP is representative of the U.S. population. More information may be found at http://www.rand.org/labor/roybalfd/american_life.html.

The ALP is uniquely positioned to address the operationalization and impact of financial literacy. Because the ALP acts as an internet test bed for the Health and Retirement Survey, subsequent survey waves typically incorporate new questions and questionnaires from diverse sources. In particular, between 2006 and 2009, the ALP has fielded four surveys assessing financial literacy. Each of these surveys was constructed by different researchers using different methodologies (although, as we will describe, they were certainly influenced by each other). These four surveys are summarized in Table 3.

Table 3. Four Financial Literacy Assessments on the ALP

Wave	Sample Size	Number of Items	Example
Wave 5	1151	13 true/false & multiple-choice questions	Buying a single company stock usually provides a safer return than a stock mutual fund.
Wave 11	1005	Performance on a hypothetical choice	Fees from allocation of money among S&P index funds (with different fee structures)

Wave 12	566	experiment 70 true/false questions, using a confidence scale	A checking account normally earns a higher rate of return than other types of investments purchased from a bank.
Wave 64	1645	23 multiple-choice questions	Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return? Savings account, bonds, stocks, don't know

Because of the multiple authors and methods, we have the opportunity to examine several research questions:

- What strategies for measuring financial literacy appear to be promising, in terms of empirical reliability?
- How unified is the construct of financial literacy, in terms of stability across waves and measurement strategies?
- What contextual and individual-difference factors contribute to higher financial literacy?
- How well does financial literacy predict downstream behaviors, such as information search and both hypothetical and actual investment behavior?

Sample

As can be seen in the different sample sizes in Table 3, not all ALP respondents were invited to participate in each study. This is in large part determined by the research goals and budgetary constraints of specific studies. Across the four waves, 55.7% were female, ages ranged from 16-108 ($M = 50.7$, $SD = 14.1$), and 48.4% reported having at least a bachelor's degree. Additionally, 12.5% report annual household incomes less than \$25,000; 23.2% between \$25,000 and \$50,000; 23.4% between \$50,000 and \$75,000; and 40.9% over \$75,000. Overall, 403 individuals participated in all four waves. In our analysis of the relationship between financial literacy and actual investment behavior, we also use data from Wave 73 of the ALP. Wave 73 was given to 2224 respondents who answered detailed questions about their investment behavior related to retirement accounts. Respondents were asked about contributions to those accounts, whether they take advantage of employer matching in retirement accounts, portfolio allocation, advice-seeking, and decumulation.

Survey Instruments

The questions in Wave 5 of the ALP were written by Annamaria Lusardi and Olivia Mitchell and described above. The financial literacy module consists of five multiple-choice basic financial literacy items and eight multiple-choice sophisticated financial literacy items. An iterated principal factor analysis is conducted using 13 indicators for correct answers for these items. The final overall financial literacy score for each

individual is determined by weighting each correct answer by the estimated factor loadings. For further details, please see Lusardi and Mitchell (2007a, b).

In Wave 11, we asked respondents to participate in an experiment on allocating a hypothetical investment portfolio among four different S&P 500 index funds. Respondents were given information on S&P 500 index funds, namely that these funds aim to track the S&P 500. The key difference between the funds, therefore, was the names and the fees associated with the funds. One fund dominated the other funds in the sense that it had the lowest front-end fee and the lowest expense ratio. As a measure of financial literacy, we use whether the respondent minimized their investment fees by allocating their entire portfolio to the lowest fee fund.

The questions in Wave 12 were written by Miles Kimball and Robert Willis, as a pilot study for the Cognitive Economics Survey. The financial literacy scale consists of seventy true/false questions, covering concepts such as portfolio diversification, compound interest, and institutional knowledge, such as aspects of how annuities work. Participants were asked to rate their certainty about each statement on a 12-point scale that ranged from 100% false to 100% true. The answers were recoded according to the correct answers so that a score of 1 means that the answer to a particular question is perfectly wrong and 12 is perfectly correct. We compute respondents' average score across all questions, divide it by 12, and interpret the resulting total as a proxy for their financial knowledge. The survey questions and methodology are described in more detail in Delavande, Rohwedder and Willis (2008).

The financial literacy scale in Wave 64 was designed to allow for multiple dimensions of financial literacy. We report here on results from three subscales.¹⁰ The Basic subscale consists of the five basic financial literacy items in the Lusardi and Mitchell's scale. The Investing subscale consists of the eight sophisticated financial literacy items in Lusardi and Mitchell's scale, as well as five additional items on investment markets and products. Finally, the Life Insurance subscale consists of four items on life insurance and annuity products.

In addition, ALP respondents also provide detailed demographic data, including measures of age, gender, education and household income.

Analytic Strategy

We use Cronbach alpha, a measure of internal consistency, to address the reliability of individual measures of financial literacy. Alpha ranges between zero and one, with values above .7 generally considered good. Pearson correlations are used to assess the

¹⁰ Wave 64 also included a fourth subscale, general retirement accounts knowledge subscale, consisting of five items (one was dropped because legal developments changed its meaning). However, this subscale was extremely difficult, with mean performance barely above chance ($M = .28$, $SD = .20$). It also showed very little internal consistency (Cronbach alpha = .30) and did not correlate highly with the other subscores. For these reasons, it was removed from the Wave 64 financial literacy score.

stability of financial literacy across waves and measurement strategies. To assess contextual and individual-difference effects on financial literacy, linear regression analyses predict financial literacy (computed separately for each wave) with gender, age, education, and household income.

To reduce the effects of non-response and panel attrition for panel estimates, post-stratification weights are developed for each wave using the current population survey (CPS) as a benchmark. Marital status, region, education, age, race/ethnicity, gender, and income are used for post-stratification. Analyses presented below are weighted using this method.

Results

Table 4 presents descriptive statistics on each of the four financial literacy assessments, as well as subscores for wave 64. Because the different waves have different scales, it is not meaningful to compare absolute scores. However, each wave shows substantial variation in performance, with some individuals doing much better than others – a necessary condition for investigating individual differences. Within Wave 64, mean performance is highest for the basic subscore, as was expected, with life insurance being the most difficult subtest.

Table 4. Descriptive results

Financial Literacy Score	Mean (SD)	Median (Range)
Wave 5: Lusardi & Mitchell	.68 (.22)	.69 (0 – 1)
Wave 11: Fee minimization	.24 (.43)	.00 (0 – 1)
Wave 12: CogEcon	.70 (.10)	.71 (.34 – .93)
Wave 64: Hung & Yoong	.62 (.24)	.65 (0 – 1)
Basic subscore	.71 (.26)	.80 (0 – 1)
Investing subscore	.61 (.27)	.64 (0 – 1)
Life insurance subscore	.52 (.33)	.50 (0 – 1)

How reliable are the financial literacy scales? A necessary condition for construct validity is reliable measurement. Table 5 presents Cronbach alpha, which assesses the extent to which the individual items in the measure reflect a single underlying factor (or alternately, a set of highly correlated factors).

Table 5. Internal consistency of financial literacy scores

Financial Literacy Score	Number of Items	Cronbach Alpha
Wave 5: Lusardi & Mitchell	13	.76
Wave 12: CogEcon	70	.71
Wave 64: Hung & Yoong	23	.88
Basic subscore	5	.51
Investing subscore	14	.86
Life insurance subscore	4	.59

Generally speaking, all three financial literacy scales show reasonable internal consistency (alpha cannot be computed on Wave 11, since that score consists of only a

single item from an investment experiment). Among the subscores of the Wave 64 scale, only the investing subscore shows sufficient internal consistency by itself.

How stable is financial literacy across waves and measurement strategies? If all four financial literacy measures reflect the same underlying concept, they should show stability across waves and measures. Table 6 presents Pearson correlations among the four waves.

Table 6. Pearson correlations among four waves

	Wave 5	Wave 11	Wave 12
Wave 5: Lusardi & Mitchell	1		
Wave 11: Fee Minimization	.33	1	
Wave 12: CogEcon	.65	.35	1
Wave 64: Hung & Yoong	.72	.34	.65

NOTE: All correlations significant at $p < .001$.

The three knowledge tests (waves 5, 12, and 64) correlate much more strongly with each other than they do with performance on the experimental task (wave 11). All correlations, however, are highly statistically significant, indicating a degree of stability across time and measurement strategy.

For the Lusardi and Mitchell measure, we are able to examine the stability of financial literacy across waves further by taking advantage of the fact that the 13 items used to compute the financial literacy index from wave 5 were repeated in wave 64. In addition, respondents who were not part of the panel in wave 5 were asked the same set of questions in wave 21. We can then compare how these responses changed over time and whether the passage of more time in between the two surveys had an impact on the financial literacy scales, holding the measurement strategy constant.

When comparing correct responses on the questions, 65% of the sample get the same number of correct answers in the repeat survey, or answer one additional question right or wrong on the second survey. This much variation can easily be attributed to noise in the survey responses. We then replicate the Lusardi and Mitchell methodology and compute overall financial literacy scales in each of these waves. There is a strong overall correlation between the financial literacy scales from waves 5 and 21 with wave 64, with a Pearson correlation coefficient of 0.76 for the entire sample. Separating the sample by the wave of the first survey, the Pearson correlation coefficient with wave 64 is 0.74 for those who answered questions in wave 5, and it is 0.80 for those who joined the survey afterwards and answered questions in wave 21. As expected, the less time between the two surveys, the higher the correlation between the responses. However, both these correlations are large and provide substantial evidence for stability of financial literacy over time, at least with respect to the Lusardi and Mitchell scales.

Table 7 examines the specific issue of domain specificity, correlating the three subscales of the Wave 64 instrument. Again, all correlations are highly statistically significant, suggesting a common underlying factor. However, the strongest correlations are with the investing subscale (which, incidentally has the greatest number of items, helping to make it more reliable).

Table 7. Pearson correlations among three Wave 64 subscores

	Wave 64	Basic	Investing
Basic subscore		1	
Investing subscore		.59	1
Life insurance subscore		.36	.50

NOTE: All correlations significant at $p < .001$.

Who is the most financially literate? Table 8 displays the results of four linear regressions, predicting financial literacy with demographic characteristics.

Table 8. Predictors of financial literacy

Predictor	Wave 5	Wave 11	Wave 12	Wave 64
Gender (female)	-.221***	-.095**	-.210***	-.220***
Age	.243***	.144***	.320***	.295***
Bachelor's degree	.282***	.129***	.307***	.267***
HI: \$25-50K	.101**	.027	.004	.147***
HI: \$50-75K	.171***	.053	.152**	.257***
HI: >\$75K	.300***	.178***	.260***	.389***
R-square	.30	.09	.37	.37
F-statistic	80.25***	16.35***	54.83***	148.06***

* two-sided p -value $< .05$; ** $p < .01$; *** $p < .001$.

Note: Analyses are linear regressions, weighted separately for each wave.

The same pattern emerges across all four waves. Financial literacy is higher for men, older individuals, those with bachelors' degrees or more, and those with higher income. The weakest results are for Wave 11, which is the single item, drawn from experimental performance (i.e., fee minimization).

Table 9 presents similar regressions for the subscales of the Wave 64 financial literacy measure.

Table 9. What predicts specific types of financial literacy, within Wave 64?

Predictor	Basic	Investing	Life Insurance
Gender (female)	-.187***	-.216***	-.114***
Age	.200***	.251***	.312***
Bachelor's degree	.178***	.272***	.118***
HI: \$25-50K	.136***	.150***	.044
HI: \$50-75K	.182***	.255***	.131***
HI: >\$75K	.317***	.387***	.190***
R-square	.20	.34	.16
F-statistic	64.80***	133.10***	50.50***

* two-sided p -value $< .05$; ** $p < .01$; *** $p < .001$.

Note: Analyses are linear regressions, weighted separately for each wave.

The investing subscale is by far the most strongly predicted by demographic variables, followed by basic and life insurance subscores.

Does financial literacy predict financial behavior?

Financial literacy consistently predicts measures of people’s planning behavior. For example in Table 10a, each wave’s financial literacy measure is included in a regression where the dependent variable is an indicator for whether or not individuals report ever having tried to save for retirement. In Table 10b, the measures are included in a second set of regressions, where the dependent variable is an indicator for whether or not individuals report ever having tried to make a plan for retirement savings. In both cases, financial literacy is generally strongly positively predictive.

Table 10a: Have You Ever Tried To Save for Retirement?

Predictor	Wave 5	Wave 11	Wave 12
Financial Literacy	0.448***	0.125**	0.424
Gender (female)	0.059	-0.030	-0.025
Age	0.005***	0.007***	0.008***
Bachelor’s degree	0.047	0.097**	0.111*
HI: \$25-50K	0.156***	0.176***	0.162**
HI: \$50-75K	0.205***	0.278***	0.278***
HI: >\$75K	0.339***	0.351***	0.368***
R-square	0.18	0.16	0.20
F-statistic	30.16	24.91	24.28

* two-sided p-value < .05; ** p < .01; *** p < .001.

Predictor	Wave 64	Wave 64 - Basic	Wave 64 – Investing	Wave 64 – Insurance
Financial Literacy	0.513***	0.145	0.347***	0.080
Gender (female)	0.018	-0.014	0.020	-0.025
Age	0.007***	0.008***	0.007***	0.008***
Bachelor’s degree	0.018	0.062	0.022	0.073
HI: \$25-50K	0.124*	0.161**	0.130*	0.174**
HI: \$50-75K	0.148**	0.206***	0.156**	0.213***
HI: >\$75K	0.274***	0.347***	0.290***	0.365***
R-square	0.15	0.13	0.15	0.13
F-statistic	19.38	17.91	19.80	17.71

* two-sided p-value < .05; ** p < .01; *** p < .001.

Table 10b: Did You Ever Make a Plan for Retirement Savings?

Predictor	Wave 5	Wave 11	Wave 12
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Financial Literacy	0.414***	0.141***	0.385
Gender (female)	0.062	-0.017	-0.008
Age	0.004***	0.006***	0.007***
Bachelor's degree	0.045	0.092*	0.106*
HI: \$25-50K	0.137**	0.150***	0.140**
HI: \$50-75K	0.186***	0.254***	0.264***
HI: >\$75K	0.334***	0.340***	0.372***
R-square	0.16	0.15	0.18
F-statistic	26.37	21.62	21.21

Predictor	Wave 64	Wave 64 - Basic	Wave 64 – Investing	Wave 64 – Insurance
Financial Literacy	0.522***	0.133	0.357***	0.080
Gender (female)	0.022	-0.012	0.025	-0.021
Age	0.006***	0.007***	0.006***	0.007***
Bachelor's degree	0.015	0.059	0.017	0.070
HI: \$25-50K	0.093	0.134*	0.099	0.145**
HI: \$50-75K	0.113	0.174**	0.121*	0.180**
HI: >\$75K	0.260***	0.337***	0.273***	0.352***
R-square	0.14	0.12	0.14	0.12
F-statistic	17.35	15.73	17.51	15.60

* two-sided p-value < .05; ** p < .01; *** p < .001.

However, financial literacy is *not* consistently predictive of total savings measures. Table 11a shows that, for individuals enrolled in a DC plan, the financial literacy measures do not consistently predict account balances.

Table 11a: The Logarithm of Total 2008 Balance in 401(k) plan

Predictor	Wave 5	Wave 11	Wave 12
Financial Literacy	0.706	-0.130	4.589*
Gender (female)	-0.175	-0.526*	-0.075
Age	0.045***	0.046***	0.037*
Bachelor's degree	0.731**	0.824**	0.273
HI: \$25-50K	0.182	0.000	-0.608
HI: \$50-75K	0.662	0.730	0.000
HI: >\$75K	1.226	1.039	0.584
R-square	0.19	0.16	0.22
F-statistic	5.95	2.60	5.04

Predictor	Wave 64	Wave 64 - Basic	Wave 64 – Investing	Wave 64 – Insurance
Financial Literacy	-1.028	-0.445	-0.674	-0.210

Gender (female)	-0.270	-0.261	-0.258	-0.201
Age	0.052***	0.048***	0.052***	0.050***
Bachelor's degree	0.857***	0.809***	0.854***	0.796***
HI: \$25-50K	0.380	0.203	0.354	0.332
HI: \$50-75K	1.132	0.924	1.085	1.042
HI: >\$75K	1.696	1.497	1.651	1.590
R-square	0.18	0.18	0.18	0.18
F-statistic	5.79	6.05	5.76	6.02

* two-sided p-value < .05; ** p < .01; *** p < .001.

One interpretation of these results is that, in the domain of savings and investments for retirement, although these financial literacy measures may be strongly predictive of consumers' *intentions*, they do not have the same predictive power when applied to long-term *outcomes*. This may reflect that contextual and other factors can interfere with translating knowledge and intention into action (see e.g., Ajzen, 1991; Fishbein & Ajzen, 1975).

Discussion of Empirical Results

As noted above, the first step in validating a construct (and its associated measures) is to define the domain over which the construct applies. The theory and measurement strategies presented here provide these conceptual and operational definitions. Indeed, one of the strengths of this study is the capitalization on financial-literacy instruments designed by different researchers. The approaches taken here focus primarily on the actual financial knowledge, rather than on skills, behavior, or perceived knowledge. Furthermore, knowledge itself was broken down in Wave 64 into basic, investing, and insurance sub-domains.¹¹

Several of the measures included here also involve a substantial number of items. van Rooij et al. (2007) highlight the fact that many existing financial literacy measures are crude, typically with very few items. Clearly there are pressures to reduce the length of instruments for placement in large surveys where respondent time is dear. However, a basic property of scales is that their reliability (not to mention their ability to cover the construct domain) increases with the number of items.

¹¹ It is also advisable to use pilot data, collected empirically, to help define a construct's domain. Morgan et al. (2002) suggest qualitative mental-model interviews with decision makers and substantive experts as a means of establishing the full domain, and they and their colleagues have demonstrated this approach across a wide variety of domains. Similarly, Volpe et al. (2006) used a survey of corporate benefit administrators to identify important topics within the financial literacy domain. Such exercises not only inform the content of questions, but they can also provide language natural to decision makers. In the absence of such an approach, questionnaires can be biased towards concepts favored by researchers, and questions tend to frame concepts in terms unfamiliar to respondents. van Rooij, Lusardi, and Alessie (2007) demonstrate that financial literacy measurement is sensitive to question wording, suggesting the importance of systematic attention to question and survey design.

We address reliability in several ways, demonstrating substantial stability in the measurement of financial literacy across items, time, and measurement strategy. The different measures of financial literacy generally showed good internal consistency – one measure of reliability. They also showed good test-retest reliability, when considering the original Lusardi and Mitchell items. Finally, there were strong correlations across waves, suggesting an underlying construct that is not overly dependent on the specific measurement strategy.

Finally, a valid construct should be associated (or not) with other constructs in sensible ways. van Rooij et al (2007) note that many studies measuring financial literacy don't also contain predicate, covariate, and outcome measures needed to establish this final aspect of construct validity. Here we present evidence that financial literacy is predicted by demographic factors. In particular, financial literacy increases with education and income, as one would expect. Financial literacy also predicts self-reported saving and retirement planning, although did not predict a measure of actual retirement savings. It should be noted that the current analyses, while suggestive, do not firmly establish causality. Nevertheless, financial literacy does appear to generally correlate as expected with other related constructs.

4. Conclusions

Current economic conditions have raised serious concerns about Americans' financial security, especially for those who lack the skills and resources to withstand financial market downswings and take advantage of upswings. Individuals are taking responsibility for a growing number of financial decisions, the two most important arguably being the purchase and financing of a home and preparing for retirement. As demonstrated by the sub-prime mortgage experience, poor financial decision-making appears to be a surprisingly widespread phenomenon with sizeable consequences that build over time and often go unnoticed until a point of crisis.

For individuals, poor savings and investment decisions may carry serious implications for long-term financial security. With the shift to defined-contribution (DC) pension plans and uncertainty about government Social Security, American households are being increasingly called upon to undertake their own financial planning for retirement. As noted above, a more fundamental problem may be that large segments of the US population have low levels of financial literacy. More specifically, the results presented here suggest that the less financially literate may be less likely to engage in recommended financial practices, such as planning for retirement.

However, significant debate continues about the role of financial literacy, the extent of the problem it truly represents and the best way to address it. A large part of this debate may be linked to the fact that a great deal of variation continues to exist in how researchers define and measure financial literacy itself. For example, studies that treat various financial education programs as a proxy for financial literacy need to be explicit about this assumption; while studies that measure different aspects of financial literacy may well reach different conclusions when looking at the impact of their measure on

behavior. By providing a review of theoretical and operational approaches to financial literacy, as well as a composite definition, we provide one tool for sharpening this debate.

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