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Data from the Swedish Financial Supervisory Authority's 2010 consumer survey show that many Swedish adults struggle with simple calculations and have a poor understanding of basic financial concepts. In other words, they lack numeracy and financial literacy. Both the Swedish data and previous research from other countries suggest that deficiencies with regard to numeracy and financial literacy may affect household financial decision making.

Numeracy, Financial Literacy and Household Finance

Johan Almenberg and Daria Finocchiaro[1]
Johan Almenberg works at the Ministry of Finance but wrote this commentary while working at the Monetary Policy Department.
Daria Finocchiaro works at the Monetary Policy Department.

Households are increasingly faced with large and complex decisions that affect their financial security. For example, rising house prices result in higher household debt levels, while pension reforms that replace defined benefits with defined contributions shift responsibility from governments to households. Meanwhile, the financial sector is offering increasingly complex financial products to households.

A growing body of research examines to what extent households have the skills required to make informed financial decisions. A range of measures have been used to address this question, including tests of basic skills such as cognitive ability in general and numerical ability in particular, as well as measures of financial knowledge, in particular the understanding of, or familiarity with, financial concepts and products.

An important finding in this research is that many adults struggle with basic calculations and lack an understanding of elementary financial concepts. In other words, they lack financial literacy. Low levels of financial literacy have been documented in a number of high-income industrialized countries and there are large differences between demographic groups.[2] Moreover, inadequate financial literacy has been linked to household financial decision making in a number of ways. For example, it has been found that individuals with low levels of numeracy and financial literacy save less, take on more debt, plan less for retirement, transact at higher costs and are more likely to default on their mortgages.[3]

This raises the possibility that some households may be making serious investment mistakes because they lack the skills and knowledge required to make informed financial decisions. Investment mistakes can have serious consequences for individual well-being, for example through taking on too much debt, failing to meet savings targets for retirement, or taking large financial risks without fully realizing it and hence not anticipating possible outcomes. Such mistakes may also entail a low rate of return on investments in relation to the degree of risk taken, because the investments are not diversified with regard to their risk.

In 2010, standard measures of numeracy and financial literacy were added for the first time to a consumer survey commissioned by the Swedish Financial Supervisory Authority. This economic commentary discusses some of the results of this survey with regard to numeracy and financial literacy among Swedish adults. The key finding is that many Swedish adults struggle with basic calculations and lack an understanding of elementary financial concepts. A more detailed analysis is presented in Almenberg and Widmark (2011).

1. The views put forward in this Economic Commentary are the views of the authors and do not necessarily represent the views of the Riksbank.
2. See, for example, Bernheim (1995, 1998), Hilgert, Hogerth and Beverly (2003), OECD (2005), van Rooij et al (2007), Banks and Oldfield (2007), Lusardi and Mitchell (2009) and McArdle et al (2010).
3. In addition to the aforementioned references, see, for example, Agarwal et al (2009), Lusardi and Tufano (2009), Agarwal and Mazumder (2010) and Gerardi et al (2010).

How does one measure numeracy and financial literacy?

The demarcation between numeracy and financial literacy is not consistent in the existing literature (see Hung et al, 2009, for a discussion). There is some agreement, however, around defining financial literacy as more knowledge based, involving familiarity with financial concepts and products, whereas numeracy is more directly related to cognitive ability, in particular the ability to process numerical information and perform simple calculations. Numeracy can be thought of as a support for financial literacy.

The 2010 consumer survey commissioned by the Swedish Financial Supervisory Authority contained two sets of widely-used survey questions aimed at measuring numeracy and financial literacy in the adult population. These questions consist of a set of six numeracy questions first introduced in 2002 in a longitudinal survey of retirement savings in England[4] and a set of six financial literacy questions largely based on questions introduced in recent years in longitudinal surveys of health and retirement patterns in the US population.[5] The questions were translated into Swedish with the smallest possible modification of the contents.

The six numeracy questions aim at measuring basic numerical ability, as illustrated by the following two examples:

1 a. If the probability of getting a disease is 10 per cent, how many people out of 1,000 would be expected to get the disease?

1 b. 5 people win a lottery and share the prize. If the prize they are sharing is 2 million, how much does each of them get?

By contrast, the six financial literacy questions aim at measuring knowledge of basic financial concepts such as interest, inflation and diversification, for example:

2 a. Buying stock in a single company is usually safer than buying shares in a mutual fund. True or false?

2 b. Suppose the interest on your bank account is 1 per cent and inflation is 2 per cent. If you keep your money in the account for a year, will you be able to buy more, as much, or less at the end of the year?

In addition to measures of numeracy and financial literacy, the survey also contained a number of questions about the respondents' background and household finances. Data were collected through a telephone survey of a representative sample of about 1,300 Swedish adults aged 18-79.

There are big differences between demographic groups

The 2010 consumer survey shows that many Swedish adults display low levels of both numeracy and financial literacy. Similar patterns are well documented in many other countries. Sweden does not perform particularly poorly in comparison, nor particularly well.

Many Swedish adults struggle with basic calculations. For example, 13 per cent of the respondents could not provide a correct answer to a simple question involving a ten per cent probability (question 1a above), and 31 per cent failed to provide a correct answer to a question that requires dividing 2 million by 5 (question 1b above). The majority of those failing to provide correct answers provided answers that were incorrect. Only a minority stated that they did not know.

The performance on the financial literacy questions is also poor. For example, 32 per cent of the respondents failed to provide a correct answer to the question about risk and diversification (question 2a above), and 41 per cent of the respondents failed to provide a correct answer to the question about inflation and purchasing power (question 2b above).

In addition, the survey indicates that there are large and statistically-significant differences between demographic groups. Table 1 shows that levels of numeracy and financial literacy are lower among the elderly, among individuals with a low level of

4. English Longitudinal Study of Ageing – see Banks and Oldfield (2007) for details.
5. US Health and Retirement Study 2004 and RAND American Life Panel 2006 – see Lusardi and Mitchell (2006, 2007).

education and/or a low income, among women and among those born outside of Sweden. The differences are large and to some extent additive. For example, men aged 40-49 and earning more than SEK 40,000 per month achieve an average of 5.7 correct answers on the six numeracy questions and 5.0 correct answers on the six financial literacy questions. By contrast, women aged 65 or above and earning less than SEK 15,000 per month achieve an average of 3.3 correct answers to the numeracy questions and 3.1 correct answers to the financial literacy questions.

Numeracy and financial literacy affect financial decision making

We also observe large differences between individuals when grouped according to their financial behaviour. For example, numeracy and financial literacy levels are higher among individuals that have long-term savings, use online banking, participate in the stock market or own a home. These links do not appear to be driven by differences in other individual characteristics, such as age, education or income.[6]

Levels of numeracy and financial literacy are also higher among individuals that self-report as being more inclined to take risks.[7] The link between numeracy and financial literacy on the one hand and risk-taking on the other may in part explain the positive correlation of numeracy and financial literacy with, for example, participation in financial markets, but deeper analysis of the data shows that numeracy and financial literacy have distinct, large and statistically-significant positive correlations with both stock market participation and homeownership also when taking differences in risk attitude and other individual characteristics into account.

These patterns suggest that non-participation in markets may be a common response to deficiencies with regard to numeracy and financial literacy, consistent with the view that such deficiencies increase the individual's cost of information gathering and processing in the financial domain.

Do numeracy and financial literacy affect mortgage choices?

Mortgage debt constitutes a large part of the liability side of Swedish households' balance sheets. For many households a mortgage contract is the most important financial contract they will ever enter into. Taking on a mortgage is also a complex decision, ideally requiring, among other things, an understanding of both nominal and real interest rate risk.

Research conducted in other countries shows that mistakes are common in the mortgage market. In the UK, findings show that consumers have a poor understanding of the risk profile of their mortgages (Miles, 2003). In the USA, many consumers appear to choose mortgage products on non-economic grounds (Campbell, 2006) and individuals who appear confused about their mortgage terms are more likely to have an adjustable-rate mortgage (Bergstresser and Beshears, 2009). Numerical ability has also been linked to delinquency and default in the US subprime mortgage market (Gerardi et al, 2010). Notably, this relationship is robust to controlling for other characteristics of both the borrower and the mortgage contract. This indicates that the relationship is not explained by differences relating to personal finances or terms of lending.[8]

The Swedish housing market is characterized by widespread homeownership, relatively high loan-to-value ratios and the pervasive use of adjustable-rate mortgages.[9] About half of the respondents in the Swedish Financial Supervisory Authority's 2010 consumer survey report that they have a mortgage; among these, just over 40 per cent report that they have an adjustable rate on more than two thirds of their mortgage debt.

6. The exception is numeracy and long-term savings. When controlling for demographic variables, numeracy is no longer associated with savings (whereas financial literacy continues to be).
7. The risk measure in the survey is based on the so-called general risk question used in Dohmen et al (2010). This question has been shown to be a good predictor of individual risk-taking.
8. The inclusion of controls for other aspects of cognitive ability enables the authors to show that the effect is specifically linked to numerical ability and not to general cognitive ability. The measure of numeracy used in Gerardi et al (2009) is largely the same as the one used in the consumer survey.
9. Here defined as having an interest rate that is fixed for three months at a time or less.

Individuals who report having a mortgage achieve, on average, higher numeracy and financial literacy scores than individuals without mortgages.[10] This pattern also extends to those making highly-leveraged investments in housing. Figure 1 shows that mean numeracy and financial literacy scores are also above average among individuals that make housing purchases with a down payment of one third or less. Moreover, this applies equally to those who have made such investments in the last five years, five to ten years ago, or more than ten years ago. In other words, the data do not indicate deterioration over time with regard to average levels of numeracy or financial literacy among individuals that purchase homes with a high loan-to-value ratio.

Both fixed and adjustable-rate mortgages are risky, but the risk profiles of the two products differ. To simplify somewhat, fixed-rate mortgages entail inflation risk, whereas adjustable-rate mortgages entail a liquidity risk since the interest rate can increase unexpectedly resulting in increased nominal interest payments. When thinking about the costs associated with a household not being able to pay the interest on their mortgage, or when many households are unable to do so at the same time, the exposure to liquidity risk through adjustable-rate loans is of primary importance.

Figure 2 shows that individuals who report that a large share of their mortgage is at an adjustable rate are considerably more likely to have tried to calculate how their personal finances would be affected by a rise in mortgage rates. These individuals also achieve above average numeracy and financial literacy scores, including an above average understanding of inflation, and are more inclined to take risks. In addition, a larger share of this group believes that adjustable-rate mortgages are cheaper in the long run than fixed-rate mortgages.[11]

To sum up, the survey data indicate that individuals with exposure to housing-market risk, including liquidity risk from adjustable-rate mortgages, have comparatively high levels of both numeracy and financial literacy. Adjustable-rate mortgages are also associated with a higher willingness to take risk and with the belief that it is cheaper, on average, to have an adjustable rate than a fixed rate. These findings are consistent with the view that these households are taking calculated risks. Moreover, we do not detect deterioration over time in the average levels of numeracy and/or financial literacy among individuals making highly-leveraged investments in housing.

What are the conclusions?

Many Swedish adults struggle with basic calculations and lack an understanding of elementary financial concepts. There are large differences between groups, with the old, those with low incomes and a low level of education and women averaging lower scores on both measures. Similar patterns have been documented in many other countries and the data from the Swedish Financial Supervisory Authority's consumer survey indicate that Sweden is no exception. The communication of economic policy, including monetary policy, needs to take into account that a significant fraction of households may be very poorly equipped to process quantitative information, including numerical concepts such as probabilities or percentages, and key economic concepts such as inflation and the distinction between real and nominal interest rates.

More research is needed

The findings from the 2010 consumer survey raise concerns about how well equipped Swedish households are to make complex financial decisions. Expanding financial education programmes, for example in schools or in the workplace, will not necessarily solve this problem. Evidence concerning the effectiveness of financial education programmes is mixed, although programmes targeted at vulnerable groups appear to have been more successful.[12] More research is needed to address important questions

10. This finding is not driven by the fact that both outstanding mortgages and cognitive ability tend to decline with age. The pattern persists even if we exclude individuals above retirement age from the sample, or if we look only at the youngest group in the sample.
11. These differences apply in comparison to other individuals with mortgages as well as in comparison with all individuals in the sample. When comparing these results with the findings of Bergstresser and Beshears (2009) it is important to bear in mind that mortgage patterns are very different in Sweden and the USA. In Sweden, adjustable-rate mortgages are very common. In the USA, fixed-rate mortgages are more common.
12. See Agarwal et al (2010) for a review of this research area.

regarding financial education programmes. Do they raise levels of financial literacy? Do they lead to better economic outcomes? Do they affect outcomes through raising financial literacy or through other channels? And are such programmes cost-effective?

Financial literacy, however, is strongly correlated with numeracy and it is likely that numeracy is an important support in attaining financial knowledge. This raises the prospect that improving numeracy levels in the population may improve financial literacy as well. More research is needed in this area.

Non-participation in markets does not solve the problem

To some extent, the problem of low levels of numeracy and financial literacy is mitigated by non-participation in markets. Individuals with low levels of numeracy and/or financial literacy are less likely to make risky investments through stock market participation or by buying real estate. Two other important aspects of housing-market risk, high leverage and exposure to liquidity risk through adjustable-rate mortgages, are also positively associated with numeracy and financial literacy, suggesting that many households with a high degree of exposure to housing-market risk are taking calculated risks.

Non-participation, however, is no panacea. While opting out of markets may reduce the probability of making costly mistakes, it is also likely to pose a serious obstacle to wealth accumulation. With regard to the stock market, non-participation may seriously impede the returns on long-term savings.[13] With regard to the housing market, the limited availability of rental apartments in attractive urban areas makes it more difficult for households to refrain from purchasing a home. As a result, households that would otherwise have preferred to rent are driven into the owner-occupied segment (see OECD, 2007, for a discussion). There is a link between low levels of numeracy and financial literacy on the one hand and non-participation in the stock and housing markets on the other hand. As a result, measures aimed at stimulating homeownership or stock market investments, for example through beneficial tax treatment, may lead to individuals with high levels of numeracy and financial literacy achieving better economic outcomes than individuals with low levels of numeracy and financial literacy.

Monitoring and prudent regulation can help, but the path is not clear

Low levels of financial literacy in the adult population indicate significant vulnerabilities with regard to household financial decision making. This in turn points to a potentially important role for the close monitoring of the financial-services industry, in particular with regard to the provision of household credit and to savings products. In the USA, a legislative experiment requiring high risk mortgage applicants to submit loan offers for review by a certified financial counsellor significantly reduced subsequent default rates (Agarwal et al, 2009). The main effect was on the types of mortgage offered by the lenders, and not through the mortgages demanded by the consumers themselves. This suggests that such programmes may work by affecting the incentives of intermediaries rather than by providing better information to unsophisticated consumers.

It may also be possible to reduce the negative consequences of household investment mistakes by means of prudent regulation, for example with regard to disclosure requirements and default options, that takes into account the limited ability of many households to make informed financial decisions. How do we best design financial products and regulations so as to help households make good decisions in the face of widespread deficiencies in numeracy and financial literacy? Economic research in this area – what Campbell (2006) calls household financial engineering – is in its infancy, but offers the potential to improve the welfare of many households.

13. It is important to bear in mind that individuals with low levels of financial literacy who choose not to participate may have earned low risk-adjusted returns on their investments, for example through poor diversification. This may greatly reduce the welfare loss from non-participation. See Calvet, Campbell and Sodini (2007) for a detailed analysis.

Table 1. Numeracy and financial literacy scores, by demographic variables

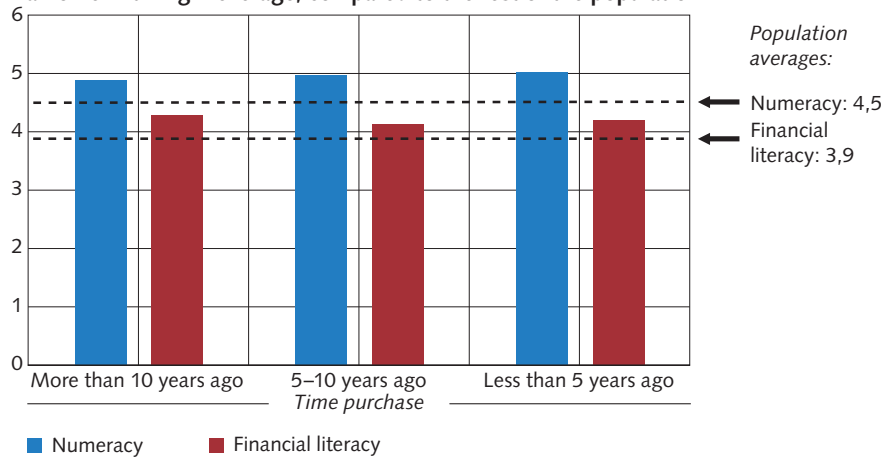
		Numeracy questions (max = 6)			Fin. literacy questions (max = 6)		
	Obs.	Correct	Incorrect	Don't know	Correct	Incorrect	Don't know
Age							
18-29	382	4.33	1.21	0.46	3.49	1.45	1.06
30-39	176	4.85	0.90	0.24	4.09	1.16	0.75
40-49	205	4.84	0.90	0.26	4.20	1.20	0.60
50-64	318	4.47	1.09	0.44	4.12	1.15	0.73
65+	203	4.06	1.30	0.65	3.77	1.30	0.93
Education							
Secondary	803	4.18	1.27	0.55	3.61	1.39	1.00
Tertiary	357	4.87	0.85	0.28	4.18	1.10	0.72
Advanced degree	134	5.28	0.69	0.04	4.73	0.96	0.31
Monthly income							
< 15k	325	4.03	1.28	0.70	3.40	1.38	1.21
15-20k	184	4.23	1.22	0.55	3.51	1.34	1.15
20-25k	200	4.37	1.19	0.45	3.78	1.29	0.93
25-30k	164	4.82	0.96	0.21	4.25	1.16	0.59
30-35k	120	4.87	0.93	0.21	4.37	1.22	0.42
35-40k	50	5.02	0.94	0.04	4.52	1.06	0.42
> 40k	105	5.39	0.58	0.03	4.62	1.09	0.30
Gender							
Men	661	4.72	1.02	0.26	4.17	1.25	0.58
Women	641	4.23	1.17	0.60	3.59	1.29	1.1
Country of birth							
Sweden	1,194	4.51	1.08	0.41	3.91	1.27	0.82
Other	105	4.12	1.28	0.60	3.59	1.16	1.25
Total	**1,302**	**4.48**	**1.10**	**0.43**	**3.88**	**1.27**	**0.85**

Table 2. Numeracy and financial literacy scores, by financial decisions and risk attitude

		Numeracy questions (max = 6)			Fin. literacy questions (max = 6)		
	Obs.	Correct	Incorrect	Don't know	Correct	Incorrect	Don't know
Long-term savings							
Yes	974	4.58	1.06	0.36	4.04	1.23	0.73
No	319	4.20	1.19	0.61	3.40	1.39	1.2
Internet banking							
Yes	1048	4.66	1.00	0.34	4.01	1.23	0.76
No	253	3.72	1.49	0.79	3.33	1.44	1.23
Stock market participation							
Yes	703	4.79	0.95	0.62	4.27	1.17	0.56
No	599	4.11	1.27	0.27	3.43	1.39	1.1
Homeowner							
Yes	833	4.67	1.01	0.32	4.11	1.20	0.69
No	468	4.14	1.26	0.60	3.47	1.38	1.14
Adjustable-rate mortgage							
Less than one third	221	4.64	1.02	0.34	3.98	1.25	0.77
One to two thirds	107	4.78	1.03	0.20	4.26	1.23	0.50
More than two thirds	262	4.98	0.84	0.19	4.37	1.10	0.53
Risk-taking							
Low	465	4.16	1.20	0.64	3.54	1.33	1.13
Middle	418	4.50	1.11	0.39	3.90	1.23	0.87
High	419	4.80	0.97	0.23	4.24	1.24	0.52
Total	**1,302**	**4.48**	**1.10**	**0.43**	**3.88**	**1.27**	**0.85**

Figures

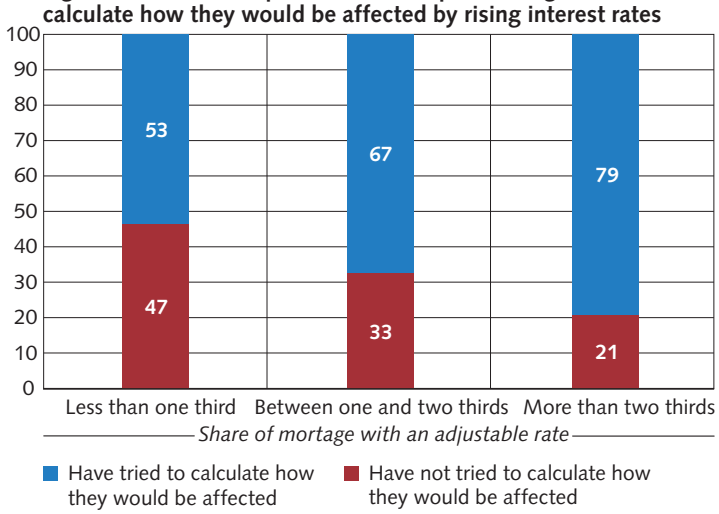
Figure 1. Numeracy and financial literacy among individuals purchasing a home with high leverage, compared to the rest of the population



Note. High leverage is here defined as a loan-to-value ratio of two thirds or more. The number of observations in the three columns are, respectively, 188, 256 and 166. All standard errors are smaller than 0.1.

Source: The Swedish Financial Supervisory Authority's consumer survey 2010.

Figure 2. Share of respondents who report having tried to calculate how they would be affected by rising interest rates



Note. The number of observations in each column is, respectively, 221, 107 and 262.

Source: The Swedish Financial Supervisory Authority's consumer survey 2010.

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