

"A man is
great by
deeds, not by
birth"

-Chanakya

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Cognition and Wealth accumulation among Indian households

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Abstract

In this article, we study the association of cognitive traits and, in particular, numeracy of both spouses on financial outcomes of the family. We find significant effects, particularly for numeracy for financial and non-financial respondents alike, but much larger effects for the financial decision maker in the family. Once again, cognitive traits such as numeracy are an important component of that decision with larger effects of numeracy for financial respondents and stronger when the financial respondent is the husband.

Introduction

In a world of uncertain returns from pension provisions, it is becoming increasingly important that individuals are able to understand the financial choices they face and can choose savings and debt products, investment portfolios and pension contribution rates accordingly. It has been well documented across the world that, there exists high level of heterogeneity among individuals in terms of wealth accumulation, share of risky assets in portfolio, saving rates, Investment decisions (Thomas and Spataro, 2018) and retirement planning (Alessie and Lusardi, 2009). Scholars have pointed out that higher wealth accumulation (Smith et al 2010, pension adequacy(Alessie and Lusardi, 2009), Savings (Jappelli and Padula, 2013) are associated with socio- demographic characteristics like probability of remaining in a marriage, being male and with higher levels of social interactions and higher social networks. The financial variables like income and level of wealth is also considered to be strong predictors of prudent financial behaviour.

Controlling for most of the socio-economic and financial variables, numeracy or financial literacy has found to be a good predictor of prudent financial decision making and the results even grew stronger when human capital is also added into the empirical model underlining its separate effect. However, in establishing the role of the numeracy/financial literacy, one interesting question arose what the other dimensions are, i.e. other than numeracy result in individuals performing sound financial decisions.

Among other financial decisions wealth accumulation offlate has emerged as a interesting subject of interest in both developed and developing countries. For example, Smith et al., (2010) examined the association of cognitive traits and, in particular, numeracy of both spouses on financial outcomes of the family. They made use of the Health and Retirement study (HRS), a nationally representative longitudinal survey of the population of the US who are over 50 years old. Using the sample of married couples as the unit of this study examines the relationship between observed wealth outcomes (total household wealth, total financial wealth and the fraction of financial wealth held in stock) of the household and these cognitive abilities of both spouses. The researcher pointed out that the independent impacts which were statistically significant for all three financial outcomes and for financial and non-financial respondents alike. The study also highlighted that, the estimated impact of answering a question correctly is much higher for the financial respondent compared to non-financial respondents in all three outcomes.

In the case of developing country context, DeGraff and Rebeca Wong (2014) discusses the determinants of wealth accumulation in Mexico. They examines the association between early-life outcome and old-life wellbeing using data from Mexican health and aging study. They adopted the life course approach which considers aging as a process and late-life stocks as the result. In the study they argue that many of the outcomes or decisions made throughout the life cycle such as age at first marriage or educational attainment, may be endogenous to late-life economic well being. They have also pointed out that unobservable characteristics like intelligence also have direct effect on the dependent variable wealth in older age. They have used both individual level data derived from first wave of the Mexican Health and aging study (MHAS), a nationally representative prospective panel study of Mexicans aged 50 and over in 2001 and aggregate historical data in this analysis. .. The research concludes that the two estimated explanatory variables-age at first marriage and years of own education are both statistically significant for both men and women for explaining the heterogeneity in the accumulation of wealth in later life.

In this background, we study the association of cognitive traits and financial outcomes (wealth accumulation) in an emerging country like India at a family context. Our analysis relies on data from Pilot wave of the Longitudinal Aging Survey of India (LASI), a representative survey of Indians who are at least 45 years old. The LASI survey was fielded in four states: Karnataka, Kerala, Punjab, and Rajasthan.

Cognition and Economics: Theoretical framework

Cognitive skills have become increasingly important for work tasks over time (Broadberry, 1997; Spitz-Oener, 2006; Skirbekk, 2008). Schmidt and Hunter (1998) show that an individual's test scores on cognitive ability are more highly correlated with her labor market productivity than any other observable characteristic. Education, in addition to increasing cognitive skills and labor-market productivity, has significant spill over effects on non-market aspects of the individual's life and on society. Grossman (2006) has emphasized the causal role of education in increasing productivity in a number of non-market outcomes such as consumption, savings, own health, fertility and child health and cognitive development.

Whatever the origin of adult cognitive skills, financial matters are not straightforward for most individuals and may depend in part on their ability to invoke several dimensions of their cognitive skills. This may involve aspects of

(a) retrieving relevant prior financial information from memory,

(b) using one's accumulated knowledge and skills (Crystallised intelligence (Gc))

and

(c) the ability to draw inferences about what is the best solution to a novel problem (Fluid intelligence (Gf)) for details, see Cattell (1987); McArdle and Woodcock (1998).

A useful shorthand division of the principal dimensions of intelligence is to separate them into fluid intelligence (Gf) and crystallised intelligence (Gc). Fluid intelligence is the thinking part – memory, abstract reasoning and executive function. In contrast, crystallised intelligence is the knowing part – the main accumulation of influence from education and lifetime experience; for more details, see McArdle et al. (2002).

The cognitive measures listed above are intended to indicate different aspects of the adult cognitive profile (see McArdle et al., 2002). Prior research has suggested strong normative age declines in most of these cognitive functions, but a hierarchy of cognitive strengths and weakness of any individual are indicated in many aspects of adult daily functioning. At a most basic level, the need for an intact neuro-cognitive system is thought to be necessary to deal with everyday issues in communication and learning in the simple judgments needed for survival (e.g., gathering food and water). At another step up in everyday complexity, the ability to remember to complete tasks, to be able to react to simple stimuli, and the ability to deal with simple numerical problems, are important skills in the consideration in successfully dealing with everyday challenges (see Farias et al, 2008) Higher order aspects of cognitive skills, such as having expertise in a specific area (i.e., Crystallized Intelligence).

Other things equal, the value of acquiring financial knowledge is higher for persons who desire higher levels of retirement wealth because of a higher lifetime income, a lower rate of time preference or lower defined benefit pension wealth. Similarly, investment will be greater among persons who have lower costs or greater efficiency in acquiring additional knowledge because of greater fluid intelligence or because they have more financial knowledge obtained in their formal education or on-the-job.

Data

The data we use are from Longitudinal Ageing survey of India (LASI), a pilot survey conducted in four selected states in India. The LASI is modelled on the Health and Retirement Survey (HRS) of the United States and therefore is designed to be representative survey of individuals aged 50+ living in India. Though the first wave was completed in 2012, the data has not yet been released for public use and therefore we use the pilot wave of LASI that was conducted in 2010 among Indian states of Punjab, Rajasthan, Karnataka and Kerala based on 2001 census. Punjab and Rajasthan lie in the northern part of India, Karnataka and Kerala in the southern part. The states chosen are able to capture regional variations² as well as socioeconomic and cultural differences across India (Lee et al. 2011).

The multidisciplinary survey consisted of two main sections: the household interview and the individual interview³. The household module asks about physical environment and household finances, including income, expenditure, consumption, and assets, and could be completed by any knowledgeable household member who is referred as the financial respondent of the household. The individual module asks about demographics, family, social activities, health and health behaviours, cognition, work and pension, and includes biomarker collection are asked to age-eligible members of the household. It has to be noted that the household response rate was 88.6% and the individual response rate was 91.7% .

² Punjab is an economically developed state that benefitted significantly from the Green Revolution in the 1970s, while Rajasthan, comprising large tracts of desert, is relatively poor. Kerala stands apart in India in terms of social development indicators - it has close to 100% literacy and a relatively developed healthcare system. Karnataka is a prosperous state and the manufacturing hub for a number of large public-sector industries in India.

³ Survey questions were translated into languages common in these states (e.g., Hindi, Malayalam, Kannada and Punjabi), and interviews were done in the language of respondent's choice.

Sample

We exploit two key advantages of LASI. The first advantage is that if an individual is in the sample, the spouse/partner is most likely to participate. The second advantage is that in these multi-person households, the interviewer asked who is the most knowledgeable in relation to family finances, including matters of wealth. LASI designates this person as “Financial respondent” and collects all the responses of the questions relating to financial decision making. In fact, household characteristics or information on financial and physical wealth are collected only once (i.e from Financial respondent) from each household/couple. In contrast, individual characteristics and attributes such as health status, educational attainment, cognition and non-cognition personality traits and other socio-demographic variables are collected from each individuals of a household.

Our unit of analysis is married/co-inhabiting couples aged above 40 years. We are interested to examine the relationship between cognitive traits of between cognitive traits of both financial respondents and non-financial respondents (NFR) in relation to matters related to accumulation of wealth. Given that our unit of analysis is married/co-inhabiting couples, we exclude individuals who have never married, separated/divorced or widowed. Thus, out of the 1683 household members, we focus our analysis on the spousal data of 430 households (860 individuals) aged above 40.

2.3 Measurement

LASI interviewers provide information on various components of wealth which is used to construct values for physical wealth and financial wealth of each individual which constructs the total wealth in our model. Within each household, the financial respondent is asked whether they or (spouse/partner) hold, and their valuations of owner occupied dwelling, business or farm, livestock, jewellery and valuables, vehicles and farm equipment’s; savings deposit, other deposits including risky assets, post office deposits comprise of financial assets. Questions relating to debt are also enquired and information of mortgages on house, farm-land and business, debt owed to financial institutions, friends and family are collected. As for the cases where precise information is not provided, we have used the mid points of the unfolding brackets as the inputted data points for those who do not answer the original questions.

The first outcome variable used in our analysis is the value of net total wealth. It is obtained by subtracting the total wealth (sum of financial wealth⁴ and physical wealth) from mortgage and non-mortgage debt. We disaggregate the net total wealth into two components (1) net housing wealth and (2) net non-housing wealth as housing covers the lion share of total wealth in most cases in these four states. The level of house ownership is high among selected couples and this means that most of Indians accumulate wealth by home ownership where only 7 % of couple do not have a dwelling on their own either with a mortgage or not.

Cognitive traits

In LASI, cognitive abilities are measured using three measures namely episodic memory, mental status and numeracy which together measures Fluid Intelligence and Crystallised Intelligence. Each scale comprises of questions and responses which are later analysed and provided with suitable scores discussed in the Appendix A1. The scores could possibly run from 0 to 20. For example to measure the episodic memory, we use two memory measures: immediate and delayed word recall – which is available in LASI which together provide a composite score of 20⁵. Our second cognitive measure is the mental status questions of the Telephone Interview of Cognitive Status (TICS) battery established to capture intactness or mental status of individuals which are earlier used in studies by (Smith, Mcardle, & Willis, 2010; Onur & Velamuri, 2014). TICS questions consist of the following items –, naming today's date⁶ (month, day, year), and naming the Prime minister of India. Answers to these questions are aggregated into a single mental status score that ranges from 0 to 2.

The third measure of cognition we measure is numeracy (respondent's numerical ability) involving counting backwards 20 to 0, counting backwards 100 to 0, serial 7 subtraction from 100 (up to five times) and computation of two numerical questions where one is scored as correct or incorrect.. Nine scores are possible running from zero to nine depending on the number of correct answers. We include this measure based on the argument explored by Peter et al (2007) who argue that more numerate individuals may be more able to process information and make complex yet optimal financial decisions. Moreover numerate individuals also appear

⁵ . Respondents are read a list of ten simple nouns and are then asked first to immediately repeat as many of these words as they can in any order. After a five minute measurement of self-rated depression, they are then asked to recall as many of the original words as possible

⁶ Date naming as part of a Mini-Mental State Examination scale has been previously validated for the older Indian populations (Mathuranath et al. 2010)

to be more patient, and are thus more likely to have saved and invested in the past (Parker and Fischhoff 2005), less risk averse (Benjamin, Brown, and Shapiro 2013).

The cognitive measures listed above are intended to indicate different aspects of the adult cognitive profile (see McArdle et al., 2002) and we avoid the problem of life-cycle effects of cognitive traits and subsequent measurement error as we use the cross-sectional aspect of LASI⁷. Is there literature to support this hypothesis. Furthermore, as is common in the existing literature, we expect cognitive traits to be stable amongst adults, see, for example, Cobb-Clark and Schurer (2012, 2013) and, hence, fixed (i.e. time invariant), see Nyhus and Pons (2005) and Heineck and Anger (2010). This implies that they are not driven by the outcome of interest, i.e. wealth accumulation, and can effectively be deemed as plausibly exogenous

Other regressors

While our focus is on cognitive traits, we also control for characteristics that have found to be significantly influencing wealth accumulation. Focusing on individual characteristics, we include separate individual level control variables for financial respondents (FR) and non-financial respondents (NFR). Education is proxied by number of years of education of each spouse/partner. Caste, an important variable in the context of Indian population is also controlled. We include a categorical variable based on respondents' self-report: scheduled caste and scheduled tribe, other backward class (OBC), and all "other" caste or affiliations, including "no caste" affiliation. The scheduled castes (SCs) and scheduled tribes (STs) are two groups of historically-disadvantaged people recognized in the Constitution of India⁸ We construct a dummy variable 1 if the respondent is either a SC or ST and 0 otherwise and another dummy variable if the respondent is an OBC or not.

Also following the literature proposed by DeGraff (2014), that early life decisions have considerable impact on the wealth accumulation decisions on later life, we include a dummy

⁷ Whilst cognitive traits have been purged of life cycle effects, by also conditioning wealth accumulation on age this enables the age of the individual to have a direct influence upon their wealth accumulation behaviour in addition to the influence of age on cognitive traits.

⁸ They have often been excluded from education, public spaces (e.g., temples, wells for drinking water), and most other aspects of civil life in India (Subramanian et al., 2008). The primary criteria for delimiting ST includes traditional occupation, definitive geographical area, and cultural characteristics reflecting a range of tribal modes of life such as language, customs, traditions, and religious benefits. While less marginalized and stigmatized than scheduled castes or tribes, members of OBC are also recognized by the Indian government as being of relatively lower social status and having barriers to economic and educational opportunities

for early marriage keeping 1 or 0 otherwise. It is argued that age at first marriage might, for example, influence old-age wealth through the timing of family formation and maintenance expenditures. Later marriage can postpone the onset of expenses associated with setting up one's own household and supporting children, and also may be indicative of being better established prior to marriage more generally. We expect age at marriage to positively influence wealth in late life.

We also include household level variables for income and geographical dummies Three state dummies are created based on the location in order to take care of differences in asset prices, primarily housing and therefore dummy for Karnataka, dummy for Punjab, dummy for Rajasthan are created taking value 1 and 0 otherwise. The dummy for state of Kerala is considered the base. To account for the relationship between family structure and household wealth, we control for the number of children. Finally, we add, a measure of income of the household, a self-reported assessment of income of both FR and NFR.

Wealth distribution and statistical analysis

Table 1 illustrates the summary statistics of net total wealth, net housing wealth and net non-housing wealth. One can see that , without much surprise, the distribution of the wealth is skewed at distribution of wealth is skewed at the top end, with between two thirds and three quarters of couples having a value of net total wealth, net housing wealth or net non-housing wealth below the average value. One solution to the problem of right skewness in wealth is to take a logarithmic transformation. However, this transformation is troublesome for couples with negative or zero wealth.

Table 1 Distribution of net wealth, net housing wealth and net non-housing wealth

	Net Wealth	Net housing wealth	Net non-housing wealth
Q10			
Q25			
Q50			
Q75			
Q90			
Mean			
% with below average value			

% with above average value			
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As Table 1 shows, for example, 9.5% of couples have non-positive net non-housing wealth. An alternative solution is to transform wealth with the inverse hyperbolic sine function, as initially suggested by Burbridge, Magee, and Robb (1988) and subsequently employed by Carroll, Dynan, and Krane (2003) and Pence (2006). The inverse hyperbolic sine of wealth w is

$$g[w, \epsilon] = \frac{\ln[\epsilon w + (\epsilon w^2 + 1)^{1/2}]}{\epsilon} \tag{1}$$

Where $\hat{\epsilon}$ is an estimated scale parameter. Like the logarithmic transformation, $\ln w$; $\hat{\epsilon}$ downweights large values of wealth but has the advantage of retaining zero and negative values found in the original data.

We then model (transformed) wealth using quantile regression methods. As highlighted by Cameron and Trivedi (2010) and Davino, Furno, and Vistocco (2014), this approach allows one to study the impact of the regressors at different levels of the conditional distribution of the outcome variable, thereby allowing a richer understanding of the data. Using this method, we can investigate whether the effect of cognitive traits on wealth accumulation differs at different quantiles of the conditional distribution. In particular, we can investigate whether certain cognitive traits are more important for couples at the bottom of the wealth distribution as opposed to couples at the top of the distribution. For a given conditional quantile θ of (transformed) net wealth, the quantile regression can be formulated as follows

$$Q_\theta(W|X) = X\beta(\theta) \tag{2}$$

where $0 < \theta < 1$ and $Q_\theta(\cdot)$ denotes the conditional quantile function for the θ -th quantile of (transformed) net wealth W . We estimate quantile models at the 10th, 25th, 50th, 75th and 90th quantiles of the conditional distribution of (transformed) net wealth.

Results

Descriptive statistics

Summary statistics of the individual and household characteristics of 860 individuals and 430 couples in our sample are reported in Table 1. For individual characteristics we report the mean, standard deviation for both FR and NFR. For household characteristics we simply provide the mean and standard deviations in square brackets

Table 1: Summary statistics of the cognitive traits and other characteristics

	Financial respondent (FR)	Non-financial respondent (NFR)
Individual level characteristics		
TICS	5.42	5.27
Numeracy	1.71	1.64
Average recall	4.48	4.44
Dummy for female		
Age , mean	52.1	50.7
Education years, mean	11.7	9.8
Dummy for young marriage	0.24	0.36
Dummy for caste	0.31	0.30
Household characteristics		
Number of children	1.45	1.38
Household family income in the past one year	3.45	3.01

Table 1 shows that the Financial respondents score on TICS, numeracy and average recall are higher than the non-financial respondents. Also, in comparison with the non-financial respondents (NFR), the financial respondents are more likely to be male, more educated, less likely to be married early. There is no statistically significant difference for dummy for caste (SC/ST) and (OBC) among FR and NFR in our sample.

To illustrate, the nature of joint relationship between financial outcomes and spousal cognition scores, Table 2 provides the total house wealth against numeracy scores of husband and wife. Net total wealth increased as numeracy score rises and in particular couples with

higher numeracy had accumulate on average INR 1159406 compared to 319208 where neither spouse could answer any question correctly.

Table 2 : Total net wealth by gender/Spouse level

Husband/Wife	0	1	2	3
0	319208	308001	494332	692037
1	345428	334221	520552	718258
2	564065	552857	739189	936894
3	786576	775369	961700	1159406

Dwelling deeper into our variables of interest, namely the cognition variable, it is found that net total wealth, net non-housing wealth and net housing wealth all rise along with numeracy (Table 3). In order to exploit the FR and NFR classification, the data is further arranged in this specific way and the results are more dramatic in nature, when it comes to both net total wealth and net non-housing wealth. First of all, our measures of wealth net total wealth, net non-housing wealth and net housing wealth are generally higher when the numeracy scores of both financial and non-financial respondents are higher. Secondly, to we find that numeracy of financial respondent matter most, as revealed by the fact that five out of six off diagonal pairs of net financial wealth is larger if the higher numeracy score is that of the financial respondent. In the case of net-housing wealth, four out of six diagonal pairs is larger when the higher numeracy score is that of the financial respondent.

Table 3: Total net wealth by numeracy score of financial and non-financial respondent

Financial respondent/Non-financial respondent	0	1	2	3
0	319208.5	308001	494332	692037
1	345428.9	334221	520552	718258
2	564065	552857	739189	936894
3	786576	775369	961700	1159406

Our preliminary analysis of the components of cognitive ability namely numeracy has forced us to decipher an important issue whether financial decision making is symmetrically related to cognition. In many households in India, there is complete specialisation of financial decision making. In this background we incorporate the financial respondent (FR) and non-financial respondent (NFR) component, into the spousal analysis. For example, the cognitive ability of the financial decision maker (FR) may have more influence on the household wealth accumulation decision of the household. To explore this, we have arranged the cognitive measure by gender and by financially knowledgeable person in the household in Table 4A.

Table 4A: Means of cognition Variables by family members and whether financial respondent (sample of married couples)

	Male	Female	Financial Respondents	Non-Financial Respondents
	0	1	1	0
TICS (0-10)	5.39	5.30	5.42	5.27
Word Recall (0-10)	4.49	4.43	4.48	4.44
Numeracy (0-3)	1.86	1.50	1.71	1.64

Consider our stratification by gender. We find that TICS, the mental status is quite similar for husband and wife. The levels of memory are also a bit higher for women than male partners, while numeracy is higher among men. When we shift the data instead to financial and non-financial respondents, we find that financial respondents have advantage in all the cognitive measures, except in the case of TICS mental status, where a little difference is observed.

Table 4A and 4B stratifies the gender and by whether one is a financial respondent or not. For women there is a little difference in cognitive scores between those who are financial respondents or not. In contrast, for men, financial respondents appear to have higher cognitive scores than male non-financial respondents in all the three cognition measures.

Table 4B: Means of cognition variables by gender and financial respondent

	Male Financial Respondents	Male Non-Financial Respondents	Female Financial Respondents	Female Non-Financial Respondents
TICS (0-10)	5.33	5.46	5.51	5.09
Word Recall (0-10)	4.46	4.55	4.49	4.34

Numeracy (0-3)	1.88	1.85	1.54	1.44
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Models of household wealth

In this section, we report our empirical results which describe the relation of dimensions of cognition of both spouses to wealth accumulation among middle-aged and older adults. We estimate separate models for three financial outcomes: net total wealth, net housing wealth and net non-housing wealth. These models are estimated over a sample of married couples.

The models are estimated in level form (in calendar year 2010) and the estimated coefficients are associated standard errors (in brackets) are listed in Table 6. As discussed above, standard non-cognition variables like gender of the respondent (female =1), caste dummies (SC/ST=1) and (OBC=1). Further, individual characteristics like age, early life decisions like age left education, and a dummy for young marriage are also added for financial and non-financial respondents. We also include household characteristics like number of children and dummies for states along with log of household income. Cognition measures are treated separately for financial and non-financial respondents. Missing values are included in all models for people who did not respond and those who prefer not to reveal their responses.

Table 5 provides the estimates of the relationship between cognitive attributes of both spouses/partners and the three financial outcomes for their households. Wealth levels (net total, net non-housing wealth, net-housing wealth) are lower for lower castes where the levels are lower for the SC/STs when compared to other back ward castes (OBC). The wealth levels are positively influenced by education of both partners and negatively if the partners are married at young age. The coefficients of household variables like number of children reveals that negative effect on the wealth accumulation of all variables. Turning our attention to the household income, we find that coefficient displays a positive effect.

Table 5: Relationship of total wealth to cognition of both net housing and non-housing wealth

Variable	Net total wealth	SE	Net housing wealth	SE	Net non-housing wealth	SE
TICS FR	0.395**	(0.003)	0.077	(0.023)	-0.14*	(0.020)

Numeracy FR	12.50**	(0.002)	9.40**	(0.003)	14.30*	(0.132)
Average recall FR	4.741*	(0.112)	-1.338	(0.022)	-3.14*	(0.024)
TICS NFR	5.54	(0.003)	0.973	(0.003)	0.142	(0.003)
Numeracy NFR	8.43*	(0.002)	4.44**	(0.002)	7.32**	(0.002)
Average recall NFR	3.95	(0.112)	-3.102	(0.112)	1.112*	(0.112)
Age FR	9.39*	(0.002)	4.21**	(0.003)	-0.427*	(0.003)
Age NFR	10.26**	(0.112)	4.656**	(0.002)	0.002*	(0.002)
Education years FR	6.804**	(0.003)	1.580**	(0.112)	0.788**	(0.112)
Education years NFR	5.77**	(0.002)	2.95**	(0.003)	5.36**	(0.003)
Dummy for young marriage	-1.12**	(0.112)	-3.45**	(0.002)	-1.34**	(0.002)
Dummy for female	-2.86*		-1.11*	(0.112)	-2.14**	(0.112)
Household characteristics						
Dummy for caste SC/ST	-3.12**	(0.003)	=5.86**	(0.112)	-9.36**	(0.003)
Dummy for caste OBC	-1.21**	(0.002)	-1.09***	(0.003)	-2.56**	(0.002)
Number of children	-1.12**	(0.112)	-3.45**	(0.002)	-1.34**	(0.002)
Household family income in the past one year	2.78**	(0.112)	5.44**	(0.112)	4.44***	(0.003)

As far as cognitive variables are concerned, we find there is less systematic evidence for the TICS mental status and average recall cognition measure in explaining the three wealth accumulation variables. It has to be noted that except for net total wealth (where estimated effects of TICS mental status and average recall are higher for financial respondent than nonfinancial respondent), the effects of both aforementioned cognitive variables remained similar for financial and nonfinancial respondents in the case of net-housing variables and net non-housing variables. In the case of numeracy, the estimated impact on financial respondents are higher than nonfinancial respondents for all the wealth measures.

The extreme degree of heterogeneity and the right skewness in the net total wealth and left skewness in the terms of net housing wealth and net non-housing wealth could imply that estimated mean may not characterise many individuals in the sample. In this background, we attempt to estimate quantile models estimated at 25, 50, 75 and 90th percentile for net total wealth, net non-housing wealth and net housing wealth for our spousal sample.

Quantile regression results

In this section we report our empirical results of the quantile regression which describes the relation of cognitive variables of both spouses to transformed (net total wealth, net non-housing wealth and net housing wealth). First, we focus on the net wealth and then turn to net housing and net non-housing wealth

Net total wealth

Table 8 reports the results of the quantile regression (for transformed net total wealth). Focusing on the cognitive traits, results are presented after conditioning them on various individuals and household characteristics. It is evident from Table 7 that cognitive traits (TICS mental status and numeracy) of the FR appear to be strongly related to accumulation of net total wealth. While, numeracy and TICS mental status have positive impact at higher quantiles of net wealth for FR, a lower impact with no systematic relationship is found for NFR. The increase is even steeper for numeracy for FR implying a much lower estimated impact for NFR is particularly for the case of higher quantiles of net total wealth. In contrast no meaningful associations are found for average word recall in the case of FR and NFR.

Turning to individual non-cognitive traits, years of education seems to have consistent positive effect across the wealth distribution, with exception to the 10th and 25th quartile. The other early life decision variable namely the decision to marry early has negative impact on the wealth distribution and is more pronounced in the left side of the quantile distributions. In the case of age wealth, has been increasing at a decreasing rate for both partners (FR and NFR).

Caste dummies play a significant role in determining the wealth accumulation, where as expected low caste dummies have a negative impact which is consistent across all wealth levels. The dummy of SC/ST has significantly more impact than dummy for OBC, reflecting the fact that households belonging to SC/ST community have lesser probability to accumulate wealth than OBCs.

Also geographic locations are an important determinant for wealth accumulation, where households located in Punjab and Kerala than in Karnataka and Rajasthan have accumulated more wealth. This result is in line with our expectations where the housing prices and financial wealth has been significantly higher in Punjab and Kerala owing to higher financial activity.

In the case of household characteristics, we find that higher the number of children in the household, the lower the wealth accumulation, but however this does not hold true at higher

levels. The household income is an important determinant of wealth accumulation and higher the incomes of the household the higher wealth are reflected.

Table 6 Quantile regression of the net total wealth

Individual characteristics								
	Q25		Q50		Q75		Q90	
Numeracy FR	11.48**	(0.132)	21.001*	(0.11)	33.96**	(0.101)	65.00*	(0.07)
TICS FR	0.916**	(0.06)	0.820**	(0.04)	5.039**	(0.07)	6.885*	(0.02)
Average recall FR	1.880**	(0.01)	1.779**	(0.12)	1.165**	(0.06)	12.8*	(0.07)
Numeracy NFR	3.22*		4.65	(0.01)	17.25**	(0.23)	55.60*	(0.05)
TICS NFR	0.017*	(0.06)	-0.0181	(0.02)	2.88**	(0.05)	3.44**	(0.12)
Average recall NFR	-0.0562	(0.97)	-0.023	(0.23)	-0.334	(0.05)	-0.989	(0.24)
Dummy for young marriage	-11.2**	(0.05)	-12.22**	(0.09)	-8.93**	(0.03)	-0.02**	(0.33)
Dummy for SC/ST	-12.23**	(0.12)	-10.33**	(0.23)	-8.73**	(0.02)	-3.12**	(0.09)
Dummy for OBC	-8.23*	(0.23)	-6.75**	(0.06)	-3.12**	(0.07)	1.13**	(0.08)
Age left education FR	2.86**	(0.10)	5.54**	(0.11)	14.40**	(0.04)	6.63**	(0.07)
Age left education NFR	2.13**	(0.03)	3.221**	(0.33)	14.33*	(0.07)	10.68*	(0.06)
Household characteristics								
Number of children	-0.56**	(0.22)	-0.86**	(0.08)	0.012	(0.09)	0.36**	(0.02)

Household income	2.74**	(0.02)	5.144**	(0.08)	6.56*	(0.09)	10.66*	(0.34)
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Net housing wealth and net non-housing wealth

We also perform additional supplementary analyses to determine whether the results are similar when we decompose net wealth into (transformed) net housing wealth (Table 6) and net non-housing wealth (Table 7)⁹.

Several key results emerge. First, numeracy and TICS of the FR are once again strong determinants of wealth accumulation. While numeracy and TICS is significantly correlated with net housing wealth (Table 6), only numeracy is significantly correlated with net non-housing wealth only in higher quantiles (Table 7). Second, average recall of the FR and NFR are not associated with all forms housing and non-housing wealth. This association is negative and larger in magnitude at lower quantiles. Third, the cognitive traits predominantly numeracy of the FR are more important than those of the NFR in shaping the accumulation of net total wealth including net housing wealth and net non-housing wealth.

In caveating these results, it is important to point out that there is not a large degree of portfolio diversification in these Indian states with regards to the holding of financial assets. Our preliminary analysis has suggested that among most of the LASI cohorts owner-occupied housing wealth accounts for about 70% of LASI respondents' total wealth. Disaggregating net wealth in this manner may not be the most optimal manner to analyse the results. Consequently, in the section that follows, we limit our commentary to discussion of results for net wealth, unless otherwise specified.

The third observation encompassing a consistent message numeracy and TICS mental ability the FR were more important predictors of wealth accumulation than those of the NFR requires a detailed investigation. Table 6 revealed that the cognitive characteristics of the NFR do not significantly predict wealth when adjusted for cognitive characteristics of the FR. This finding is in line with our hypothesis that the cognitive traits of the individual designated the person most knowledgeable about the household finances will exert more of an influence on a variable that constitutes a long run indicator of financial planning behaviour (i.e. wealth accumulation). Besides, table 2 displays that having a higher mean number of years of

⁹ Tables are provided upon request

education, the FR scored significantly higher on the numeracy, TICS compared to the NFR averages (Table 2). These findings are potentially informative because they suggest that a rational choice is occurring within couple pairs that the more educated and higher numerate among the dyad assumes the responsibility for managing the household finances. Thus, while we do not dispute the fact that many financial decisions are made by consensus agreement at the couple level, the results would seem to indicate that the traits of the FR predominate. That the effects of personality on wealth are more important for the FR compared with the NFR is an important finding as it suggests that intervention strategies designed to incentivise saving/provision for retirement should target the FR.

Discussion

Numeracy and wealth

Numeracy of the FR was found to be positively associated with wealth controlling for the cognitive characteristics of the NFR (Table 3). When we decomposed net wealth into net housing wealth and net non-housing wealth, we found that numeracy was significantly associated with net housing wealth for the FR at the 50th and 75th quantiles of the distribution (Table 5). By contrast, numeracy of the FR was only significantly associated with net non-housing wealth above the 50th percentile of the conditional distribution (Table 6).

But what are the life-course pathways through which this cognitive trait contributes to wealth? One possibility is that it could be that more numerate people make better informed financial decisions. Interestingly, laboratory-based studies of financial risk taking have shown that individuals who are more numerate take more risks to achieve a gain (Lauriola & Levin, 2001), whereas less numerate individuals tend to over-estimate risk (Butler & Mathews, 1987) which motivates a preference for loss avoidance. Secondly, recognising that many financial decisions are taken at the household level, it could be argued that high numeracy of the FR may moderate the spending preferences of the NFR, all other things being equal. Indeed, there is even some evidence that individuals in couple pairs with spendthrift tendencies are more likely to select a partner with thrifty tendencies to help balance the relationship (Rick, Small, & Finkel, 2011).

TICS and Wealth

TICS of the FR was found to be positively associated with wealth controlling for the cognitive characteristics of the NFR (Table 3). When we decomposed net wealth into net housing wealth and net non-housing wealth, we found that TICS was significantly associated with net housing wealth for the FR at the 75th and 90th quantiles of the distribution (Table 6). By contrast, TICS of the FR was only significantly associated with net non-housing wealth above the 10th and 25th percentile of the conditional distribution (Table 7). One possible explanation for the finding that a TICS seems to matter more at the lower end of the wealth distribution is that households have to be more discerning about their consumption pattern when resources are scarce compared to when resources are plentiful. Under these circumstances, TICS mental skill may be particularly important because a higher level of acquired wealth provides a buffer against potential future financial shocks.

Average recall and wealth

Although none of the associations were statistically significant, there was a general tendency for average recall to be positively associated with net wealth however at left side of the quartiles. When we decomposed net wealth into net housing wealth and net non-housing wealth, we found that TICS was not significantly associated with net housing wealth and net non-housing wealth. Besides, this we could not establish any systematic relationships for this trait.

4.7. Limitations

The study has several limitations. Firstly, cognitive traits were measured at the same time as the dependent variable so reverse causality remains a concern. Secondly, we had a substantial number of couple pairs who were excluded from the analysis because: (a) one of the persons within the couple pair did not participate in LASI, or (b) they were missing information on wealth. We attempted to overcome the second problem by imputing for missing cases where wealth was missing, and these sensitivity analyses revealed that the trends in the data were very similar. Thirdly, there is little portfolio diversification in Indian states and the majority of Indian people's wealth is bound up in the asset value of residential property which limits our ability to look at individual components of wealth such as savings and financial investments. Finally, these may not hold in other cultural contexts because of differences in welfare systems that may differentially incentivise or disincentivise

savings behaviour, or because of differences in how these personality traits are rewarded and reinforced within countries (Hofstede & McCrae, 2004). For example, as the recent worldwide financial crisis has shown, some countries naturally value prudence in fiscal matters whereas other countries may adopt or encourage financial investment and risk-taking.

4.8. Strengths

The study also has a number of strengths. It employs a gold standard measure of cognitive ability measurement. We are also able to control for a wide range of covariates that could possibly confound the association between personality and wealth such as early life decisions such as marriage, which may contribute to wealth. Thirdly, it examines the putative causal role of cognition on wealth accumulation by focusing on the financial dynamic within the household (i.e. FR versus NFR) rather than stratifying by gender as others have done (e.g. Duckworth & Weir, 2010), and finding that the cognitive characteristics of the FR matter more.

4.9. Conclusions and policy implications

Overall, our empirical findings indicate that cognitive ability is important in shaping individuals' economic and financial decision-making. Our paper contributes to the limited but expanding literature exploring the implications of cognitive traits for economic outcomes in later life among older couples in emerging economies. Our results have the potential to not only enhance our understanding of economic decision making within couples, but also to expand the spectrum of policy options that could be used to assist households to have adequate resources in retirement. It is becoming increasingly clear that Government messages implying telling people to save more for their retirement is not enough to change behaviour. In essence, this comes down to whether Governments should 'shove' or 'nudge' people to provide more for their retirement. One potential solution is to completely ignore individual differences in the propensity to save and force individuals (i.e. shove) to provide more for retirement through automatic (mandatory) enrolment in a pension scheme (e.g. Australia's superannuation scheme). However, in designing such schemes, one has to give consideration to unintended consequences. It is entirely plausible that in doing so, Governments may disincentivise additional savings for retirement if individuals assume that the contributions made through automatic enrolment are adequate to a comfortable retirement (Hardcastle, 2012). What is needed is a well-designed series of behavioural 'nudges' or choice architectures that leverage individual differences in dispositional tendencies and natural preferences to incentivise saving for retirement.

There are few concrete examples of how we can nudge people with different personality traits to increase savings for retirement as behavioural economics is still in its infancy but it may still be possible. For example, tax incentive schemes that provide tax relief for individuals making additional voluntary contributions might be a useful economic lever for numerate individuals. Future studies should be designed to ascertain whether these behavioural insights and techniques are effective in promoting, incentivising and sustaining the savings rate among individuals with different cognitive traits.

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