

**Disentangling Cognitive Function and Financial Literacy:
Implications for Financial Retirement Security Research**

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1. Human Capital Approach to Financial Knowledge

Why do we need to disentangle cognitive function from financial literacy in this time of financial turmoil? Data collected only a few months ago in the Cognitive Economic Survey that I describe in this memo show vividly that older Americans with high cognitive ability and high levels of financial knowledge are much wealthier than those with lower levels of ability and knowledge. (See Figures 3 and 4 below.) These smart and knowledgeable people had nice homes and, because they knew that the historical returns on stocks were high—indeed, puzzlingly high (Mehra and Prescott, 1985; DeLong and Magin, 2009)—they held much of their financial wealth in stocks. The bursting of the housing bubble and the stock market crash following the collapse of Lehman Bros. has hit these people very hard. Conversely, people with lower levels of cognitive ability and financial knowledge have dramatically lower rates of stockholding, either directly or in retirement accounts, and a much lower fraction of their wealth tied up in stock, although many have a substantial portion of wealth in housing. Their failure to invest in stocks meant that they had accumulated less wealth during the boom of the 1990s or even during periods of strong returns during the past decade, but their lower exposure also protected them from the direct impact of the recent stock market crash, if not from the subsequent recession or depression of the real economy.

In part, the reason that less cognitively able people did not invest in stocks is that, based on their subjective expectations, stock returns looked both lower and riskier to them than would be indicated by the historical record of stock returns (Kezdi and Willis, 2008). More generally, I have argued that people's financial knowledge is a component of their human capital that enables them to obtain higher returns on their savings for any given level of risk. Better financial knowledge may enable people to make better decisions on their own about portfolio allocations or mortgage finance; it also helps them to distinguish good products from bad or poorly priced products and good advice from scams (Delevande, Rohwedder and Willis, 2008). The incentive to acquire financial knowledge depends on an important scale economy: while increased knowledge raises the feasible expected return per dollar, the total value of the investment depends on the number of dollars to which the improved return is applied. Thus, because they have a higher volume of savings, incentives to acquire financial knowledge are greater for higher income people, people who place a higher weight on retirement consumption or bequests and people without defined benefit pension plans. The costs of acquiring knowledge tend to be lower for people with more education and higher cognitive ability. In addition, there may be important spillover effects (or lack thereof) from family and social networks and from occupational skills and knowledge that create differences in financial knowledge and lead to variation in financial decisions and outcomes.

The founder of human capital theory, T.W. Schultz, emphasized another aspect of human capital, allocative ability, which is particularly important in times of turmoil. Allocative ability is a person's capacity to "...to perceive, interpret correctly, and to undertake action that will appropriately reallocate their resources." (Schultz, 1975, p. 827). Schultz, Welch (1970) and others argued that the value of allocative ability value is greater under conditions of disequilibria when changes technology or economic conditions undermine the value of rules of thumb and conventional practices based on past conditions and create a premium on understanding issues at a more fundamental level. Schultz suggested that a central question is the extent to which these allocative abilities are acquired through education and experience.

In the context of the current financial turmoil and its impact on older Americans, it of importance to know whether the kinds of financial knowledge that will enable people to "appropriately reallocate their resources" and otherwise cope with the economic crisis can be acquired quickly

through private action (e.g., self-education) or policy interventions or whether this knowledge is only acquired slowly through formal education and lifelong experience.

2. Data Resources for Studying the Impact of Financial Literacy on Behavior and Outcomes During the Crisis

The current economic crisis presents a natural experiment in which the reactions of individuals and households to the crisis can provide evidence on this question. Moreover, because one of the crucial questions is how much people can learn and adapt in a short period of time, current longitudinal surveys may provide evidence soon enough to be of relevance for near term policy issues. For example, the Health and Retirement Study fielded its 2008 wave between March and December of 2008 with about 14,000 interviews occurring before October 1 and about 1200 interviews afterwards. In addition, the HRS will field a special post-crash internet survey within the week or so. RAND's American Life Panel, another internet survey, is conducting regular post-crash surveys every three months and, in addition, has administered the Cognitive Economic Survey (CogEcon) questionnaire to panel members during November-December, 2008.

For purposes of disentangling cognitive function and financial literacy, using the economic crisis as a natural experiment, the most promising body of data is the Cognitive Economic Survey. CogEcon is an innovative new survey that was administered by mail and internet to a national sample of 1,222 persons, age 51 and older and their spouses regardless of age between March and August, 2008. A post-crash survey of CogEcon subjects is currently being designed and will be fielded in late April or early May. CogEcon was designed by a team of economists to help understand the cognitive bases of economic decision making.¹ The CogEcon questionnaire, which has a median length of 53 minutes on the internet version, includes a battery of twenty-five questions on financial sophistication, detailed measures of income, wealth and portfolio allocation plus measures of risk tolerance, self-assessed financial knowledge, use of records and other sources of information and several questions on decision making. Respondents were drawn from the pool of participants in the "NCGS+HRS" cognition study led by John J. McArdle, a cognitive psychologist who is an HRS co-PI. That project conducted an extremely detailed, three hour cognitive assessment of sample members, measuring many components of fluid and crystallized intelligence. Since most analytical uses of the data combine the information collected in the CogEcon Survey with the cognitive measures from the "NCGS+HRS" cognition study, the full reference to the data should be CogEcon/NCGS+HRS.

The NCGS+HRS survey collects a variety of measures to characterize the fluid and crystallized of respondents. Fluid intelligence refers to an individual's ability to think and reason in unfamiliar circumstances while crystallized intelligence reflects one's accumulated knowledge and skills. (For details, see Cattell, 1987; Horn & McArdle, 2007; and McArdle & Woodcock, 1998.) As illustrated in Figure 1, the theory suggests that an individual's fluid intelligence grows rapidly during childhood, reach a peak between ages 15-20, then declines linearly for the rest of the lifetime. In contrast, crystallized intelligence tends continue to grow during adulthood, reaching a plateau that tends to remain stable into old age.

¹ In addition to Willis, the design team includes Daniel Benjamin, Andrew Caplin, Miles Kimball, Kathleen McGarry, Claudia Sahn, Matthew Shapiro, and Tyler Shumway. Our research was supported by the National Institute on Aging grant PO1 AG026571.

Figure 1. Life Cycle Pattern of Fluid and Crystallized Intelligence

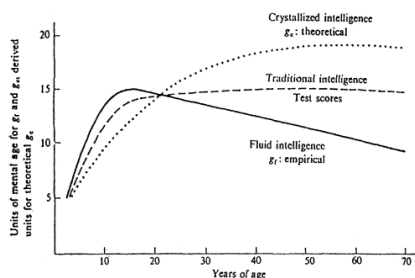
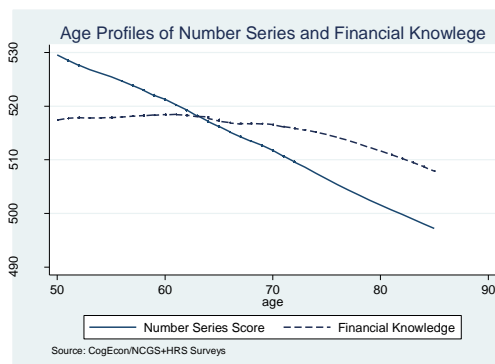


Figure 1. A theoretical description of life span curves of intellectual abilities. From *Intelligence: Its structure, growth and action* (p. 206) by R. B. Cattell, 1987, Amsterdam: North-Holland. Copyright 1987 by Elsevier Science Publishers. Reprinted with permission.

Figure 2



One component of fluid intelligence measured in NCGS+HRS is the number series test which tests a person’s ability to recognize patterns in a series of numbers and is highly loaded on psychometric g (or IQ). A component of crystallized intelligence measured in CogEcon is a person’s score on a 25-item battery of financial knowledge items designed to assess an individual’s understanding of the stock market, mortgage finance, insurance, etc. Figure 2 shows age profiles between ages 50 and 85 of the number series score (solid line) and financial knowledge score (dashed line), both normalized to have mean 500 and standard deviation 25. The life cycle patterns closely correspond to what would be expected from the theory of fluid and crystallized intelligence, with linear decline with age in the number series score and relative stability of the financial knowledge score.

3. Human Capital and the Theory of Fluid and Crystallized Intelligence

There are clear parallels between the psychological theory of fluid and crystallized intelligence and economic theories of investment in human capital (Willis 2007; Heckman and Cunha, 2007; Delevande, Rohwedder and Willis, 2008). In this view, an individual combines his stock of knowledge (crystallized intelligence), reasoning ability (fluid intelligence) and effort (determined by incentives) in order to produce new knowledge. Over the life cycle, one would expect the accumulation of knowledge to generate substantial correlations between fluid and crystallized intelligence and, in turn, between these measures and other forms of economic behavior. For example, early results reported from CogEcon by investigators at a project conference in September, 2008 suggest that higher ability is related to lower risk aversion, more patience, larger intertemporal elasticity of substitution, fewer mistakes in portfolio allocation, greater financial knowledge, and a greater ability to acquire additional financial knowledge. In addition, Hsu, Fisher and Willis (2008) find that higher ability people in CogEcon have much greater access to the Internet, a valuable resource for persons seeking financial knowledge or managing their wealth.

Figure 3

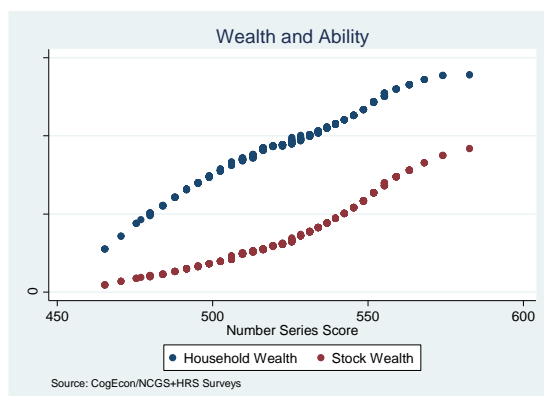
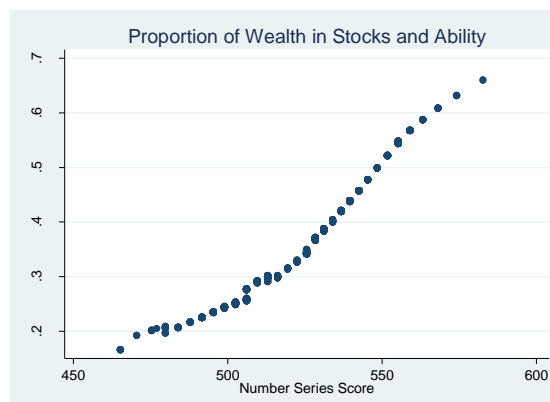


Figure 4



I have plotted (using a non-parametric smoother) the relationship between number series score and total wealth and stock market wealth in Figure 3 and between number series score and the share of wealth held in stocks in Figure 4. Clearly, both mean wealth and the share of stocks in total wealth are strongly increasing in fluid intelligence. It is important to stress that these plots incorporate the influence all of the channels through which intelligence influences economic welfare and behavior including educational attainment, marital status and choice of mate, occupation and income as well as factors such as parental and environmental characteristics that are correlated with intelligence. No causal inferences are warranted. Similar plots with the financial knowledge score on the horizontal axis yields a very similar pattern even though the simple correlation between financial knowledge and the number series score is only 0.48.

4. What Can We Learn from a Post-Crisis of CogEcon Respondents?

There is reason to think the financial crisis could have a dramatic effect on many aspects of a household's situation and the household's characteristics. Moreover, we hypothesize that people who differ in fluid and crystallized intelligence will react differentially to the financial stress they and the nation are facing

1. Even households who made no change in their financial assets would have seen dramatic changes in the values of those assets that would depend on the details of exactly which assets they held (including houses). But in addition, many households may have sold their stocks in a quest for safety, while others bought stocks with the view that the crash was a buying opportunity. Those who sold their stocks have effectively locked in their losses and will face reduced retirement resources even if the stock market recovers, while those who did not sell face risk of further declines going forward.
2. The broader macroeconomic effects of the financial crisis include rising unemployment, wage cuts, business failures and restricted availability of credit. This is likely to cause important changes in measures of financial distress such as reliance on pawnshops and payday lenders, late loan payments, denial of credit, and the interest rates at which people are able to obtain credit. The Cognitive Economics Survey gives us baseline measures of all of these indicators of financial distress.
3. Although standard economic theory assumes that people's risk tolerance is an unchanging parameter, there is evidence that those who experienced the Great Depression came out of it with a permanently lower tolerance for risk-bearing. The current crisis may have a similar effect in reducing people's tolerance for risk-bearing.

4. Although fluid intelligence should be largely unaffected, crystallized intelligence relevant for financial decisions may show a significant change as a result of the broad reporting of financial events. The Cognitive Economics Survey provides a baseline of how well people answer questions about financial markets that have a clear answer that should not be affected by the crisis, such as questions about compound interest and whether it is true that “You could save money in interest costs by choosing a 15-year rather than a 30-year mortgage,” “Mutual funds pay a guaranteed rate of return,” “It is easy to find mutual funds that have annual fees of less than one percent of assets,” or “If the interest rate falls, bond prices will rise.”
5. There is every reason to think that people’s views about financial markets will change dramatically as a result of the financial crisis. Shifts in these attitudes could affect financial behavior and levels of achieved financial security for years to come, even if the economy and the financial markets fully recover. The Cognitive Economics Survey has very detailed data at baseline about attitudes toward the financial markets. These are assessed by true/false, degree of confidence questions.

For example, the answers to the following questions are likely to be affected by the financial crisis:

- a. “You should put all of your money into the safest investment you can find and accept whatever return it pays.”
 - b. “Financially, investing in the stock market is no better than buying lottery tickets.”
 - c. “If you are smart, it is easy to pick individual company stocks that will have better than average returns.”
 - d. “There is no way to avoid people taking advantage of you if you invest in the stock market.”
 - e. “An employee of a company with publicly traded stock should have little or none of his or her retirement savings in the company’s stock.”
 - f. “It is best to avoid owning stocks of foreign companies.”
 - g. “Older retired people should not hold any stocks.”
 - h. “You should invest most of your money in a few good stocks that you select rather than in lots of stocks or in mutual funds.”
 - i. “To make money in the stock market, you should not buy and sell stocks too often.”
 - j. “It is important to take a look at your investments periodically to see if you need to make changes.”
 - k. “If inflation is not an issue, it is better for young people saving for retirement to combine stocks with long-term bonds than with short-term bonds.”
 - l. “Buying a stock mutual fund usually provides a safer return than a single company stock.”
6. It would be surprising if expectations of stock market returns did not change after the crisis. But some people may expect a recovery, while others expect things to get worse.
 7. Finally, the financial crisis may have chastened some who exhibited overconfidence, and may in fact induce underconfidence in the financial knowledge that people have—causing people to doubt even basic facts and principles.

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