ECONOMIC LITERACY: AN INTERNATIONAL COMPARISON*

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This article uses international panel data on 55 countries from 1995 to 2008, merging indicators of economic literacy with a large set of macroeconomic and institutional variables. Results show that there is substantial heterogeneity of financial and economic competence across countries, and that human capital indicators (PISA test scores and college attendance) are positively correlated with economic literacy. Furthermore, inhabitants of countries with more generous social security systems are generally less literate, lending support to the hypothesis that the incentives to acquire economic literacy are related to the amount of resources available for private accumulation.

Households have interacted with financial markets in the last 20 years much more than in the past and also have been exposed to increased financial risk as a consequence of financial market liberalisation and policy reforms aimed at promoting retirement savings through private pension funds and individual retirement accounts. Although to different extents, these trends are affecting all countries and all dimensions of economic transactions, from payment needs, as witnessed by the growth of the credit card industry, portfolio investments, and borrowing in the mortgage and consumer credit markets. Many of these activities, however, are entered into by uninformed individuals.

The recent crisis has amplified the risks that people face when they lack the financial sophistication required to absorb financial shocks. Other things equal, differences in economic literacy create the potential for significant distributional consequences of a financial crisis, because unsophisticated investors are more exposed to financial market fluctuations then investors that are able to manage and diversify risks. The risks are especially severe for individuals whose pensions depend on stock market developments and for the elderly whose assets are based on decisions made in the past and whose margins for adjustment are smaller.

Some recent financial economic studies have made considerable progress in measuring economic literacy. Economists have tended to measure literacy through a rough self-assessment of respondents' financial sophistication; however, there is a second generation of studies based on detailed and more reliable questions on finance. These surveys have established convincingly that a large proportion of the adult population knows very little about finance and that many individuals are unfamiliar with even the most basic economic concepts, such as risk diversification, inflation, interest compounding, and mortgage and other debt instruments (Lusardi, 2008). There is also substantial evidence that economic literacy differs widely across households and tends to

be rather limited in the less educated, poorer demographic groups. What makes this evidence even more worrying is that many people are not even aware of their ignorance.

Although considerable progress has been made on measuring economic literacy, its determinants, the effectiveness of financial education and the consequences of financial literacy for households' financial decisions are not well understood. This article adopts an international comparative perspective, which involves merging indicators of economic literacy with a wide set of macroeconomic and institutional variables. The purpose of the analysis is to study the factors that are more likely to explain international differences in literacy using cross-country and time-variable indicators.

To study cross-country differences in economic literacy, the ideal dataset would include an assessment of financial knowledge and skills, such as is provided by OECD-PISA for 15-year olds for mathematics or science. In the absence of such detailed (and expensive) data, we rely on the IMD World Competitiveness Yearbook (WCY), which compiles summary indicators of economic literacy for 1995 to 2008. The indicators are computed based on interviews with senior business leaders in 55 countries; the WCY aggregates their responses by country to provide an overall score for economic literacy. The data show that economic literacy varies substantially across countries, from the lowest scores in some Latin American and former socialist countries to high values in the Scandinavian countries and East Asia.

Regression analysis indicates that PISA test scores and educational achievement are positively associated with economic literacy. On the other hand, countries with high mandated savings in the form of social security contributions and resulting more limited resources for private wealth accumulation, show lower levels of financial literacy. The results are robust to the presence of other macroeconomic and institutional variables and country-fixed effects. These findings are consistent with standard human capital models where households' knowledge depends on cognitive abilities and the incentives to acquire information, which, in turn, are related directly to the size of financial markets (Delavande *et al.*, 2008).

The article is organised as follows. Sections 1 and 2 respectively, discuss the importance of economic literacy and review the existing international evidence. Section 3 explains the indicator of economic literacy used, Section 4 describes the data used in the article and Section 5 reports the cross-section and panel regressions. Section 6 concludes.

1. Why is Economic Literacy Important?

Economic literacy is increasingly important for households' decisions about how to invest wealth and how much to borrow in financial markets. Literacy also has far-reaching consequences for the stability of the overall economy.

1.1. *The Asset Side*

On the asset side, economic literacy is important because financial products have become extremely complex. Even for simple products, such as savings accounts and government bonds, there are usually several options and several different contracts, which makes choice more difficult. Furthermore, due to financial market innovations

and deregulation, since the end of the 1980s, the number of financial products available has increased considerably, with many new options in terms of investment in equities and bonds. In many countries, households are more exposed to financial risks as a consequence of greater stock market participation and policy shifts aimed at promoting retirement/pension arrangements through individual retirement accounts and private pension funds.

Several empirical studies have found that lack of economic literacy is associated with poor risk diversification, inefficient portfolio allocations and low levels of savings. Banks and Oldfield (2007) look at numerical ability and other dimensions of cognitive function in a sample of older adults in England (the English Longitudinal Study of Ageing) and find that numeracy levels are strongly correlated with measures of retirement saving and investment portfolios, understanding of pension arrangements and perceived financial security. In subsequent work, Banks *et al.* (2010) look at the extent to which differences in numeracy and broader cognitive ability predict subsequent trajectories for key economic outcomes such as wealth, retirement income and key dimensions of retirement expectations.

Christelis *et al.* (2010) study the relation between cognitive abilities and stockholding based on the Survey of Health, Assets, Retirement and Expectations (SHARE) and find that the propensity to invest directly and indirectly in stocks (through mutual funds and retirement accounts) is strongly associated with mathematical ability, verbal fluency and recall skills. In a related paper, McArdle *et al.* (2009) find that numeracy, measured through the accuracy of responses to three simple mathematical questions, is a strong predictor of total wealth, financial wealth and the fraction of wealth held in stocks. Smith *et al.* (2010) extend the evidence studying the relationship between household wealth and the cognitive status of both spouses.

Alessie *et al.* (2008) study the relation between financial sophistication and wealth relying on specific measures of financial literacy available in a special module of the Dutch DNB Household Survey. The module contains basic questions on the ability to perform simple calculations and to understand compound interest, inflation, money illusion, and more advanced questions on stock market functioning, characteristics of stocks, mutual funds and bonds, equity premiums and the benefits of diversification. They find that financial sophistication is associated with higher wealth, higher probability to invest in the stock market and higher propensity to plan for retirement.[1]

Guiso and Jappelli (2008) relate financial literacy to portfolio diversification by Italian investors. They use the 2007 Unicredit Customer Survey (UCS), which has detailed indicators of investors' portfolio choice, financial literacy and demographic characteristics. Financial literacy is strongly correlated to the degree of portfolio diversification, even controlling for other socioeconomic characteristics and proxies for risk aversion. The authors compare objective measures of financial literacy obtained through specific questions on finance, with investors' self-assessment of financial knowledge, and find only a weak relation between the two measures: 50% of those with poor financial literacy report above average confidence on financial

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[1] The study also addresses the endogeneity between financial literacy and wealth. To account for the fact that wealth, portfolio management and planning activities independently exert an effect on financial literacy, the study uses economic education as an instrument for financial information.

matters, while 15% of investors who score well on literacy confess to knowing little about finance.

In the context of developing countries, Cole *et al.* (2009) analyse the relation between economic literacy and participation in formal financial markets. Using survey data on India and Indonesia, they show that financial literacy is a powerful predictor of demand for financial services. However, in a field experiment where randomly selected unbanked households were offered finance education, they find that, with the exception of completely uneducated and financially illiterate households, the programme had no effect on the likelihood of opening a bank savings account. Hastings and Tejeda-Ashton (2008) use survey responses and the results of an experiment involving participants in Mexico's privatised social security system to examine how financial literacy impacts on workers' choice behaviour and how simplifying the information related to management fees may increase measures of price elasticity sensitivity among the financially illiterate. They find that how information is presented to workers can have a substantial impact on the optimal fees that firms can charge in the marketplace.

One of the limitations of all the studies cited is that the incentive to become financially literate depends on the level of wealth and the portfolio allocation, which give rise to an endogeneity bias. Two papers that address this crucial issue provide conflicting results. Christiansen *et al.* (2008) use a large register-based panel data set containing detailed information on Danish investors' educational attainment as well as financial and socioeconomic variables. The authors show that stockholdings increase if individuals have completed an economic education programme and if an economist moves into the household. To sort out the double causality between portfolio choice and the decision to become an economist, Christiansen *et al.* (2008) use improved access to education due to a new university as an instrument for economic education. The instrumental variable estimates suggest that causation runs from economic education to stock market participation. The endogeneity issue is also addressed by Cole and Kartini Shastri (2009) who show that financial literacy education mandated by US state governments does not have an effect on financial market participation. They show that participation rates among those who graduated before it became compulsory (and therefore were not exposed to financial literacy education) are identical to the rate for those graduates who were exposed to this programme.

1.2. *The Debt Side*

On the debt side, borrowing in mortgage markets, ownership of credit cards and consumer credit have increased in almost all OECD countries. To evaluate the information available on different loan possibilities, choose among different credit instruments and identify predatory lending necessitate 'a minimum level of financial literacy and skills to distinguish between products' (OECD, 2005, p. 65). The recent crisis shows that poor economic literacy can affect not only the choice of individual investors and borrowers but can be an aggravating factor in a recession because household debt plays a central role in the balance sheets of banks and other financial intermediaries. Using cross-country data on household debt and panel data on arrears, Jappelli *et al.* (2008) find that household indebtedness is associated with increased

'financial fragility', as measured by the sensitivity of household arrears and insolvencies to the amount of lending and to macroeconomic shocks.

Despite its importance and potentially damaging consequences, the debt side of economic literacy has received less research attention than the asset side. Lusardi and Tufano (2009) analyse a national sample of Americans with respect to their debt literacy, financial experience and judgment about the level of their indebtedness. They measure debt literacy through a set of questions that test the respondents' knowledge of fundamental concepts related to debt, and find that there is illiteracy in all segments of the population, but especially women and the elderly. The article finds a strong relationship between debt literacy and both financial experience and debt load, and finds also that individuals with lower levels of debt literacy tend to transact in high-cost ways (incurring fees and using high cost borrowing). This finding lends support to the claim that low levels of economic literacy have contributed to debt buildup, which, in some countries (e.g., the US and Germany), has been accompanied by an increased number of insolvencies and bankruptcies.

1.3. *The Macro Side*

Economic literacy also contributes to the good workings of markets and policies. First, lack of financial literacy may create more favourable conditions for deceitful financial practices and unfair competition in financial markets, and be a serious impediment to effective financial intermediation. In contrast, as stressed at the 2006 Meeting of the G8 Finance Ministers, 'well-informed and educated financial consumers lead to better financial markets where rogue products are forced from the marketplace and confidence is raised' (G8, 2006). When households are well informed, they can also discipline policy makers, so that 'better-informed citizenry makes for better economic policy-making' (Mishkin, 2008), a point stressed by Bernanke, who argues that improving financial literacy is a way to restore confidence in the economy: 'the Federal Reserve's mission of conducting monetary policy and maintaining a stable financial system depends upon the participation and support of an educated public. As the Fed pursues the monetary policy objectives that have been set out by Congress (price stability, maximum employment and moderate long-term interest rates) it is essential that the public understands our objectives and our actions. Educating the public about the reasoning behind our decisions helps to build confidence in our economic system – another critical factor in keeping our economy running smoothly' (Bernanke, 2006).

2. International Evidence

Despite the importance of economic literacy for households' decisions and the proper functioning of financial markets, the evidence on the importance of literacy and the effectiveness of financial education is focused primarily on the US.[2] There are surveys

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[2] Lusardi (2008) surveys the empirical evidence and finds mixed support for the effectiveness of these programmes, partly because attendance at seminars is voluntary and partly because it is difficult to disentangle the consequences of an increase in financial education from peer and community effects in raising savings (Duflo and Saez, 2003). Willis's (2008) view of the potentially negative role of financial education stresses that for some consumers financial education programmes increase confidence without improving ability, thus leading to worse decisions.

of other regions but they are not comparable in either focus or method. A recent OECD report lists surveys in 12 countries that provide one or more indicators of economic literacy (OECD, 2005).[3] These surveys rely on two approaches to measuring literacy. One is to test respondents on their knowledge and understanding of financial terms and their ability to apply financial concepts to particular situations: usually available for the US, Italy, Korea and the Netherlands. The other approach is to ask respondents to self-assess their financial understanding and ability to deal with financial matters: these indicators are available for the UK, Japan, Australia and some other countries. Outside the OECD, two recent surveys elicit measures of economic literacy in India and Indonesia (Cole *et al.*, 2009).

Although these surveys differ in terms of respondents targeted, the approach to measuring economic literacy and the methodology, we can identify some common findings. First, many countries exhibit a rather low level of literacy; second, economic literacy is correlated with education (as measured by school or college attendance).[4] Also, where comparisons are possible, respondents generally report knowing more about financial matters than is actually the case. Finally, surveys show that economic literacy tends to be associated with higher income and wealth. However, this should not be interpreted as a causal link running from literacy to wealth, because the incentives to learn about finance are directly related to the level of resources. Indeed, as mentioned in Section 1, sorting out the causality between economic literacy and portfolio outcomes is a major challenge.

In principle, to enable cross-country comparison, a single questionnaire should be administered to a random sample of the population in each country and the data integrated with economic, demographic and institutional variables. However, such an approach (like the PISA test of educational achievement among 15-year olds) would require substantial resources and coordination efforts. Christelis *et al.* (2010) make an attempt in this direction by analysing indicators of cognitive abilities (including some related to economic literacy) in the 11 countries covered by SHARE. Their analysis of a sample of respondents aged 50 and over, shows that cognitive abilities tend to be higher in Northern Europe, decline with age and be positively associated with a college education.[5] However, there is wide variation of cognitive abilities within each country, age and education group. Given the small number of countries they cover, explaining cross-country differences using SHARE data is clearly not feasible.

In the absence of international microeconomic data, the present article relies on a survey of business leaders, which data have so far not been used to study economic literacy or its determinants. There are two advantages to using this dataset. First, it provides consistent international comparison of economic literacy in 55 countries over

[3] According to the OECD report, in only 5 countries (Australia, Japan, Korea, the US and the UK) is there detailed information on methodology, results, questions asked and target groups.

[4] Guiso and Jappelli (2005) document that in the 1995 and 1998 Bank of Italy Surveys of Household Income and Wealth (SHIW) a significant proportion of households was not aware even of the existence of many financial instruments. The article also explores the determinants of awareness, and finds that the probability that survey respondents are aware of the existence of stocks, mutual funds and investment accounts is positively correlated with education, household resources, long-term banking relations and proxies for social interaction.

[5] The cross-country variability of cognitive skills among people with similar levels of education is not a unique feature of SHARE data. For instance, the PISA survey finds a significant North-South gradient in mathematics, science and verbal skills among young (under 15 years) Europeans at the same school grade.

the 1995–2008 period, allowing to relate literacy to macroeconomic and institutional variables within a panel framework. Second, experts with an international dimension are less subject to the fact that individuals in different countries might use different response scales. The limitations to these data are that they are only available in aggregate form, which does not allow analysis of specific socioeconomic groups.

3. Indicator of Economic Literacy

Since 1995, the IMD WCY has published an indicator of economic literacy. The indicator is computed from a survey of senior business leaders who represent a cross-section of the business community in the countries examined, and merged with data drawn from international organisations. The sample distribution reflects a breakdown of industry by sectors (manufacturing, services and primary) and the sample size is proportional to each country's GDP. The survey questions are targeted to top and middle managers, nationals or expatriates, located in local and foreign enterprises in the country in question, who generally have an international experience and outlook. The surveys are administered in January for completion and return by March of the same year. The overall size of the survey is about 4,000 business leaders and 55 countries.

The economic literacy question asks respondents to evaluate, on a 0–10 scale, the sentence: 'Economic literacy among the population is generally high'. Dropping missing values for some countries, we constructed a panel of 55 countries for 1995 to 2008: 14 in Asia, 7 in Latin America, 15 in the EU, 12 former socialist countries and 7 other countries (South Africa, US, New Zealand, Norway, Canada, Switzerland, Australia). The survey also includes an 'Education in finance' question (available only from 1999 to 2008), which asks for an evaluation of the statement: 'Education in finance does meet the needs of the business economy'. Clearly the economic literacy indicator is more closely related to the level of literacy of the population at large. However, the correlation coefficient for the two indicators is 0.81 and the main results of the article are unaffected if we use the indicator for education in finance.[6]

Figure 1 plots the distribution of economic literacy for the world and highlights large international differences from a score of less than 3 for South Africa, Venezuela, Peru, Mexico and Croatia, to values above 7 for Ireland, Finland and Singapore. Most of the former socialist countries show low literacy scores. This points to an interpretation that the history of financial market developments matters and that a relatively low development of stock and credit markets is associated with a low level of literacy.

One caveat related to using the WCY index is that it indirectly elicits the level of economic literacy in each country based on managers' and country experts' responses, rather than a standardised survey of individuals. The only dataset that has some comparability with WCY is SHARE, which provides detailed information on cognitive abilities (including a few questions related to economic literacy) at the individual level, for 11 European countries.[7] In SHARE the variable closest to economic literacy

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[6] Table 5 reports fixed effects estimates using this alternative indicator of literacy.
[7] It should be noted that SHARE is a representative of the population aged 50+, and not of the population at large.
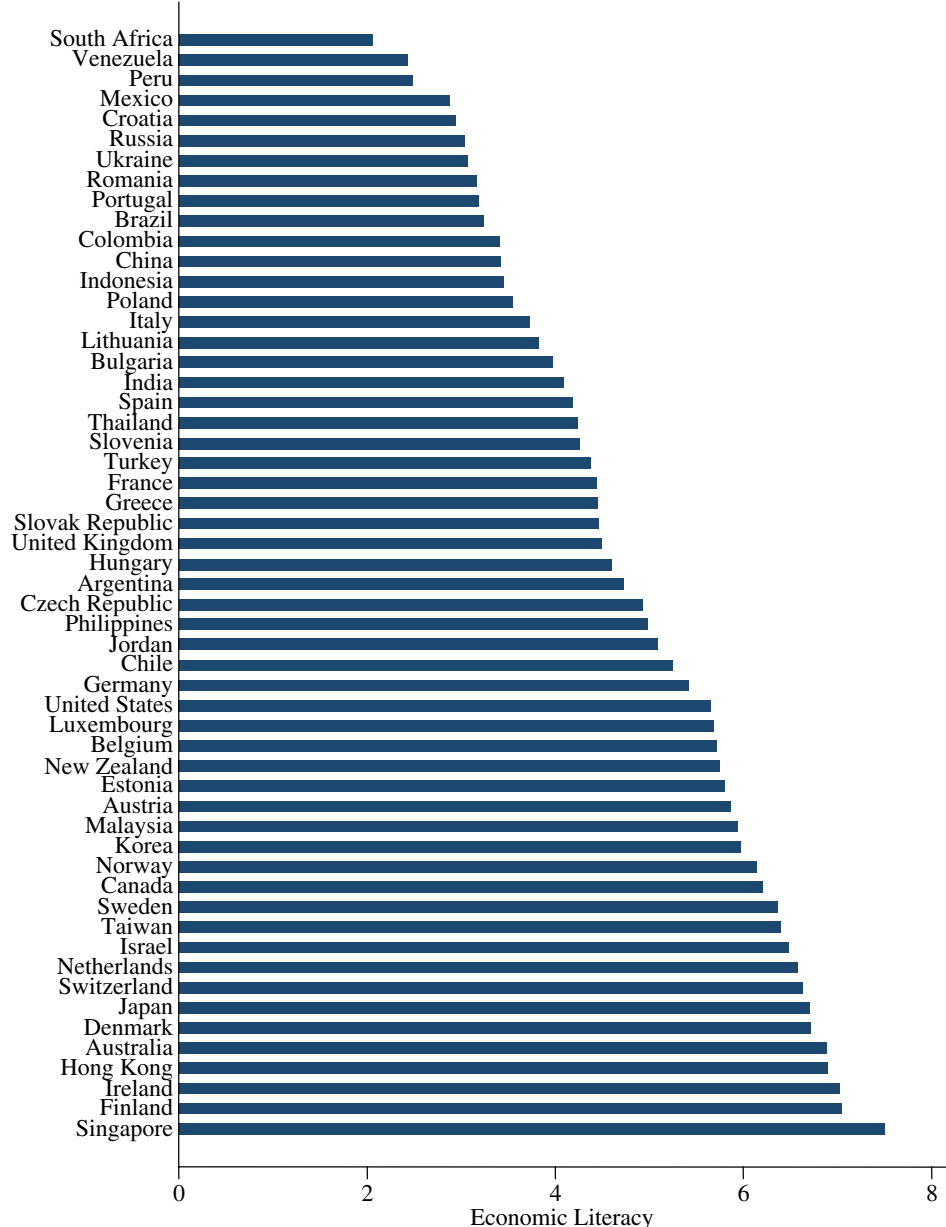
Fig. 1. *Economic Literacy Around the World*

measures the ability to perform basic numerical operations and understanding of basic financial principles.

Specifically, SHARE respondents are asked:

(*1*)   to find 10% of a number;
(*2*)   to compute the cost of a good that sells at half price;

(3) to compute the cost of a new car based on knowing the cost of a used car and that the used car is two-thirds of a new car;

(4) to find the value of an account balance after two years of an annual interest rate of 10%.

On the basis of these questions, Dewey and Prince (2005) construct an indicator based on these questions. The indicator ranges from 1 to 5 and is a function of the number of questions answered correctly; its construction and the actual questions are provided in the Appendix to this article.

Although the SHARE variable is not the ideal measure of economic literacy because it includes only a few economic concepts, there is evidence that knowledge about numerical problems is related to financial outcomes. McArdle *et al.* (2009) suggest that more numerate individuals are more adept at complex decision making including financial decisions, and also appear to be more patient and thus more likely to have saved and invested in the past. Examining the results from a 25-item test of financial knowledge in the Cognitive Economics Survey, Delaevande *et al.* (2008) find that the number series score has a strong and significant effect on the financial test score – as does educational attainment and number of economics courses the respondent has attended.

In the context of the present study, the SHARE numeracy variable is quite useful because it is available for 11 countries for which IMD data are also available. Figure 2 plots the WCY and SHARE indicators, showing that the two series are strongly positively correlated (correlation coefficient is 0.79). In both surveys, Italy and Spain have the lowest scores, and Sweden, Switzerland and Denmark the highest. Despite the very
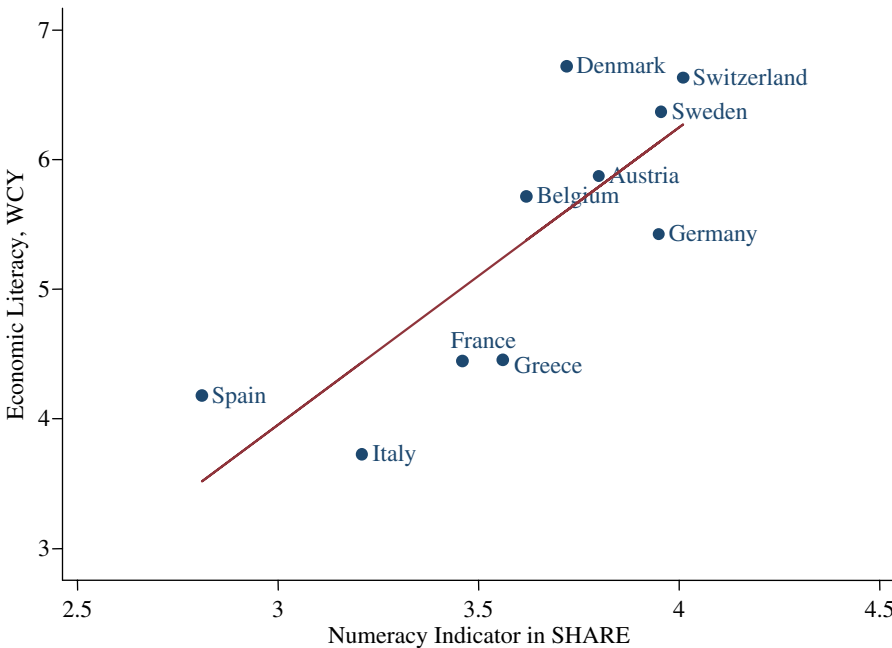

Fig. 2. *Comparison Between WCY and SHARE Indicators of Economic Literacy*

different survey design, countries are well aligned, which increases confidence in the WCY literacy indicator being a reasonable proxy for economic literacy. The comparison is useful also because the scale of the WCY indicator is not directly interpretable. Figure 2 shows that two points change in the WCY indicator (the distance between Italy and Belgium, or between France and Sweden) is associated with a one point change in the SHARE numeracy indicator. It would be rather arbitrary, however, to interpret the WCY indicator as a function of the number of correctly asked questions in each country, as in SHARE. Therefore, in the regressions analysis we shall standardise the WCY indicator and the independent variables to have mean zero and a standard deviation of one.

We can make some comparisons between WCY and other measures of economic literacy also using the Cole *et al.* (2009) survey responses. In Indonesia and India two survey measures of economic literacy are obtained through the responses to three questions adapted from Lusardi and Mitchell (2007), which makes the comparable with the US.[8] Measured economic literacy in India and Indonesia is substantially lower than in the US, which is in line with WCY ranking.

4. Descriptive Analysis

The most natural framework to study the determinants of economic literacy is to consider that people accumulate financial knowledge, combining ability and effort according to a human capital production function similar to Cunha and Heckman (2007). Applying this framework to the context of economic literacy, Delavande *et al.* (2008) and Willis (2009) suggest that the incentives to acquire financial knowledge depend on the level of private resources: while increased knowledge raises the expected return from each dollar invested, the total value of the investment depends on the number of dollars to which the improved return is applied. Thus, incentives to acquire financial knowledge are greater for individuals with higher levels of resources available for investment.[9] Similarly, investment will be greater among people with lower costs or greater efficiency in acquiring additional knowledge because of their greater ability or because of their greater financial knowledge obtained through formal education.

To apply this framework to our cross-country data, we relate economic literacy to measures of human capital, social interactions and resources. Similar to cognitive abilities, we use the PISA test scores (available for 1995, 2000, 2003 and 2006 for a maximum of 44 countries)[10] and formal education, measured by college enrolment

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[8] The questions are:
  (*1*) Suppose you borrow 100,000 rupiahs from a money lender at an interest rate of 2% per month, with no repayment for 3 three months. After 3 months, do you owe less than 102,000 rupiahs, exactly 102,000 rupiahs, or more than 102,000 rupiahs?
  (*2*) If you have 100,000 rupiahs in a savings account earning 1% interest per annum, and prices for goods and services rise 2% over a 1-year period, using the money in the account, can you buy more than, less than, or the same amount of goods in 1 year as you could today?
  (*3*) Is it riskier to plant multiple crops or one crop?
[9] van den Berg *et al.* (2010), using a Dutch longitudinal database, find that cognitive functioning of elderly individuals may be affected by negative economic shocks such as job loss or the reduction of pension benefits, and by events such as the loss of a child or partner or the onset of a serious chronic condition.
[10] PISA is available for 27 countries in 1998, 28 in 2000, 33 in 2003 and 44 in 2006. For each country, we take the average value where more than one observation is available.

rates and health conditions (proxied by life expectancy).[11] Countries differ also in the opportunities to exploit cognitive abilities. We thus consider technological infrastructures (internet connections or computers per capita) and social interactions (proxied by the fraction of urban population) to measure how abilities can be combined to obtain additional financial knowledge.[12] Finally, to proxy for the resources available for financial investments we use the generosity of the social security system (measured by the social security contributions rate), GDP per capita (PPP adjusted) and an indicator of financial development (the GDP ratio of stock market capitalisation and private credit). In the cross-section analysis, each of these variables is averaged over the 1995–2008 period and merged with institutional and legal indicators available in the World Bank Doing Business dataset (degree of contract enforcement, judicial efficiency, legal origin of the country, quality of credit information sharing). Statistics for the 1995–2008 sample are reported in Table 1.

Table 1

Descriptive Statistics

	Mean	Median	Standard deviation	Minimum	Maximum
Economic literacy	4.87	4.73	1.44	2.06	7.50
Education in finance	5.66	5.81	1.24	3.54	7.93
Math score in PISA survey	481.94	495.88	55.06	353.17	561.82
Science score in Pisa survey	486.09	497.62	47.57	385.11	550.10
Secondary school enrolment rate (%)	83.04	87.83	12.20	54.74	99.13
Tertiary education (%)	26.31	26.62	11.97	4.93	49.38
Social security contribution rate (%)	19.30	17.48	12.10	1.08	49.88
Share of urban population (%)	70.60	70.01	15.86	27.85	99.46
Life expectancy	74.35	75.67	5.07	56.08	81.16
Stock market capitalisation (% of GDP)	65.25	44.97	52.53	7.41	229.90
Private credit (% of GDP)	75.61	74.99	44.02	12.41	167.83
Financial development (% of GDP)	142.58	138.49	89.79	21.66	389.73
Log per capita GDP	9.20	9.28	1.18	6.31	11.07
GDP Growth	0.07	0.06	0.04	-0.02	0.21
Old Europe	0.27	0.00	0.45	0.00	1.00
Latin America	0.13	0.00	0.34	0.00	1.00
Asia	0.24	0.00	0.43	0.00	1.00
Former socialist countries	0.24	0.00	0.43	0.00	1.00
Other countries	0.13	0.00	0.34	0.00	1.00
English origin	0.22	0.00	0.42	0.00	1.00
French origin	0.33	0.00	0.47	0.00	1.00
Investor protection index	10.58	10.33	3.25	4.33	18.33

Note. Variables are averaged over the 1995-2008 period, except for education in finance, available from 1999 to 2008. The sample includes the following countries. Asia: China, Hong Kong, India, Indonesia, Israel, Japan, Jordan, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, Turkey. Latin America: Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela; New Europe: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia, Ukraine; Old Europe: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom; Other countries: Australia, Canada, New Zealand, Norway, South Africa, Switzerland, United States.

[11] McArdle *et al.* (2009) mention that factors associated with lower cognitive performance include low socioeconomic status, birth complications and poor early nutrition.

[12] As noted in a recent OECD report, access through internet to many financial products has reduced transaction costs but also increased the likelihood that consumers will encounter sophisticated financial assets (OECD, 2005).
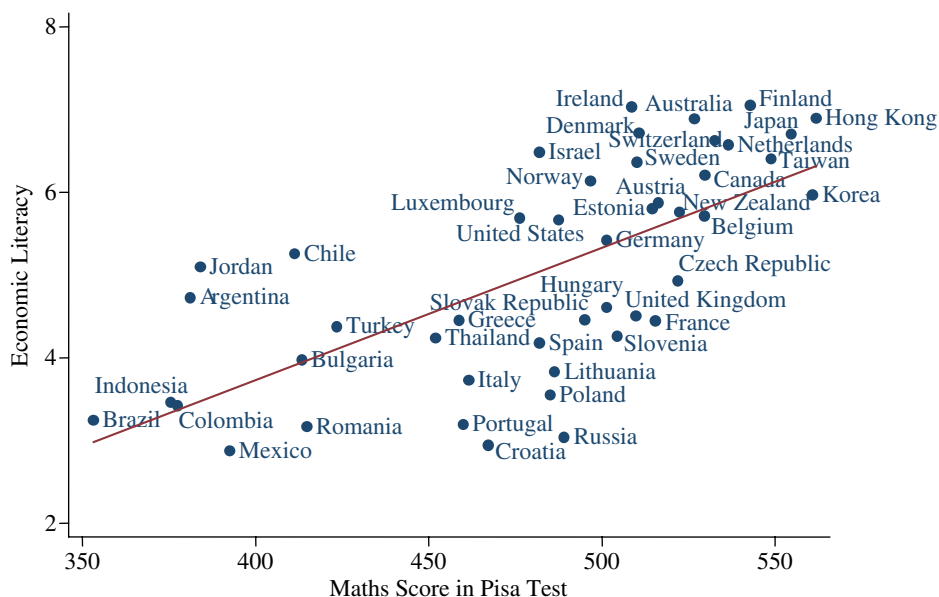
Fig. 3. *Economic Literacy and Math Score in the PISA Survey*

The most informative and reliable indicator of cognitive ability is provided by the PISA scores (Hanushek and Woessman, 2008). Figure 3 shows that there is a strong positive association between economic and mathematical abilities, and that the effects are potentially large. For example, in countries where the PISA score is less than 400, the indicator of economic literacy does not exceed 4, while in almost all countries with mathematics scores above 500 the indicator for economic literacy is higher than 6. There is also a positive correlation between economic literacy and the fraction of the adult population with college education: in countries with college achievement rates below 25% economic literacy is less than 5 and that where college achievement exceeds 40%, literacy is above 6.

The share of the urban population is also positively correlated to literacy (see Figure 4). Countries where most of the population is concentrated in large cities (e.g., Australia, Belgium, Hong Kong, Israel) also feature relatively high literacy, lending support to the idea that more intense social interactions are associated with higher literacy.[13]

Economic literacy is positively correlated to economic development (measured by GDP per capita) and financial development (the GDP ratio of stock market capitalisation plus private credit), the most widely used indicator of financial development (Beck *et al.*, 2009). These correlations may be interpreted as financial development raising the volume of saving and the incentives to learn about finance. However, such a

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[13] Hong *et al.* (2004) show that stock market participation is higher among more socially connected individuals. A related line of research points out that trust is an important determinant of economic exchange and financial transactions. Guiso *et al.* (2004) find that, other things being equal, the proportion of stock-holders is higher in Italian provinces with relatively high social trust. People who are more active socially might be more inclined to trust, making the effects of sociability and trust difficult to distinguish empirically.
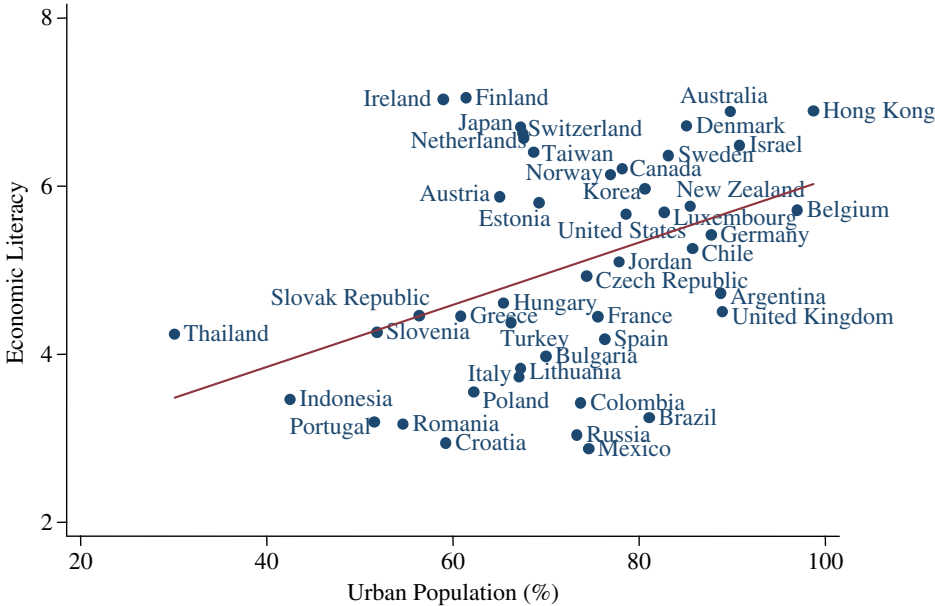
Fig. 4. *Economic Literacy and Share of Urban Population*

conclusion would be premature, because the two-way correlation may be driven simply by financial development being correlated to education, GDP per capita and other determinants of literacy. Furthermore, economic literacy can affect financial development, for at least three reasons. First, higher literacy leads to more efficient allocation of savings and higher per dollar returns, attracting more investment and growth in the country. Second, higher literacy might induce greater stock market participation and financial market depth, as shown in Christelis *et al.* (2010) and Alessie *et al.* (2007). Third, as Bernanke (2006) claims, economic literacy might build confidence in the market economy, discipline financial intermediaries and create a better policy environment for growth.

The social security payroll tax rate is directly related to the amount of mandated saving in the form of social security contributions and, therefore, is also an indicator of the resources available for private accumulation, particularly in the form of private pension funds, life insurance and other retirement savings vehicles. Since payroll tax is set by the government, it can be fairly safely assumed that it is not affected by the level of economic literacy. This rules out that governments decide to introduce less generous socials security benefits in countries where people do not have sufficient economic literacy to manage their own pension investment well. This assumption is reasonable, as recent social security reforms (in Sweden, Italy, Germany and elsewhere) were implemented to address population aging and fiscal crisis, rather than to raise the level of economic literacy of the country.

Figure 5 shows that contribution rates are negatively correlated to economic literacy: countries where contribution rates are lower than 20% (Chile and New Zealand) score above 6 for economic literacy, while countries with higher contribution rates (Greece, Spain and Portugal) show relatively low literacy levels. Since the contribution rate is
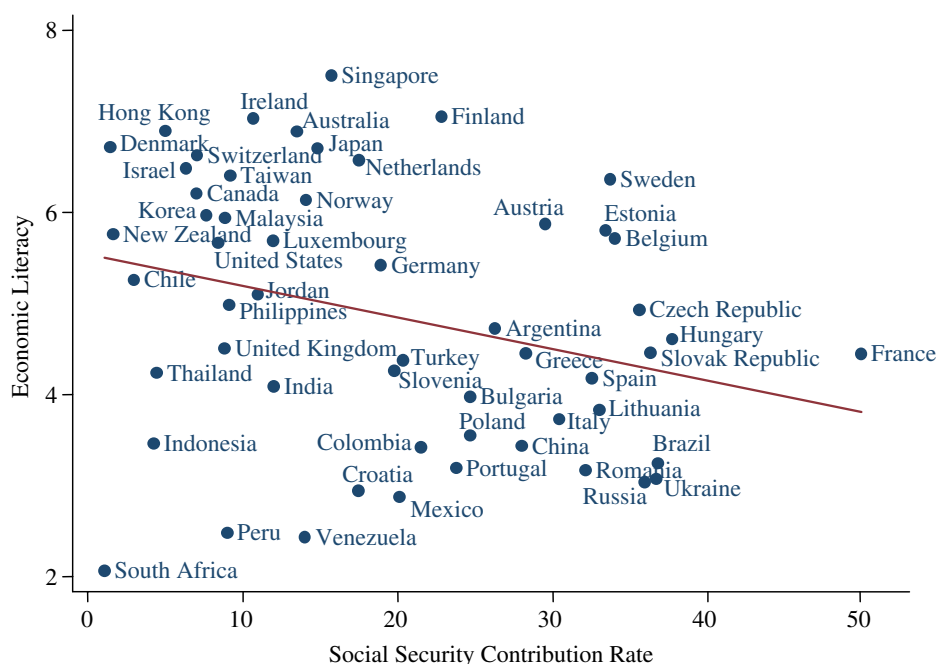
Fig. 5. *Economic Literacy and Social Security Contribution Rate*

more likely to be exogenous with respect to economic literacy, in the literacy regressions we rely primarily on contribution rate to proxy for private resources. However, we also provide OLS and instrumental variables estimates based on financial development and GDP per capita.

5. Regression Analysis

Table 2 shows the sample average of the variables of interest for each country and reports a first set of regressions for the 46 countries with non-missing observations. The baseline specification includes the mathematics score in PISA, the social security contribution rate and the share of urban population, which arguably are exogenous variables. To ease the interpretation of the results, in the regression analysis each of the variables is standardised to have mean zero and a standard deviation of one.

The coefficients of each of the three variables are precisely estimated and have the expected sign. The mathematics score and the share of urban population are positively associated with literacy, while the coefficient of the social security tax rate is negative, lending support to the hypothesis that incentives to acquire economic literacy are higher when savings mandated by government are lower. In terms of economic significance, an increase of one standard deviation in mathematics score (equivalent to moving from Ireland to Korea) is associated to an increase in literacy of 0.54 standard deviations. Likewise, an increase of one standard deviation of urbanisation (equivalent to moving from Finland to France) is associated to an increase of 0.26 standard deviations of literacy; and an increase in one standard deviation of the social security

Table 2

Regressions for Economic Literacy – Baseline Estimates

	OLS		Robust regression	
	(1)	(2)	(3)	(4)
Maths score in Pisa	0.541	0.562	0.525	0.551
	(0.084)***	(0.080)***	(0.089)***	(0.087)***
Social security contribution rate (%)	−0.312	−0.209	−0.317	−0.222
	(0.082)***	(0.087)**	(0.087)***	(0.095)**
Share of urban population (%)	0.260	0.180	0.282	0.202
	(0.095)***	(0.095)*	(0.101)***	(0.104)*
Former socialist countries		−0.551		−0.524
		(0.214)**		(0.235)**
Constant	0.116	0.248	0.136	0.254
	(0.082)	(0.093)**	(0.087)	(0.102)**
Observations	46	46	46	46
R-squared	0.65	0.70	0.63	0.66

Note. The dependent variable is the index of economic literacy. Left-hand-side and right-hand-side variables (except for the dummy for former socialist countries) have been standardised to have mean zero and standard deviation equal to one. The robust estimation method is implemented using the *rreg* robust estimation command in Stata, which performs an initial OLS regression, calculates the Cook's distance, eliminates the gross outliers for which the Cook's distance exceeds 1, and then performs iterations based on Huber weights. Standard errors are reported in parenthesis. One star indicates significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

contribution rate (for instance, moving from Germany to Italy) is associated with a reduction of 0.31 standard deviations of literacy.

Column 2 of Table 2 extends the baseline specification introducing a dummy for former socialist countries. The coefficient of this dummy is negative and statistically different at the 5% level, in line with the fact that for historical and institutional reasons the populations in these countries are less familiar with portfolio management and financial decisions. In particular, in former socialist countries literacy is 0.55 standard deviations lower than in other countries. The coefficients of other regional dummies (for Latin America, Asia and other European countries) are not statistically different from zero. The last two columns in Table 2 repeat the estimation using a robust estimation method to check for the effect of influential observations; the results are unaffected.

In what follows, we provide a number of checks for the correlations in Table 2, expanding the variables used in the estimation, controlling for the potential endogeneity of some of the variables, and reporting fixed effects estimates at the level of individual countries. Table 3 presents expanded baseline regression that include the additional variables: science score in PISA, secondary school enrolment rate, college achievement, life expectancy, internet connections, log of per capita GDP and GDP growth. None of these coefficients is statistically different from zero at standard confidence levels. The results of the baseline estimates are unaffected, with the exception of the coefficient of the share of urban population which is less precisely estimated.

We next report regression estimates for the relation between economic literacy and three proxies for financial market deepening: GDP ratio of stock market capitalisation, GDP ratio of private credit and the sum of these two items (financial development). Table 4 shows that, other things being equal, the measures of financial market

Table 3

Regressions for Economic Literacy – Additional Variables

	(1)	(2)	(3)	(4)	(5)
Maths score in Pisa	0.656	0.527	0.545	0.427	0.492
	(0.292)**	(0.127)***	(0.108)***	(0.133)***	(0.136)***
Social security contribution rate	−0.207	−0.182	−0.211	−0.189	−0.224
	(0.088)**	(0.096)*	(0.088)**	(0.088)**	(0.091)**
Share of urban population (%)	0.182	0.165	0.174	0.150	0.160
	(0.096)*	(0.100)	(0.099)*	(0.097)	(0.101)
Former socialist countries	−0.537	−0.533	−0.521	−0.507	−0.369
	(0.221)**	(0.218)**	(0.250)**	(0.216)**	(0.385)
Science score in Pisa	−0.098				
	(0.292)				
Secondary school enrolment rate		−0.056			
		(0.163)			
College achievement		0.129			
		(0.111)			
Life expectancy			0.038		
			(0.159)		
Internet connections per 100 people				0.189	
				(0.149)	
Log per capita GDP					0.113
					(0.182)
GDP growth					−0.040
					(0.129)
Constant	0.244	0.249	0.234	0.202	0.184
	(0.095)**	(0.095)**	(0.112)**	(0.099)**	(0.137)
Observations	46	46	46	46	46
R-squared	0.70	0.71	0.70	0.71	0.70

Note. The dependent variable is the index of economic literacy. Left-hand-side and right-hand-side variables (except for the dummy for former socialist countries) have been standardised to have mean zero and standard deviation equal to one. All regressions are estimated by OLS. Standard errors are reported in parenthesis. One star indicates significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

deepening are not correlated with literacy. Given the potential endogeneity of financial market development with respect to literacy, in the last two columns of Table 4 we supplement the OLS estimates with instrumental variable regressions.

We draw on the large literature on the legal and institutional determinants of financial development to obtain our instruments, and use dummies for the legal origin of the country and an index of the strength of investors' protection (a combined indicator of transparency of transactions, director liability, and shareholders' ability to sue officers and directors for misconduct).[14] The Sargan test does not reject the hypothesis of valid instruments. The F-tests of the exclusion of the instrument set in the first-stage regression were statistically significant at the 1% level (5% in case of private credit). Since such a diagnostic has limitations when there is more than one endogenous regressor (as in column 3), we compute the partial R squared (Shea, 1997).[15] In

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[14] The variables are drawn from the World Bank Doing Business database. La Porta *et al.* (1997) argue forcefully that legal origin of the country and investors' protection are strong determinant of the depth of its financial markets.

[15] Shea's partial R-squared is a test of the individual explanatory power of the instruments, accounting for correlation among the instruments. The results obtained indicate that there is enough separate variation in the instruments.

Table 4

Regressions for Economic Literacy: The Role of Financial Development

| | OLS | | IV | |
	(1)	(2)	(3)	(4)
Maths score in Pisa	0.554	0.507	0.649	0.512
	(0.112)***	(0.103)***	(0.198)***	(0.130)***
Social security contribution rate	−0.255	−0.234	−0.318	−0.238
	(0.102)**	(0.099)**	(0.154)**	(0.125)*
Share of urban population (%)	0.238	0.255	0.234	0.257
	(0.101)**	(0.099)**	(0.106)**	(0.102)**
Stock market capitalisation (% of GDP)	0.205		0.299	
	(0.138)		(0.268)	
Private credit (% of GDP)	−0.061		−0.273	
	(0.151)		(0.393)	
Financial development (% of GDP)		0.158		0.148
		(0.125)		(0.227)
Constant	0.174	0.160	0.199	0.160
	(0.086)**	(0.084)*	(0.092)**	(0.079)**
Observations	42	42	42	42
R-squared	0.68	0.67	0.66	0.67
Sargan test (p-value)			0.65	0.94
Shea's partial R squared: stock market capitalisation			0.24	
Shea's partial R squared: private credit			0.13	
F-test of the exclusion of the instruments				4.22

Note. The dependent variable is the index of economic literacy. Left-hand-side and right-hand-side variables have been standardised to have mean zero and standard deviation equal to one. In the IV estimates the instruments are: a dummy for English origin, a dummy for French origin, and an index of the strength of investors' protection (based on the average of transparency of transactions, director liability index, and shareholders' ability to sue officers and directors for misconduct). Standard errors are reported in parenthesis. One star indicates significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

both specifications, the instrumental variable estimates confirm lack of significance of the indicators of financial development; the lack of correlation is not affected by the particular set of instruments used.[16]

The cross-sectional estimates can be criticised for excluding too many country-level characteristics that potentially are related to economic literacy and for which the regressions in Table 3 do not control. To address this issue, we exploit the panel structure of the sample; Table 5 reports the fixed effects estimates. We drop the dummy for former socialist countries (which is absorbed by the country fixed effects) and add to the baseline regression a cyclical indicator (GDP growth rate) and – in

[16] We also experiment with an index of *Creditor Rights* as a measure of creditor legal protection built using the methodology proposed by La Porta *et al.* (1997). Higher values of this index imply that secured lenders are better protected in the case that a borrower defaults. As a measure of actual creditor protection, we include the variable *Time to Enforce Payment*, which measures the (log of the) number of days it takes for a creditor to secure an outstanding payment through the courts if a debtor defaults. Finally, we include among the instruments the variable *Information Sharing in Credit Markets* because Djankov *et al.* (2007) and Brown *et al.* (2009) find that information sharing among lenders is associated with improved availability and lower costs of credit.

Table 5

Regressions for Economic Literacy and Education in Finance
Fixed Effects Panel Estimates

	Economic literacy		Education in finance	
	(1)	(2)	(3)	(4)
College achievement	0.026	−0.018	0.149	0.064
	(0.062)	(0.073)	(0.091)	(0.106)
Social security contribution rate	−0.101	−0.148	−0.276	−0.414
	(0.068)	(0.070)**	(0.147)*	(0.166)**
Share of urban population (%)	0.681	0.678	−0.076	−0.096
	(0.310)**	(0.313)**	(0.507)	(0.510)
GDP growth	0.134	0.112	0.232	0.225
	(0.060)**	(0.066)*	(0.089)***	(0.099)**
Financial development		0.125		−0.000
		(0.067)*		(0.101)
Constant	0.046	0.077	0.121	0.212
	(0.065)	(0.052)	(0.109)	(0.087)**
Observations	367	324	314	277
Number of countries	46	41	46	41
R-squared	0.06	0.07	0.07	0.07

Note. The Table reports fixed effects panel estimates. The dependent variables are the index of economic literacy and the index of education in finance. Left-hand-side and right-hand-side variables have been standardised to have mean zero and standard deviation equal to one. Standard errors are reported in parenthesis. One star indicates significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

column (2) – proxies for financial development. Since for many countries only one set of PISA scores is available, we replace them with the fraction of individuals with college education. Both regressions confirm a positive and significant association between share of urban population and economic literacy. The coefficient of the social security contribution rate is statistically different from zero (at the 5% level) only in the second specification. The magnitude of the coefficients is smaller than in the OLS regressions in Table 2: a one standard deviation increase in the contribution rate is associated with a reduction of 0.15 standard deviations of literacy.

In the panel estimates the coefficients of the school attainment variable are not statistically different from zero. This is expected, given that the level of education is a slowly changing variable whose effect is hard to pinpoint in a relatively short panel.[17] Finally, it should be noted that since the institutional determinants of financial market deepening are constant over time or change only slowly, in the panel regressions there is not enough variability in the instruments to provide reliable IV estimates.

In columns (3) and (4) of Table 5 we repeat the estimation using education in finance as an alternative indicator of economic literacy (recall that the variable is available only from 1999 to 2008). The estimates show that education in finance is negatively associated with the social security contribution rate, confirming the results in columns 1 and 2. Instead, the coefficients of urban population, college achievement and financial development are not statistically different from zero.

[17] In the panel estimates the coefficients of internet connection and life expectancy are never statistically different from zero.

6. Conclusions

Many surveys have shown that investors have poor financial literacy. These surveys are targeted at different population groups around the world and elicit economic literacy in very different ways, from self-assessment to detailed questions aimed at understanding whether individuals are familiar with basic economic concepts, portfolio management and specific financial products. The data used in this article offer a comprehensive assessment of literacy across the world based on a survey of executives in 55 countries, in 1995–2008. The advantage of the dataset is strict international comparability, which allows economic literacy to be related to the quantity and quality of human capital, technological infrastructure, economic and financial development. The drawback to it is that the survey respondents are a selected group of managers and country-experts and that data are only available in aggregate form, preventing analysis of specific socioeconomic groups.

The descriptive analysis shows that literacy varies quite substantially among countries, and the regression analysis shows that its level depends on educational achievement, social interactions (as proxied by the share of urban population) and mandated savings in the form of social security contributions. The contribution rate is used as an (inverse) proxy for financial market deepening to minimise the risk of reverse causation between financial literacy and financial development. The findings can be rationalised using a standard human capital model, where financial knowledge depends on cognitive ability and incentives to accumulate knowledge are directly related to the level of household resources invested in financial markets, and particularly in pension funds.

The article has two implications for policy. First, the international comparison suggests that economic literacy improves with the drivers of human capital and financial market reform, both of which change slowly over time. Second, social security reforms associated with financial market deepening (e.g., the creation of private pension funds), by raising the incentive to acquire financial knowledge, eventually will lead also to improvements in economic literacy.

Appendix

A.1. *The World Competitiveness Yearbook (WCY)*

The IMD World Competitiveness Yearbook (WCY) is a comprehensive annual report on the competitiveness of nations available for 1995 to 2008. The WCY includes 329 variables on the following topics:

- *Economic Performance* (82 variables), covering domestic economy, international trade, international investment, employment and prices.
- *Government Efficiency* (70 variables), covering public finance, fiscal policy, institutional framework, business legislation and societal framework.
- *Business Efficiency* (67 variables), covering productivity, labour markets, finance, management practices and attitudes, and values.
- *Infrastructure* (110 variables), covering basic infrastructure, technological infrastructure, scientific infrastructure, health and environment, and education.

The WCY uses different types of data to measure quantitative and qualitative issues separately. Statistical indicators are acquired from international, national and regional organisations, private institutions and a network of 54 partner institutes worldwide. These statistics are referred to in the WCY as Hard Data and include 245 variables. The other variables are drawn from the annual Executive Opinion Survey and are referred to in the WCY as Survey Data.

The Executive Opinion Survey was designed to quantify issues that are not easily measured, for example management practices, labour relations, corruption, environmental concerns and quality of life. The Executive Opinion Survey is sent to executives in top and middle management in all of the economies covered by the WCY. The sample of respondents covers a cross-section of the business community in each economic sector: primary, manufacturing and services, based on their contribution to the GDP of the economy. The survey respondents are nationals or expatriates, located in local and foreign enterprises in a country and who, in general, have an international dimension. The surveys are sent in January and are returned in April of each year. From the last Opinion Survey, WCY indicators were based on 3,960 responses from 57 countries.

The following variables are drawn from the WCY database: economic literacy, life expectancy, fraction of urban population, internet and computers per capita, GDP per capita.

A.2. *The OECD-PISA Survey*

The OECD Programme for International Student Assessment (PISA - http://www.pisa.oecd.org) is a regular survey of 15-year olds which assesses aspects of their preparedness for adult life.

Mathematical Literacy. the capacity to identify, to understand, and to engage in mathematics and make well-founded judgments about the role of mathematics, needed in current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen.

Scientific Literacy. the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and contribute to decisions about the natural world and the changes wrought on it by human activity.

A.3. *Macroeconomic Variables*

Education. Secondary and tertiary enrolment rates (Source: OECD, Education at a Glance).

Financial development. Stock market capitalisation relative to GDP and private credit relative to GDP (Source: Beck *et al.*, 2009).

A.4. *Institutional Variables*

The following variables are drawn from the Doing Business database, available at the World Bank web site.

Legal Origin. Identifies the legal origin of the company law or commercial code of each country. Source: La Porta *et al.* (1997).

Investor Protection. Measures the strength of minority shareholder protection against directors' misuse of corporate assets for personal gain. The indicators distinguish among three dimensions of investor protection: transparency of related-party transactions (extent of disclosure index); liability for self-dealing (extent of director liability index); and shareholders' ability to sue officers

and directors for misconduct (ease of shareholder suit index). The data are from a survey of corporate lawyers and are based on securities regulations, company law and court rules of evidence transparency of transactions, director liability index and shareholders' ability to sue officers and directors for misconduct.

Information Sharing Index. The depth of credit information index measures the scope, accessibility and quality of credit information available through either public or private credit registries. The index ranges from 0 to 6, with higher values indicating the availability of more credit information, from either a public registry or a private bureau. A score of 1 is assigned for each of the following 6 features of the public registry or the private credit bureau (or both):

- positive and negative credit information
- data on firms and individuals
- data from retailers, trade creditors, utility companies and financial institutions
- at least 2 years of historical data
- data on loans below 1% of per capita incomes
- borrowers have the right to access their data in the largest registry in the economy.

Enforcing Contracts. Indicators on enforcing contracts measure the efficiency of the judicial system at resolving a commercial dispute. The data are built following a step-by-step evolution of commercial sale disputes in the local courts. Data are collected from codes of civil procedure and other court regulations and surveys completed by local litigation lawyers (and, in 25% of the countries, also by judges).The value of a claim equals 200% of the national per capita income. Time to collect the claim is recorded in calendar days, counted from the moment the plaintiff files the lawsuit in court until payment. Costs are recorded as a percentage of the claim.

A.5. *Numeracy Indicator in SHARE*

The (abridged) questions on numeracy are as follows. Possible answers are shown in a card while the interviewer is instructed not to read them out to the respondent:

(*1*) *If the chance of getting a disease is 10 per cent, how many people out of one thousand would be expected to get the disease?* The possible answers are 100, 10, 90, 900 and another answer.

(*2*) *In a sale, a shop is selling all items at half price. Before the sale a sofa costs 300 euro. How much will it cost in the sale?* The possible answers are 150, 600 and another answer.

(*3*) *A second hand car dealer is selling a car for 6,000 euro. This is two-thirds of what it costs new. How much did the car cost new?* The possible answers are 9,000, 4,000, 8,000, 12,000, 18,000 and another answer.

(*4*) *Let's say you have 2,000 euro in a saving account. The account earns ten per cent interest each year. How much would you have in the account at the end two years?* The possible answers are 2,420, 2,020, 2,040, 2,100, 2,200, 2,400 and another answer.

The numeracy indicator is a function of the number of questions answered correctly, and ranges from 1 to 5. If a person answers (1) correctly they are then asked (3) and if they answer correctly again they are asked (4). Answering (1) correctly results in a score of 3, answering (3) correctly but not (4) results in a score of 4 while answering (4) correctly results in a score of 5. On the other hand if they answer (1) incorrectly they are directed to (2). If they answers (2) correctly they get a score of 2 while if they answer (2) incorrectly they get a score of 1.

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