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Locus of control and savings☆

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ABSTRACT

This paper analyzes the relationship between individuals' locus of control and their savings behavior, i.e. wealth accumulation, savings rates, and portfolio choices. Locus of control is a psychological concept that captures individuals' beliefs about the causal relationship between their own behavior and life events. We find that households with an internal reference person (a main respondent who believes that he/she can generally control relevant aspects of life) save more in terms of levels and, in some cases, as a percentage of their permanent incomes. Although the locus-of-control gap in savings rates is largest among rich households, the gap in wealth accumulation is particularly large for poor households. Finally, our findings indicate that households with an internal reference person are in a better position to save in forms that are harder to access (such as pension wealth) than otherwise similar households with an external reference person.

1. Introduction

Governments increasingly regard households' savings rates, asset portfolios, and wealth levels as key targets for public policy intervention. The United States, for example, has explicitly made asset accumulation a key component of its antipoverty strategy (Beverly and Sherraden, 1999; Sherraden, 1991), while many countries are striving to increase the incentives for personal savings in an effort to ensure that the elderly have adequate resources in retirement (e.g. Hubbard et al., 1994). The range of policy options being considered and adopted has expanded as economists' understanding of savings behavior has evolved. Most important has been the introduction of "temptation" and "self-control" into economic models of inter-temporal decision making, in particular consumption and savings decisions (Levin, 1998; Shefrin and Thaler, 1988; Thaler and Shefrin, 1981). The key implication of these expanded, behavioral models is that revealed preferences no longer necessarily equal normative preferences opening the door for paternalistic regulation to help people avoid choices that they will later regret (Bernheim et al., 2013; Kooreman and Prast, 2010; O'Donoghue and Rabin, 1999; Thaler and Benartzi, 2004; Thaler and Shefrin, 1981).[1]

The goal of this paper is to contribute to this emerging policy debate by empirically analyzing the link between individuals' locus of control and their savings behavior. Locus of control is a psychological concept which emerged out of social learning theory more than 50 years ago. It is perhaps best described as "a generalized attitude, belief, or expectancy regarding the nature of the causal relationship between one's own behavior and its consequences" (Rotter, 1966, p. 2). Those with an external locus of control gen-

☆ This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the author and should not be attributed to either DSS or the Melbourne Institute. The authors are grateful for financial support from the Australian Research Council (DP110103456 and DP150104247) and the CSIRO-Monash Superannuation Research Cluster.

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[1] In contrast, neoclassical models typically point to better information or the elimination of capital market imperfections as the primary options for enhanced savings policy.

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erally attribute life's outcomes to external factors (e.g. fate, luck, other people, etc.) while those with an internal locus of control believe that much of what happens in life stems from their own actions. Psychologists argue that a key driver of both self-control (Rosenbaum, 1980) and motivation (i.e. effort) (Bandura, 1989; Goldsmith et al., 2000; Skinner, 1996) is an individual's belief that his or her actions will lead to the desired outcome. Thus, perceptions of control are central to understanding individuals' ability to avoid immediate temptation and achieve their long-term goals.

Our analysis takes advantage of the Household, Income and Labour Dynamics in Australia (HILDA) Survey, which provides us with extremely detailed data on both assets and financial liabilities for a large, nationally-representative sample of households at three separate points in time. Much of the previous research has relied on cross-sectional or retrospective, self-assessed savings measures and our ability to directly examine savings behavior using longitudinal measures of wealth accumulation is quite rare in the international context (Bloxham and Bett, 2009). Specifically, we investigate a broad range of household savings measures including (i) wealth accumulation; (ii) savings rates; and (iii) portfolio allocations. Finally, the HILDA data contain detailed measures of locus of control and allow us to control for a range of factors, including other non-cognitive skills, which may be related to savings behavior.

We make several contributions to the literature. First, we examine the savings behavior of couple-headed households – across the entire age spectrum – conditional on the characteristics of both partners. This focus on households rather than individuals is important given the public-good nature of families' most important asset: housing. In addition, we are the first to analyze the relationship between perceptions of control and savings at multiple points of the unconditional savings distribution in order to assess whether locus of control has similar effects on poor and wealthy households' savings behavior. Finally, we assess the role of locus of control in shaping asset portfolios (conditional on net worth) by estimating a system of asset equations with cross-equation restrictions imposed to ensure that the adding-up requirement is met (see Blau and Graham, 1990). This is a substantial improvement over research that examines individual assets in isolation. Taken together, our results shed light on the relationship between perceptions of control and wealth formation – a key component of overall economic well-being – and point to policy initiatives that may support households' savings behavior.

We find that households in which the reference person has an internal locus of control save more in terms of levels and, in some cases, as a percentage of their permanent incomes than do households with external reference persons. The locus-of-control gap in savings rates is largest among rich households. Despite this, the gap in wealth accumulation associated with locus of control is particularly important for poor households at the bottom of the wealth distribution. Finally, locus of control is also related to the way that equally wealthy households allocate their wealth across asset types. Households with an internal reference person and average net worth hold significantly less financial wealth, but significantly more pension wealth, than otherwise similar households with an external reference person.

The paper proceeds as follows. In Section 2, we briefly discuss the theoretical underpinnings of behavioral savings models and review the limited evidence linking locus of control to savings decisions. Our data, estimation sample, variable specification, and descriptive statistics are outlined in Section 3. The estimation strategy is presented inSection 4 and results can be found in Section 5. Finally, we present our conclusions and suggestions for future research in Section 6.

2. Locus of control and savings decisions

Neoclassical models of consumer behavior – for example, Modigliani and Brumberg's (1954) life-cycle theory of saving or Friedman's permanent income hypothesis (1957) – model consumer behavior as the outcome of an optimization problem in which lifetime expected utility is maximized subject to an inter-temporal budget constraint and the available information set. Such models have been the backbone of most economic analysis of consumption and savings decisions for decades. Yet there has also been extensive debate about whether or not the predictions of life-cycle models do, in fact, characterize household behavior.[2] Shefrin and Thaler (1988, pg 611) were among the first to argue that "a model of saving that omits temptation is misspecified". They instead put forward a 'behavioral life-cycle hypothesis' in which willpower represents the psychic cost associated with exercising the self-control necessary to resist immediate gratification and achieve long-term savings goals.

In contrast to neoclassical models, behavioral life-cycle theory emphasizes the importance of mental accounting, framing, and self-control in understanding inter-temporal savings decisions. Mental accounting, for example, allows individuals to resist temptation by treating various components of their wealth as non-fungible (e.g. Shefrin and Thaler, 1988; Thaler, 1990; Levin, 1998; Graham and Isaac, 2002). Marginal propensities to consume can, therefore, depend on how wealth is "framed", i.e. how it is allocated across assets with different degrees of temptation (Levin, 1998). Mental accounting and framing assist individuals in maintaining self-control.

Throughout its development, behavioral life-cycle theory has drawn heavily on psychology's long tradition of studying perceptions of control as the basis for human behavior. In particular, voluminous psychological literatures have evolved on several closely-related control concepts including locus of control, self-mastery, self-efficacy, perceived behavioral control, neuroticism, etc. These notions of control are not necessarily independent and are often considered to be markers of the same higher-order concept (Judge et al., 2002). Importantly, Rosenbaum (1980) views self-mastery (i.e. locus of control) as one component of self-control more generally arguing that 'before a person applies any specific self-controlling skill he must believe that he can control his own behavior without outside help' (p. 111).[3] Although not formally included in the Big-Five taxonomy, locus of control is related to the Big-Five factors of neuroticism and emotional stability (Almlund et al., 2011). Given this, it is not surprising that a rapidly growing literature links locus of control to numerous economic outcomes including earnings, unemployment, job search, occupational choice, educational attainment, life satisfaction, and investments in health (see Cobb-Clark et al., 2014; Cobb-Clark, 2015, and the references therein). There is also intense interest in understanding the origins of locus of control. In particular, psychologists argue that locus of control develops during childhood and stabilizes in adolescence (see Kulas, 1996). Moreover, there is evidence that parenting behavior (Carton and Nowicki, 1994) and socio-economic status (Stephens and Delys, 1973) are both linked to the development of internal control tendencies. Finally, although the evidence is inconclusive, locus of control may evolve over the life-cycle as physical and mental health changes.[4]

[2] For a sense of this debate see Shefrin and Thaler (1988), Browning and Crossley (2001), and DellaVigna (2009).

[3] Richards (1985) provides empirical evidence on the link between Rotter's (1966) locus of control scale and Rosenbaum's (1980) Selfcontrol schedule.

[4] See Gatz and Karel (1993) and Coleman and Deleire (2003) for particularly helpful reviews.

Behavioral savings theory has given rise to a new generation of empirical studies that seek to understand the relationship between cognitive and non-cognitive skills, on the one hand, and savings patterns, on the other. Zagorsky (2007), for example, finds that although individuals with higher IQs earn more, having a higher IQ does not necessarily result in greater wealth and can sometimes increase the probability of being in financial difficulty. Less numerate individuals, however, do appear to have lower wealth levels (Banks and Oldfield, 2007) and be more likely to make financial mistakes (Agarwal and Mazumder, 2013). Cognitive ability is also associated with having more patience and a greater willingness to take risks (Dohmen et al., 2010). As both can be directly linked to portfolio decisions, it is perhaps not surprising that the propensity to hold risky assets increases with numeracy, verbal fluency, memory, and IQ even after accounting for education (Christelis et al., 2010; Grinblatt et al., 2011; Smith et al., 2010).[5] On balance, however, any differences in asset accumulation do not necessarily translate into larger falls in post-retirement incomes, consumption levels, or well-being for those with a lack of numerical skills (Banks et al., 2010).[6]

The more limited empirical literature on the relationship between non-cognitive skills and savings patterns has generally focused on the role of personality as measured by the Big Five taxonomy.[7] Boyce and Wood (2011), for example, find that the marginal utility of income depends on personality traits. Given this, it is not surprising that outcomes resulting from savings and consumption decisions can be linked to personality. Specifically, openness to experience and extraversion influence the amount of unsecured debt and financial assets held by individuals (Brown and Taylor, 2011). Conscientiousness is associated with more retirement saving, while agreeableness is associated with less (Duckworth and Weir, 2011).

Much of the remaining evidence is based on measures that are only indirectly related to savings (e.g. financial planning, financial problems, etc.) and/or self-control (e.g. conscientiousness, propensity to plan, hypothetical choices, etc.). Moffitt et al. (2011), for example, finds that a measure of childhood self-control predicts adults' propensity to live in low SES households, have financial problems, and plan their finances, while those who describe themselves as "impulsive spenders" are more likely to be behind in their credit card payments (Gathergood, 2012). Households' with a higher propensity to plan their finances accumulate more wealth, which Ameriks et al. (2003) argue is evidence of the "effortful self-control" of those who budget and plan their finances. In related research, Ameriks et al. (2007) ask individuals a series of questions about the inter-temporal allocation of a hypothetical prize in an effort to identify those with self-control problems. The authors find that the more individuals' anticipated behavior deviated from their ideal behavior (either positively or negatively) the lower is their non-retirement financial assets.[8] Finally, several researchers have exploited randomized controlled trials in developing countries to show that the provision of savings products increases the propensity to save (Dupas and Robinson, 2013; Ashraf et al., 2006), suggesting that self-control may be related to savings.

We are aware of only two other studies that directly investigate the relationship between perceptions of control and savings behavior. Specifically, Salamanca et al. (2013) investigate whether the propensity to hold risky assets is related to economic locus of control once economic preferences (risk and time preference) and socioeconomic characteristics are controlled. Chatterjee et al. (2011) analyze NLSY data and find that, among primary earners in their 30s and 40s, higher self-efficacy is related to greater wealth creation and a higher propensity to hold financial assets. We extend this previous research by analyzing the role of perceived control in the wealth accumulation, rate of savings, and asset portfolios of couples.

3. Data

Our analysis relies on data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, a nationally representative household panel study. The HILDA Survey began in 2001 with 7682 households (19,914 individuals) and was extended by an additional 2153 households (5477 individuals) in 2011. Interviews are conducted annually with all adult members (aged 15 years and above) of the household on a broad range of core issues including labor market outcomes, family dynamics, as well as economic and social well-being. The Survey contains rotating modules on selected topics, including wealth and non-cognitive skills, in certain years (Summerfield et al., 2012). Specifically, HILDA includes wealth modules in 2002, 2006, and 2010, which are designed to provide detailed measures of households' assets and liabilities.[9]

We are particularly interested in wealth accumulation as a measure of savings, and restrict our analysis to couples who stay together for at least four years, i.e. over the time period 2002–2006, or 2006–2010, or both. We impose this sample restriction because our analysis makes use of lagged measures over a four-year period that refer to the same couples. We restrict our sample to couple-headed households in which both spouses are between 25 and 75 years old. Finally, we exclude about 10 percent of the couples meeting these sample restrictions due to missing information on at least one of our variables of interest. The resulting estimation sample contains 1785 couples in 2006 and 1470 couples in 2010.[10]

3.1. Wealth and asset measures

Our measure of wealth – total net worth – is derived from detailed measures of assets and liabilities that are collected at the household level (see Headey, 2003). We have information on five broad asset types including financial wealth, business equity, real estate equity, vehicles, and pensions. Specifically, net financial wealth is defined as the sum of total interest earning assets in banks and other institutions, total stocks and mutual funds, and total other investments (life insurance, trust funds, and collectibles), minus the total value of unsecured debt (including car loans). Business equity captures the net value of all business assets owned by the couple, while real estate wealth includes equity in the primary residence, holiday homes, and other properties. Vehicle wealth equals the total value of all transport (e.g. cars,

[5] See Curcuru et al. (2009) for a review of the literature on heterogeneity in asset portfolios.

[6] There is also a related literature which finds that financial literacy is associated with greater wealth, more stock holding, and a greater likelihood of planning for retirement (see Lusardi and Mitchell, 2007; 2008; van Rooij et al., 2011; Jappelli and Padula, 2013). Financial literacy, however, is best viewed as an important human capital investment rather than an innate trait (see Jappelli and Padula, 2013). In particular, Lusardi et al. (2013) argue that endogenous investments in financial knowledge have the potential to explain a large proportion of the inequality in wealth.

[7] The Big Five taxonomy classifies individuals by the degree to which they exhibit five personality traits: openness to experience, conscientiousness, extraversion, agreeableness and neuroticism (see Goldberg, 1992 and the references therein, especially Tupes and Christal, 1961 and Norman, 1963).

[8] See Seiler (2013) for a critique of this approach to measuring self-control.

[9] The data used in this paper were extracted using the Add-On package PanelWhiz v4.0 (Oct 2012) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz generated DO file to retrieve the HILDA data used here are available upon request. Any data or computational errors in this paper are our own. Hahn and Haisken-DeNew (2013) and Haisken-DeNew and Hahn (2010) describe PanelWhiz in detail.

[10] Our results are robust to the exclusion of business owners from the sample and business assets from our measure of wealth.

trucks, etc.) and recreational (e.g. boats, caravans, etc.) vehicles, while pension wealth captures the current value of the couple's pension entitlements.[11] Finally, we define total net worth as the sum of financial wealth, business equity, real estate equity, vehicles, and pensions.[12]

These measures provide high-quality information over time on wealth levels and asset portfolios. Response rates to the HILDA wealth modules are high and statistical imputation is undertaken for those households that can not provide information on some wealth components (see Headey et al., 2005; Marks et al., 2005).[13] Bloxham and Bett (2009) compare wealth measures constructed from HILDA data to those generated by the Reserve Bank of Australia and the Australian Bureau of Statistics using data from financial institutions, national income accounts, and cross-sectional surveys. They conclude that HILDA data are reliable and result in wealth measures that are broadly similar to those derived from other sources with any disparities due to differences in scope rather than data quality.[14]

By taking the difference in household wealth over a four-year period, we are left with a measure of savings that includes both "active" and "passive" savings because households may either change savings rates by active or passive choice. Our analysis is not limited to a measure of "active" savings for two reasons. First, while stock prices have declined considerably between 2006 and 2010, house prices have continued to increase over this period in Australia. We do not have the data to net out changes for both the housing market and the stock market to construct a measure of "active" savings. Second, households can choose to consume from either "active" or "passive" savings at any point (albeit with different transaction costs). Therefore, the accumulation of "passive" savings is driven not only by market prices, but also by households' active decision not to consume them.

3.2. Locus of control measure

In 2003, 2004, 2007 and 2011 HILDA respondents were asked the seven original items of the Psychological Coping Resources component of the Mastery Module developed by Pearlin and Schooler (1978). Fig. 1 shows the wording of each item and the distribution of responses. Mastery captures beliefs about the extent to which life's outcomes are under one's own control. Although the definition of mastery differs somewhat from Rotter's (1966) original definition of locus of control, the two concepts – and the scales used to measure them – are very similar. For clarity, we use the term "locus of control" when describing our results.[15] Locus of control is conceptually related to the broader concept of self-control and locus of control items are included in Rosenbaum's (1980) Self-Control Schedule which is used to measure self-control.

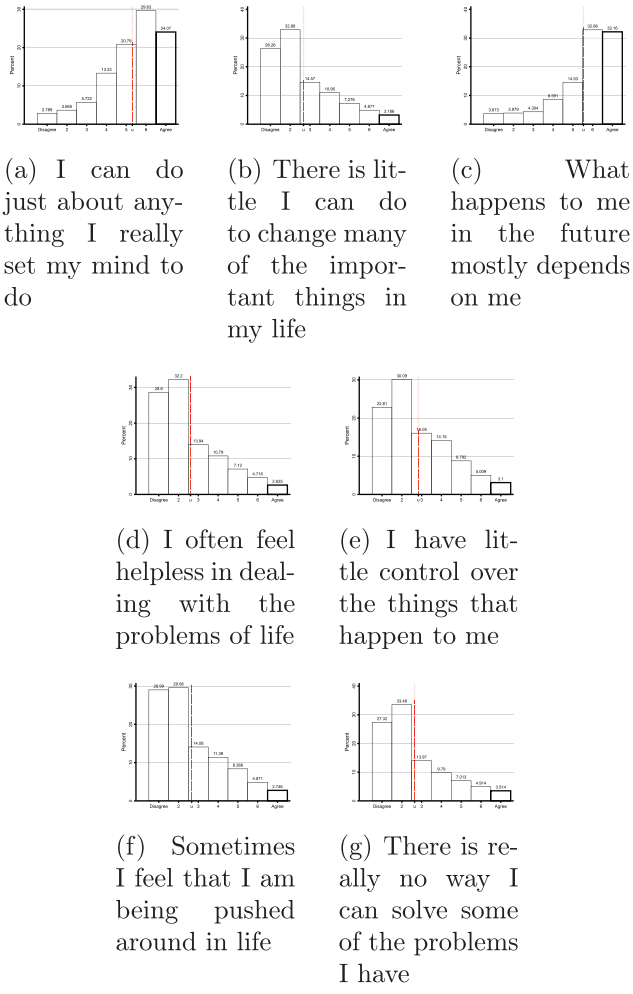

Fig. 1. Distribution of subcomponents of locus of control.

We use factor analysis to construct an overall index measuring locus of control (see Piatek and Pinger, 2010; Cobb-Clark et al., 2014). Specifically, we use factor loadings obtained from individual predictions as weights and construct a weighted index which is based on all seven items and is increasing in internal control tendencies. To facilitate interpretation, we standardize the index to have a mean of 0 and a standard deviation of 1. Our results are robust to an alternative index that weights each item equally.

Using HILDA data, Cobb-Clark and Schurer (2013) demonstrate that locus of control is relatively stable over time and does not appear to be influenced by a series of life events. Any variation in individuals' responses to the items measuring locus of control appears to be the result of random noise. Consequently, we minimize any measurement error in our locus of control measure by averaging our index across the years in which the underlying items are observed. We average the locus of control scores over 2003 and 2004 for the 2006 sample and over 2003, 2004 and 2007 for the 2010 sample such that locus of control and wealth are not contemporaneous, but that locus of control is measured before wealth. This minimizes concerns about reverse causality.

Finally, we construct an indicator variable for having an internal locus of control which equals 1 if the respondent is in the top 50

[11] Our measure of pension wealth mainly includes employer and employee contributions to superannuation at a household level. Pension wealth in Australia stems from compulsory saving through the superannuation guarantee and voluntary superannuation saving. The superannuation guarantee, which is funded through compulsory employer contributions, has been mandatory in Australia since 1992 (Nielson, 2010). Employers are required by law to contribute at least 9.5% of their employee's wages and salaries into superannuation funds (Australian Parliament, 2014). The superannuation guarantee covers adult employees who earn at least $450 a month (before tax) (Ward, 2008). Both employers and employees can make voluntary superannuation contributions and some employees are eligible for government co-contributions (Henry, 2008).

[12] All wealth, asset, and income measures are in 2010 Australian dollars.

[13] We follow standard practice in including these imputed cases in our analysis in order to avoid bias against larger households which are more likely to experience item non-response (see Headey et al., 2005).

[14] For additional information on the quality of the HILDA wealth data see Headey et al. (2008) and Wilkins (2013).

[15] In fact, psychologists argue that it is possible to distinguish (and measure) a number of closely related concepts (in particular, mastery, self-efficacy, and locus of control) which together comprise a broader notion of what is referred to as "perceived behavioral control" (see Ajzen, 2002).

percent of the locus of control distribution and 0 otherwise.[16] We then identify the partner with the most internal locus of control and attribute the locus of control of this partner to the couple, referring to this individual as the "reference person".[17]

3.3. Controls

Our analysis controls for a number of other factors that have been found to be important wealth determinants. Life-cycle theory suggests that it is the permanent component of current income upon which savings and consumption decisions – and ultimately wealth accumulation – are based (Friedman, 1957). Consequently, we control for permanent income using the natural logarithm of real net financial year disposable household income averaged over 2001 to 2010. To obtain a measure of disposable household income that does not suffer from the correlation between wealth and capital income, we ensure that disposable household income is based exclusively on non-capital income. Specifically, we remove capital components (the amount of interest from banks, other financial institutions, bonds, debentures, cash management trusts, family or other private trust funds and interest from loans to other persons not in the households, and income from company shares, managed funds and property trusts) from our disposable income measure to obtain a permanent income measure that does not include capital income.

We also account for a range of demographic characteristics that are likely to influence wealth accumulation through their effects on expenditure patterns or preferences for precautionary savings. Because wealth accumulation occurs at the household level, we include separate control variables for both the reference person and the spouse. Specifically, we control for the reference person's gender and the age of both partners. Educational attainment of each partner is accounted for by a set of indicator variables denoting the highest level of education obtained (i.e. postgraduate degree, graduate diploma/certificate, bachelor's degree, diploma, any certificate, grade 12 completion, and less than grade 12). To account for the relationship between family structure and household wealth, we further control for the number of dependent children in the household under the age of 25 as well as for whether or not the reference person has ever been divorced.

Previous research has found that personality traits are related to various dimensions of wealth, including individuals' marginal utility of income (Boyce and Wood, 2011), their level of retirement saving (Duckworth and Weir, 2011), and the amount of unsecured debt and financial assets they hold (Brown and Taylor, 2011). Consequently, we distinguish the effect of locus of control on wealth patterns from the effect of other non-cognitive skills by controlling directly for personality traits as measured by the Big Five (Goldberg, 1992).[18]

Finally, we also include measures of individuals' risk preferences and planning horizons as additional control variables in our model. Risk preferences are measured by the self-reported amount of financial risk that individuals are willing to take with regard to spare cash (cash used for savings and investments). We create an indicator variable that is equal to 1 if the willingness of individuals to take financial risks is above average, and 0 otherwise. Our measure of individuals' planning horizons is based on the time period that individuals report to find most important when planning their saving and spending. We use this information to generate an indicator variable that is equal to 1 if a person reports that the next week or the next few months are most important for planning saving and spending, and 0 otherwise. Appendix Table A.6 presents the means and standard deviations of the control variables in 2006 and 2010 by the reference person's locus of control.

3.4. Descriptive evidence: net worth and locus of control

Table 1 contains information on the distribution of total net worth and the value of individual assets by year and locus of control of the household's reference person. Households in which the reference person has an internal locus of control have higher levels of net worth – both in total and across all asset types – in each of the three years in which wealth is measured. Over time, the median wealth gap between households with an internal versus external reference person increases from approximately $57,000 in 2002 to $124,000 in 2006 and then rises slightly to $125,000 in 2010. Although very few (approximately 1 percent) of households report that they have zero or negative net worth, those that do are more likely to have a reference person with an external locus of control. Together, these differences result in a disparity in the cumulative household wealth distributions of reference persons with an internal versus external locus of control (see Fig. 2).

In order to assess the magnitude of the wealth gap associated with locus of control across the entire wealth distribution, we estimate simultaneous conditional quantile regressions of net worth, (W_{it}), on our indicator of whether or not the reference person has an internal locus of control. Specifically, we estimate

$$W_{it} = \alpha_0^\tau + \alpha_1^\tau I_i + \varepsilon_{it}^\tau, \quad (1)$$

where τ reflects the respective τ-decile of the wealth distribution and I is the indicator variable capturing the locus of control of the household's reference person. Households are indexed by i and t indexes time ($t = 2002, 2006, 2010$). Eq. (1) is estimated simultaneously at all deciles of the wealth distribution and the estimated coefficients and standard errors are presented in the first two columns of each panel of Table 2. As we condition only on the reference person's locus of control, the estimates obtained from these conditional quantile regressions capture the raw wealth gaps associated with locus of control at different points of the wealth distribution. The equality of the locus-of-control wealth gap across the wealth distribution is strongly rejected.[19]

The results in Table 2 indicate that – across the entire distribution – households in which the reference person has an internal locus of control hold significantly higher levels of wealth than households in which the reference person is external. The magnitude of the gap relative to levels of net worth (see column 3) is U-shaped, with relative gaps larger at the bottom and top of the

[16] To examine the robustness of our results with regard to alternative measures of locus of control, we have used the 25th and the 75th percentile as alternative thresholds to differentiate between internal and external locus of control. We find that the savings gap increases when we consider 75% of the households as internal and declines when we consider 75% of the households as external households. Changing the threshold does not affect our results qualitatively. The correlation in partners' locus of control is 0.7 which is statistically significant at the 1% level.

[17] We also performed our analysis using the main earner, the husband, and the financial decision-maker in the household as the reference person. The results obtained from these alternative definitions do not differ qualitatively from those presented in the paper.

[18] In 2005 and 2009, HILDA employed a 36-item inventory based on Goldberg (1992) and Saucier (1994) to measure personality traits. Principal component analysis was used to derive the contribution of each item to the five personality traits. Since personality traits are generally stable over time (Cobb-Clark and Schurer, 2013), we average over the available data to reduce measurement error and standardize the result to have mean 0 and standard deviation 1.

[19] Simultaneous estimation across different values of τ allows the variance-covariance matrix of the different α_1^τ to be obtained and the significance of the wealth gap associated with locus of control at points of the distribution to be tested (see Zhang, 2002). The equality of $\hat{\alpha}_1^\tau$ at all values of τ was tested and rejected using an F test.

Table 1
Net worth and assets by year and locus of control.

	Internals			Externals		
	Mean	SD	N	Mean	SD	N
2002						
Net Worth						
Net Worth	787,511.52	1,099,686.05	892	593,380.26	690,964.51	901
Median Net Worth	470,886.08	834,057.27	892	413,955.70	748,355.46	901
Net Worth if > 0	796,988.02	1,102,550.68	883	605,108.98	691,751.01	887
% > 0	0.988	0.107	892	0.982	0.133	901
Components of Net Worth						
Net Financial Wealth	116,250.62	349,949.39	892	88,784.86	262,271.10	901
Business Equity	88,863.40	443,533.40	892	38,003.48	241,265.05	901
Housing Equity	365,943.47	543,796.88	892	287,522.53	321,011.01	901
Vehicles Equity	35,380.19	68,745.62	892	29,422.18	38,897.17	901
Pensions	181,073.84	271,835.37	892	149,647.22	223,366.51	901
2006						
Net Worth						
Net Worth	1,159,438.48	1,797,034.30	881	830,221.63	1,109,772.92	904
Median Net Worth	676,573.03	826,726.51	881	552,247.19	656,005.61	904
Net Worth if > 0	1,173,505.06	1,800,577.46	872	846,559.11	1,112,767.96	889
% > 0	0.990	0.101	881	0.982	0.132	904
Components of Net Worth						
Net Financial Wealth	141,933.08	485,127.67	881	120,889.39	446,502.98	904
Business Equity	117,715.27	588,820.68	881	56,974.50	427,557.55	904
Housing Equity	619,322.95	1,165,963.34	881	439,168.41	531,539.17	904
Vehicles Equity	36,888.98	50,353.51	881	32,328.65	41,157.10	904
Pensions	243,578.21	364,603.82	881	180,860.68	271,814.19	904
2010						
Net Worth						
Net Worth	1,136,843.62	1,386,907.69	755	861,274.22	907,063.61	715
Median Net Worth	745,750.00	967,468.75	755	620,544.00	880,327.77	715
Net Worth if > 0	1,146,941.90	1,386,576.26	748	871,500.98	904,247.70	706
% > 0	0.993	0.084	755	0.991	0.096	715
Components of Net Worth						
Net Financial Wealth	144,720.06	480,934.94	755	76,370.00	241,733.96	715
Business Equity	85,979.60	436,548.50	755	57,097.82	308,464.64	715
Housing Equity	608,035.47	729,940.87	755	494,090.84	540,460.52	715
Vehicles Equity	38,642.23	44,954.49	755	33,013.27	40,379.64	715
Pensions	259,466.26	354,607.44	755	200,702.29	284,571.08	715

Note: Weighted numbers based on weights provided by HILDA.

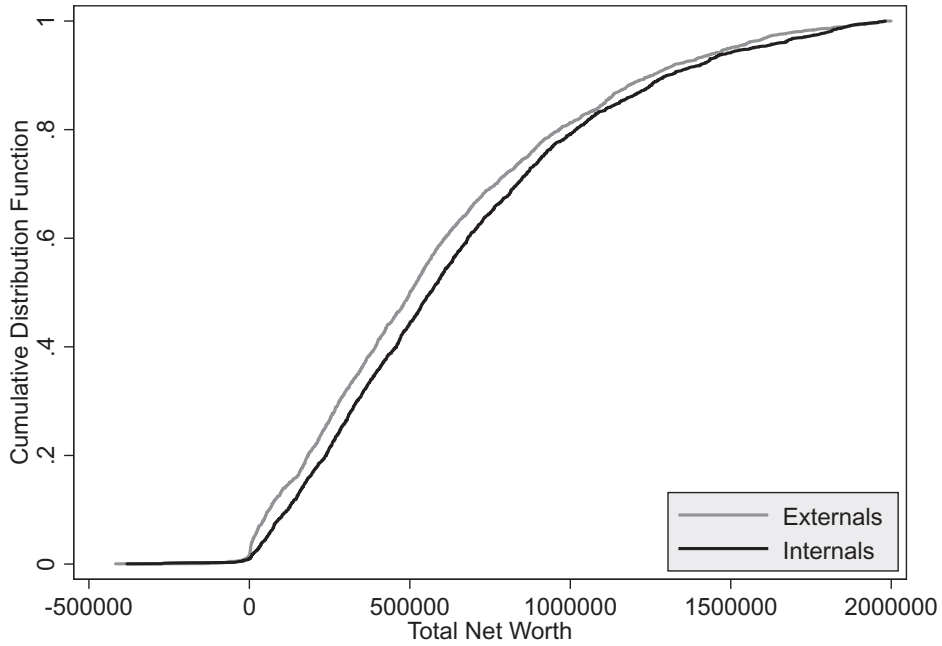

Fig. 2. Net worth distribution by locus of control note: figure based on pooled sample including data from 2002, 2006, and 2010. Underlying sample restricted to levels of net worth between - $500,000 and $2,000,000.

Table 2
Locus-of-control wealth gap by year.

Percentile	2002				2006				2010			
	Gap	Std. Error	Net Worth	Ratio	Gap	Std. Error	Net Worth	Ratio	Gap	Std. Error	Net Worth	Ratio
	Simultaneous quantile regression coefficient and standard error											
10th	37,570	13,907	80,246	0.468	86,771	38,504	181,124	0.479	79,400	32,484	178,208	0.446
20th	37,848	23,298	168,481	0.225	79,775	22,801	323,792	0.246	77,800	40,826	341,000	0.228
30th	34,411	20,188	258,861	0.133	110,281	33,253	460,470	0.239	79,300	31,701	489,500	0.162
40th	41,051	23,469	341,772	0.120	115,056	32,107	568,848	0.202	93,700	31,773	600,040	0.156
50th	56,930	35,228	464,557	0.123	124,326	35,855	693,258	0.179	125,206	49,748	775,000	0.162
60th	100,759	33,165	623,418	0.162	148,679	39,727	864,607	0.172	131,200	51,756	952,990	0.138
70th	130,886	45,988	802,532	0.163	181,685	52,303	1,108,315	0.164	171,235	85,882	1,197,300	0.143
80th	124,438	60,061	1,017,342	0.122	288,558	81,531	1,489,888	0.194	201,808	118,114	1,626,000	0.124
90th	456,165	113,367	1,712,614	0.266	667,090	134,602	2,376,404	0.281	681,000	232,702	2,425,175	0.281
Observations	1,793				1,785				1,470			

Note: See Note to Table 1. Bootstrap standard errors (100 replications).

wealth distribution (see columns 4, 8, and 12). Thus, although the absolute size of the wealth gap is largest among households in the top decile of the wealth distribution, the relative disparity in wealth associated with locus of control is particularly important among poor households. Among the poorest 10% of households, those with an internal reference person are between 45 and 48% wealthier than those with an external reference person.

4. Wealth accumulation

4.1. Estimation strategy

We begin by analyzing the relationship between locus of control and households' wealth accumulation. Our goal is not to provide an estimate of the causal effect of locus of control on savings behavior, but rather to understand the heterogeneity in savings associated with couples' control perceptions. Consequently, we regard this as a descriptive analysis. With few exceptions, researchers interested in the determinants of wealth typically estimate marginal effects only at the mean of the wealth distribution. We go beyond this, however, to also consider the potential for locus of control to have differential effects on the savings behavior of poor versus wealthy households. We are aware of only one other study that takes a distributional perspective when addressing a similar issue. Banks et al. (2010) estimate the effect of IQ on wealth at different points of the wealth distribution using the classic conditional quantile regression estimator developed by Koenker and Bassett (1978). The difficulty, however, is that their estimated marginal effects can only be interpreted with respect to the distribution of wealth (Y) conditional on wealth determinants X – i.e. only among individuals with the same IQ, age, education, etc. (Alejo et al., 2011; Fournier and Koske, 2013). This conditional distribution effectively corresponds to the error distribution, i.e. $F(Y|X) = F(\varepsilon)$, not the wealth distribution $F(Y)$ itself (Froehlich and Melly, 2010; Ker, 2011).[20] Therefore, as is often the case, their conditional quantile results are difficult to interpret and may be irrelevant from a policy perspective (see Ker, 2011; Borah and Basu, 2013).

We therefore turn to unconditional quantile regression in order to estimate marginal effects at various quantiles of the overall wealth distribution. We use the method recently developed by Firpo et al. (2009), which relies on a "recentered influence function" to essentially reweight the dependent variable so that the mean of the reweighted variable corresponds to the quantile of interest. This then allows OLS to be applied directly to the reweighted dependent variable.[21] In addition to allowing us to estimate marginal effects at various points of the overall wealth distribution, unconditional quantile regression retains the advantages of quantile regression more generally. Specifically, unlike standard OLS estimation, quantile regression is not sensitive to outliers and non-normality (Baum, 2013) – both of which are highly likely in the wealth context. Distribution quantiles are also invariant to monotonic transformations of the dependent variable, e.g. log transformations (Koenker, 2005), while data censoring is unproblematic in quantile regression (Powell, 1986).

The unconditional quantile approach developed by Firpo et al. (2009) relies on an influence function (IF) at each quantile τ of the distribution of Y, which is defined as:

$$\mathrm{IF}(Y; q_\tau) = (\tau - \mathbf{1}\{Y \le q_\tau\})/f_Y(q_\tau), \tag{2}$$

where q_τ is the value of the cumulative distribution of Y at the τth quantile and $f_Y(\cdot)$ is the marginal density function of Y. The recentered influence function simply recenters the influence function so that its mean corresponds the distribution value at the percentile of interest. Specifically,

$$RIF(Y; q_\tau) = q_\tau + \mathrm{IF}(Y; q_\tau). \tag{3}$$

Unconditional quantile regression involves estimating the expectation of the recentered influence function conditional on a set of covariates X, i.e. $E[\mathrm{RIF}(Y; q_\tau)|X]$). For simplicity, a linear relationship between the two is typically assumed so that

$$E[\mathrm{RIF}(Y; q_\tau)|X] = X'\beta^\tau. \tag{4}$$

We use this approach to estimate two models. The first captures the effects of locus of control on wealth levels accounting for previous net worth four years earlier. This allows us to assess the role of locus of control in households' wealth accumulation over a four year period. The second links locus of control to the savings rate (relative to household income) over the same period. Banks et al. (2010) adopt a similar approach in estimating the effect of cognitive function and numeracy on retirement wealth trajectories. Specifically, we assume that the growth in a household's net worth

[20] This distinction implies, for example, that someone who is in the 50th percentile of the wealth distribution conditional on their IQ and other characteristics might be in the 75th percentile of the overall wealth distribution (Borah and Basu, 2013). Moreover, an individual's conditional wealth quantile may change as covariates change (Froehlich and Melly, 2010).

[21] Firpo et al. (2007) show that OLS may be viewed as a special case of the unconditional quantile regression model. The authors also develop a second estimator that assumes a logistic model and a third estimator that does not make any functional form assumptions. They show that results based on the different estimators are very similar to each other. All estimation is done using the RIF-Regression STATA ado file from Firpo et al. (2009) which can be downloaded at http://faculty.arts.ubc.ca/nfortin/datahead.html.

is given by:

$$E[\text{RIF}(W_{it};q_\tau)|X_{it}] = \beta_0^\tau + \beta_1^\tau W_{it-4} + \beta_2^\tau W_{it-4}\times I_i + \beta_3^\tau I_i + \beta_4^\tau T_{t=2010} + Z'_{it}\beta_5^\tau + \varepsilon_{it}^\tau, \quad (5)$$

where W_{it} is the level of net worth of household i ($i = 1,\ldots,N$) at time t ($t = 2006, 2010$), I_i is an indicator of whether or not the reference person has an internal locus of control, T_t is a dummy variable for the year 2010, and Z_{it} is the set of control variables including characteristics for both reference persons and their partners as described above. The inclusion of $T_{t=2010}$ allows household wealth levels to differ in the periods before and after the Global Financial Crisis. We are particularly interested in β_3^τ which measures the disparity in wealth levels for households in which the reference person is internal as opposed to external and in β_2^τ which captures disparities in the rate of wealth accumulation for these households.[22]

We also estimate the determinants of the household savings rate. Specifically,

$$E[\text{RIF}((W_{it}-W_{it-4})/Y_i;q_\tau)|X_{it}] = \gamma_0^\tau + \gamma_1^\tau I_i + \gamma_2^\tau T_{t=2010} + Z'_{it}\gamma_3^\tau + \varepsilon_{it}^\tau, \quad (6)$$

where the saving rate $(W_{it}-W_{it-4})/Y_i$ is the difference in total net worth W_{it} over a four year period in relation to the total permanent income received over those same four years (Y_i).[23] The coefficient of interest is γ_1^τ which captures the difference in the savings rate between internals and externals.

4.2. Results

We estimate four specifications for each of the wealth models given by Eqs. (5) and (6). The first controls only for the reference person's locus of control, an indicator for 2010 and, in the model of wealth levels, for lagged wealth as well as its interaction with locus of control. The second is a parsimonious specification that adds age, gender and education as controls. The third specification also accounts for the number of children, marital history and Big Five personality traits. Household permanent income is included as an additional control variable in the third specification of the model of wealth levels. The forth specification includes risk aversion and planning horizons as additional control variables. Comparing results across specifications sheds light on the extent to which the raw wealth gap associated with locus of control (see Tables 1 and 2) is the result of disparity in other related factors, for example income or personality traits.

We report OLS coefficients, unconditional quantile regression coefficients, and robust standard errors in Table 3 for wealth levels and in Table 4 for savings rates.[24] Unconditional quantile regression coefficients can be interpreted as the marginal effects associated with each quantile τ of the unconditional wealth (or savings rate) distribution (Firpo et al., 2009), while OLS coefficients capture the marginal effect at the mean. Finally, we report the total marginal effect of a change in locus of control on wealth levels accounting for both its main effect (β_3^τ) as well as its interaction with lagged wealth (β_2^τ).[25]

Households' wealth levels are strongly positively related across years. Among households with an external reference person, each dollar of wealth held four years ago is associated with $0.72 in current wealth on average (see Column 1, Panel A of Table 3). The skewness of household wealth results in an inter-temporal relationship in net worth that is much weaker when evaluated at our particular distribution quantiles than when evaluated at the mean however. Poor households have $0.21 in current net worth for every dollar of net worth they held four years previously, while wealthy households hold $0.69 for every dollar of previous wealth. Interestingly, the inter-temporal relationship in wealth is significantly weaker – though still positive – for households with an internal reference person. Poor households with an internal reference person, for example, have a relationship between current and prior wealth levels that is approximately half that of households with an external reference person (i.e. $0.21 vs. $0.11), while the inter-temporal relationship in wealth is −$0.21 (approximately one third) smaller among wealthy households. Banks et al. (2010) also find evidence of a significantly positive inter-temporal relationship in wealth levels for individuals aged 50-61, but find that the relationship is significantly negative for individuals aged 65 and older.[26]

Households with an internal reference person accumulate significantly more wealth over time – i.e. save more – than do households that were equally wealthy four years earlier, but have an external reference person. The locus-of-control wealth gap ranges from $3,136 at the mean to between $145,179 (25th percentile) to $256,649 (75th percentile) across the distribution. Table 3 also reports total marginal effects which combine these savings gaps with differences in the inter-temporal relationship in wealth (see above) to provide an estimate of the overall impact of locus of control for households. The results demonstrate that poor households (25th percentile) accumulate $55,229 more wealth over a four year period if the reference person is internal, while rich households (75th percentile) accumulate $85,770 more. The size of these locus-of-control wealth gaps is remarkably similar irrespective of how wealthy households are, though they are smaller than that estimated by OLS at the mean of the distribution ($137,493) which is consistent with the skewness in household wealth levels.

The magnitude of the locus-of-control gap in wealth accumulation is somewhat smaller once we control for age, gender and education (Panel B). Nonetheless, the disparity in current wealth levels associated with reference persons' locus of control remains almost unchanged. Similar to the results in Panel A, the OLS estimate is larger ($135,420) than the corresponding estimates at other points of the distribution.

Average marginal effects decline when we include permanent income, the number of children, marital history and Big Five personality traits as control variables in our model (see Panel C of Table 3). Permanent income, in particular, is an important determinant of wealth levels with each dollar of permanent income being associated with between $2.86 (poor households) and $5.50 (wealthy households) in current net worth. Finally, including our measures of risk aversion and planning horizon (Panel D) reduces the wealth gap associated with locus of control, suggesting that parts of the gap may be the result of differences in these factors. However, the wealth gap remains substantial and statistically significant among poor ($37,214) households, becoming somewhat larger ($44,651) but statistically insignificant at the 75th percentile. As we are accounting for previous wealth levels and a range of other characteristics, this indicates that wealth accumulation is associated with locus of control particularly for households in the

[22] As quantile regression is not sensitive to outliers, we estimate the model in levels not logs.

[23] Recall that permanent income equals average real net financial year disposable household income over all the years the reference person is observed between 2001 and 2010.

[24] Complete results are presented in Appendix Tables A.2 and A.8.

[25] Specifically, given a model with an interaction term of the form $Y = b_0 + b_1X_1 + b_2X_2 + b_3X_1X_2 + e$, the respective average marginal effects of X_1 and X_2 may be written as $\hat{b}_1 + \hat{b}_3\overline{X}_2$ and $\hat{b}_2 + \hat{b}_3\overline{X}_1$, where hats denote estimated parameters and overbars indicate sample averages. The standard errors may be obtained from a reparameterized model of the form $y = a_0 + c_1X_1 + c_2X_2 + b_3(X_1 - \mu_{X_1})(X_2 - \mu_{X_2}) + e$, where $\hat{c}_1 = \hat{b}_1 + \hat{b}_3\overline{X}_2$ and $\hat{c}_2 = \hat{b}_2 + \hat{b}_3\overline{X}_1$.

[26] Differences in estimation strategy make it impossible to directly compare the magnitude of our results to Banks et al. (2010).

Table 3
Determinants of net worth, unconditional quantile regression (coefficients and standard errors).

	OLS	Q25	Q50	Q75
Panel A				
Lag hh net worth	0.72***	0.21***	0.33***	0.69***
	(0.09)	(0.03)	(0.04)	(0.08)
Lag worth x Locus of control	0.16	−0.11***	−0.14***	−0.21**
	(0.10)	(0.03)	(0.05)	(0.09)
Internal locus of control	3136.05	145179.42***	173412.77***	256649.08***
	(66834.45)	(33763.73)	(41420.27)	(70505.72)
Average marginal effects:				
Lag household net worth	0.80***	0.15***	0.26***	0.58***
	(0.05)	(0.02)	(0.03)	(0.05)
Internal locus of control	137493.57***	55229.46***	54695.44**	85770.59*
	(35880.07)	(21358.44)	(25880.97)	(44836.04)
Panel B				
Lag hh net worth	0.68***	0.16***	0.27***	0.59***
	(0.08)	(0.03)	(0.04)	(0.07)
Lag worth x Locus of control	0.17*	−0.09***	−0.12***	−0.17**
	(0.10)	(0.03)	(0.04)	(0.08)
Internal locus of control	−9946.50	139011.54***	168688.93***	238882.84***
	(63221.34)	(29713.91)	(35641.16)	(61699.40)
Average marginal effects:				
Lag household net worth	0.76***	0.11***	0.21***	0.51***
	(0.06)	(0.01)	(0.02)	(0.04)
Internal locus of control	135420.48***	63225.64***	66701.10***	94514.71**
	(35582.03)	(20246.49)	(24494.43)	(42855.91)
Panel C				
Lag hh net worth	0.60***	0.13***	0.23***	0.54***
	(0.08)	(0.02)	(0.03)	(0.06)
Lag worth x Locus of control	0.13	−0.11***	−0.15***	−0.20***
	(0.09)	(0.02)	(0.04)	(0.07)
Internal locus of control	−9819.26	143262.29***	181901.83***	246233.18***
	(63715.26)	(29883.49)	(36450.00)	(66484.63)
Permanent income	7.31***	2.86***	4.08***	5.50***
	(1.42)	(0.32)	(0.42)	(0.71)
Average marginal effects:				
Lag household net worth	0.67***	0.07***	0.16***	0.44***
	(0.05)	(0.01)	(0.02)	(0.04)
Internal locus of control	102628.37***	54170.18***	59144.76**	76320.47
	(33478.81)	(20532.22)	(24813.93)	(46426.29)
Panel D				
Lag hh net worth	0.58***	0.11***	0.20***	0.50***
	(0.08)	(0.02)	(0.03)	(0.06)
Lag worth x Locus of control	0.14	−0.10***	−0.13***	−0.19***
	(0.09)	(0.02)	(0.04)	(0.07)
Internal locus of control	−31477.56	118609.46***	146188.77***	199808.68***
	(63035.38)	(29043.25)	(35062.56)	(64400.90)
Permanent income	7.01***	2.54***	3.60***	4.88***
	(1.43)	(0.30)	(0.40)	(0.70)
Average marginal effects:				
Lag household net worth	0.65***	0.06***	0.13***	0.40***
	(0.05)	(0.01)	(0.02)	(0.04)
Internal locus of control	88039.44***	37214.75*	34742.66	44651.46
	(33253.58)	(20192.71)	(24294.83)	(45857.10)

Note: N=3,255. Control variables: Panel A: Year 2010; Panel B: Same as Panel A plus age, gender and education; Panel C: Same as Panel B plus permanent income, number of children, marital history and Big Five personality traits; Panel D: Same as Panel C plus risk aversion and planning horizon. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

bottom half of the wealth distribution. Bernheim et al. (2013) argue that poverty undermines the ability to exercise self-control, while wealth sustains it. Our results suggest that whatever self-control poor households possess is particularly relevant in understanding their economic well-being.

It is important to note that wealth accumulation was significantly lower between 2006 and 2010 than it was between 2002 and 2006. Everything else equal, households saved on average $202,000 less in the period encompassing the 2008 financial crisis than they did in the previous four year period (see Appendix-Table A.2). These changes are consistent with evidence that there was a large decline in equity prices which by March 2009 had reduced the wealth of Australian households by almost 10 percent. Approximately half of this decline was reversed by the end of November 2009 (Australian Bureau of Statistics, 2010).

We turn now to consider the relationship between the reference person's locus of control and the household's savings rate as a fraction of its permanent income (see Table 4). We find that – on average and across the entire distribution – households in which the reference person has an internal locus of control save a greater proportion of their permanent income. These differences are small and insignificant among households that do not save a lot (25th percentile), but become substantial among households in the top half of the savings rate distribution. At the median, households with an internal reference person save 6.6 percentage points more of their permanent income, while at the 75th percentile this gap is 13.5 percentage points. The locus-of-control gap in savings rates becomes smaller at the 25th percentile and median of the savings distribution, but larger at the 75th percentile, once we account for age, gender and education (Panel B) as well as permanent income,

Table 4
Determinants of savings rate, unconditional quantile regression (coefficients and standard errors).

	OLS	Q25	Q50	Q75
Panel A				
Internal locus of control	4.607	2.319	6.575*	13.475**
	(13.047)	(3.830)	(3.496)	(5.677)
Year: 2010	−68.430***	−30.612***	−30.683***	−40.974***
	(12.952)	(3.883)	(3.513)	(5.672)
Constant	81.695***	5.445*	47.024***	107.173***
	(10.299)	(3.009)	(2.903)	(4.796)
Control variables	No	No	No	No
Observations	3,255	3,255	3,255	3,255
Panel B				
Internal locus of control	2.715	−0.283	5.263	14.246**
	(12.930)	(3.814)	(3.489)	(5.687)
Year: 2010	−69.789***	−28.622***	−31.859***	−43.685***
	(13.362)	(3.880)	(3.480)	(5.644)
Constant	62.551*	80.864***	33.639***	27.852*
	(33.764)	(11.692)	(10.169)	(15.927)
Control variables	Yes	Yes	Yes	Yes
Observations	3,255	3,255	3,255	3,255
Panel C				
Internal locus of control	5.329	−0.480	5.345	16.827***
	(14.221)	(4.085)	(3.827)	(6.325)
Year: 2010	−69.545***	−28.273***	−31.554***	−43.586***
	(13.505)	(3.887)	(3.485)	(5.615)
Constant	109.285**	86.761***	35.022***	39.425**
	(50.299)	(13.849)	(12.667)	(19.789)
Control variables	Yes	Yes	Yes	Yes
Observations	3,255	3,255	3,255	3,255
Panel D				
Internal locus of control	1.650	−1.185	2.759	12.562**
	(14.467)	(4.090)	(3.848)	(6.404)
Year: 2010	−66.046***	−27.439***	−29.114***	−39.686***
	(13.693)	(3.922)	(3.499)	(5.611)
Constant	132.157**	95.140***	49.776***	59.947***
	(51.350)	(14.415)	(13.260)	(21.540)
Control variables	Yes	Yes	Yes	Yes
Observations	3,255	3,255	3,255	3,255

Note: See notes to Table 3.

number of children, marital history and Big Five personality traits (Panel C). Consistent with the findings presented in Table 3, we observe that the estimated coefficients decline if we include risk aversion and planning horizon as control variables in our model (Panel D). Finally, we find that on average households that have an internal reference person save a larger proportion of their permanent income than do their external counterparts. These OLS results are imprecisely estimated, however, which is consistent with the added efficiency of quantile regression if the errors are non-normal (Baum, 2013). Overall, these results are consistent with Chatterjee et al. (2011) who similarly find a positive relationship between self-efficacy and savings rates measured relative to initial wealth.

Not surprisingly, the savings rate was substantially lower in 2006–2010 than in 2002–2006. Specifically, wealth accumulation as a fraction of permanent income earned over the same period was 27.4 percentage points lower in poor households and 39.7 percentage points lower in wealthy households (Appendix-Table A.8). This is in line with U.S. trends, for example, where the ratio of household wealth to disposable personal income reached its peak in 2006 before reaching its lowest level in 2009 (Cooper and Dynan, 2013).

Taken together, these results indicate that the locus of control of a household's reference person is clearly related to the household's savings behavior in ways that are consistent with behavioral models which argue that self-control assists in achieving long-term economic goals. These relationships persist even after we account for a range of other factors that are themselves influenced by locus of control.

5. Asset portfolios

5.1. Estimation strategy

Behavioral savings models imply that tension between temptation and self-control drives not only the amount of wealth that households accumulate, but also the way that they hold it. In particular, maintaining self-control is easier and less costly if households allocate their wealth to assets with lower degrees of temptation and regard the various components of their wealth as non-fungible (e.g. Levin, 1998; Thaler, 1990). The actual savings decisions that households make, however, depend critically on whether they are "sophisticated" (i.e. aware of their self-control issues) or "naive" (unaware of their self-control issues). Sophisticated households are expected to allocate their wealth in ways that help them maintain self-control and achieve their long-term goals, while naive households may not. We investigate this proposition by analyzing whether households with an internal reference person – and presumably more self-control – allocate their wealth differently across asset types than do households in which the reference person is external. Unlike the previous literature, which typically considers specific assets in isolation (e.g. Bogan and Fertig, 2013; Grinblatt et al., 2011; Chatterjee et al., 2011), we simultaneously analyze five mutually exclusive and exhaustive components of net wealth: (1) financial wealth, (2) business equity, (3) real estate equity, (4) vehicles, and (5) pensions.

Our simultaneous asset model requires estimation of marginal effects at the mean of the distribution, leaving the results sensitive to outliers and non-normality. The standard approach in this situation would be to take a log transformation of the dependent variable. However, while less than two percent of households have negative net worth overall, it is not uncommon for households to hold zero (or negative) amounts of individual assets. Thus, we need an estimation strategy that can account for non-positive asset holdings. We therefore adopt an inverse hyperbolic sine transformation – denoted as $sinh^{-1}$ –, which is also defined for zero or negative values (Cobb-Clark and Hildebrand, 2006; 2009). This function is similar to a log transformation as it is essentially the log transformation for positive values and a negative log transformation for negative values (Burbidge et al., 1988).

We estimate the following reduced-form model of asset composition:

$$E[sinh^{-1}(A_{ikt})|X_{it}] = \delta_0^k + \delta_1^k W_{it} + \delta_2^k W_{it} \times I_i + \delta_3^k I_i + Z'_{it}\delta_4^k + \varepsilon_{it}^k. \quad (7)$$

where A_{ikt} is the value of asset k that household i holds in time period t. Households may face credit constraints which both depend on their wealth levels and drive portfolio choices. Like Blau and Graham (1990), we model asset levels as a function of net worth (W_{it}) in order to account for any capital market imperfections in asset allocations. In particular, δ_1 reflects the effect of total wealth, while δ_3 captures the effect of having an internal locus of control (I_i) on asset levels. Any differential effect of wealth on the portfolio choices of households with an internal as opposed to external reference person is captured by δ_2. As before, we also control for a vector (Z_{it}) of demographic characteristics, human capital, and personality traits of both partners as well as household permanent income in order to account for differences in portfolios choices related to household circumstances including life-cycle stage.

We estimate Eq. (7) as a system of five equations, one for each asset type. Since the sum of assets across asset types is equal to total net worth and since we are controlling for net worth in each

Table 5
Determinants of asset portfolios (Marginal Effects and t-Statistics).

	Financial Wealth		Business Assets		Real Estate		Vehicles		Pensions	
	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.
Panel A										
Total net worth	0.21	6.73	0.10	6.08	0.53	16.25	0.01	6.02	0.15	6.55
Total net worth × internal	0.08	2.51	−0.00	−0.17	−0.01	−0.26	−0.00	−1.84	−0.07	−2.39
Internal locus of control	−250379.13	−3.66	36926.13	1.51	−1752.69	−0.02	9462.54	2.22	205743.14	4.34
Average marginal effects:										
Internal locus of control	−161810.02	−3.37	34011.78	1.52	−12438.15	−0.22	5705.40	1.80	134530.99	3.80
Lag household net worth	0.25	11.07	0.10	7.24	0.52	22.99	0.01	8.17	0.12	8.24
Panel B										
Total net worth	0.15	4.93	0.12	6.97	0.52	15.31	0.01	6.42	0.19	8.32
Total net worth × internal	0.09	2.94	−0.01	−0.66	0.00	0.01	−0.00	−1.93	−0.08	−2.74
Internal locus of control	−191433.21	−2.92	34083.43	1.41	3605.41	0.05	8845.08	2.08	144899.28	3.71
Permanent income	16644.59	2.88	−2756.86	−1.25	5556.42	0.82	201.99	0.36	−19646.14	−4.83
Average marginal effects:										
Internal locus of control	−95218.45	−2.08	22889.69	1.10	4013.44	0.07	4778.33	1.53	63536.98	2.04
Lag household net worth	0.20	9.01	0.12	7.56	0.52	21.94	0.01	8.78	0.16	10.20
Panel C										
Total net worth	0.19	6.11	0.13	7.16	0.53	14.99	0.01	4.65	0.15	6.46
Total net worth × internal	0.10	3.05	−0.01	−0.56	−0.00	−0.02	−0.00	−1.97	−0.08	−2.67
Internal locus of control	−179011.01	−2.89	24183.67	0.94	27829.84	0.39	9696.52	2.31	117300.97	2.86
Permanent income	−3.55	−4.74	−0.41	−1.11	−0.50	−0.55	0.22	5.86	4.24	8.57
Average marginal effects:										
Internal locus of control	−75197.52	−1.68	14697.22	0.66	26939.54	0.49	5247.66	1.59	28313.10	0.83
Lag household net worth	0.24	9.40	0.12	7.76	0.53	20.04	0.01	5.67	0.10	7.25
Panel D										
Total net worth	0.16	5.22	0.12	7.10	0.56	15.97	0.01	4.17	0.15	6.55
Total net worth × internal	0.11	3.21	−0.01	−0.47	−0.01	−0.28	−0.00	−1.79	−0.08	−2.68
Internal locus of control	−207412.77	−3.32	23204.85	0.90	62220.08	0.88	9049.31	2.08	112938.52	2.79
Permanent income	−3.84	−5.11	−0.41	−1.08	−0.14	−0.16	0.22	5.66	4.18	8.47
Average marginal effects:										
Internal locus of control	−95582.78	−2.12	15171.87	0.67	50982.35	0.93	4965.95	1.49	24462.61	0.72
Lag household net worth	0.22	8.64	0.12	7.76	0.55	20.90	0.01	5.08	0.10	7.35

Note: See Notes to Table 3. *t*-values based on bootstrap standard errors (100 replications).

asset equation, we require a set of cross-equation restrictions in order to ensure that the marginal effects are interpretable (see Blau and Graham, 1990). First, we constrain the marginal effects of an additional dollar of net worth (m_1^k) to be jointly equal to one over all asset types k, i.e. $\sum_k \frac{\partial E[A_{ikt}|X_{it}]}{\partial W_{it}} = \sum_k m_1^k = 1$.

Second, the marginal effects of all other independent variables must capture the effect of a one unit change in that variable on a particular asset – holding net worth constant. This implies that if, for example, higher education levels result in the household holding more financial wealth, this must be counterbalanced by a corresponding decrease in the holding of some other asset type. Thus, the sum of the marginal effects of all independent variables other than net worth across asset types must be constrained to sum to zero.[27]

5.2. Results

The results (marginal effects and t-statistics) from simultaneous estimation of our five asset equations are given in Table 5. Panel A presents estimation results from a model in which only total net worth, locus of control, and their interaction are controlled.

The marginal effect of net worth captures the way that an additional dollar of net wealth is allocated across different asset types. Each additional dollar of wealth is associated with an increase of (i) $0.21 in financial wealth; (ii) $0.10 in business equity; (iii) $0.53 in real estate equity; (iv) $0.01 in vehicles; and (v) $0.15 in pension wealth (see Panel A). Adding an extensive set of controls to the model leaves asset portfolios relatively unchanged (see Panels B–D).[28]

Households in which the reference person is internal hold significantly less financial wealth ($250,379), but significantly more vehicle wealth ($9,462) and pension wealth ($205,743) than equally wealthy households in which the reference person has an external locus of control (see Panel A). There are also significant differences in the way that households reallocate their portfolios as they become wealthier. For each dollar increase in net worth, for example, households with an internal reference person allocate $0.08 more to building financial wealth than do households with external reference persons. This is counterbalanced by gaps of $0.01 and $0.07 in the shares of additional net worth being allocated to real estate and pension wealth, respectively. Not surprisingly, these differentials in households' asset portfolios are reduced somewhat when we add control variables (see Panels B–D). Nonetheless, the reference person's locus of control remains a significant predictor of the portfolio choices that the household makes, even when we control for risk aversion an planning horizon

[27] The marginal effects of a regression model of the form $Y = \sinh^{-1}(A) = X'\delta + \varepsilon$ are given by

$$\frac{dA}{dX} = \frac{dA}{dY}\frac{dY}{dX} = \frac{dA}{dY}\hat{\delta} = \frac{1}{2}[e^{\theta Y} + e^{-\theta Y}]\hat{\delta},$$

where

$$A = \sinh(Y) = \frac{1}{2\theta}(e^{\theta Y} - e^{-\theta Y}) \text{ and } \frac{dA}{dY} = \frac{1}{2}[e^{\theta Y} + e^{-\theta Y}].$$

We calculate average marginal effects using households weights and obtain bootstrap standard errors.

[28] Complete results are presented in Appendix Table A.9.

in Panel D. Overall, the combined effect implies that households with an internal reference person and average levels of net worth hold significantly less financial wealth ($95,582), but considerably more real estate wealth ($50,982) and pension wealth ($24,463) than otherwise similar households with an external reference person. If having an external locus of control is linked to having less self-control, then it is puzzling that households with an external reference person do not allocate more of their wealth to illiquid assets like pensions. At the same time, having an external locus of control may also be associated with a lack of sophistication about the challenges posed by temptation and self-control. In effect, households with an internal reference person may save more for retirement not because they have more self-control, but because they are more aware of the risks that self-control issues pose for reaching their long-term goals.

It also is interesting to put these results in the context of previous research, which finds that individuals' cognitive skills (e.g. Christelis et al., 2010; Grinblatt et al., 2011), risk preferences (see Cesarini et al., 2010, and the references therein), mental health (Bogan and Fertig, 2013), and personality traits (Brown and Taylor, 2011) are all related to the amount of financial assets they hold. Our results are consistent with this evidence that a broad range of skills, preferences, and traits contribute to understanding the heterogeneity in portfolio choices. Like Chatterjee et al. (2011), we also find that perceptions of control are related to financial wealth holdings. At the same time, Chatterjee et al. (2011) use a simple model of financial market participation to show that individuals' self-efficacy is linked to a higher propensity to own financial assets. The authors, however, do not control for household wealth raising the possibility that individuals with greater self-efficacy are more like to own financial assets simply because they are wealthier. In contrast, when comparing the entire portfolio allocation of equally wealthy households, we find that an internal locus of control is associated with lower levels of financial wealth throughout much of the wealth distribution. In fact, the locus-of-control gap in financial wealth is only positive for very wealth households with a net worth greater than one million dollars. Instead, households with an internal reference person allocate more of their wealth to building pension assets. Thus, self-control may lead households to build wealth by relying more heavily on the various commitment devices, e.g. eligibility ages or withdrawal penalties, that dramatically raise the costs of using wealth in the form of pension assets to finance current consumption.

6. Conclusions

Behavioral savings models emphasize the tension between temptation and self-control in shaping households' consumption, expenditure, and ultimately, savings decisions. To the extent that their predictions characterize behavior, they have the potential to not only enhance our understanding of economic decision making, but also to expanded the spectrum of policy options that could be used to assist households in meeting their long-term objectives. This paper makes a valuable contribution to this debate by empirically analyzing the link between individuals' locus of control – one component of self-control more generally – and their savings behavior. We find that an internal locus of control is related to higher savings both in levels and as a fraction of permanent income. For wealthy households, this manifests itself as a gap in the rate of savings relative to permanent income. For poor households, there is a large disparity in the amount of wealth accumulated over time. Locus of control is also related to the way that equally wealthy households allocate their wealth across asset types with households that have an internal reference person holding significantly less financial wealth, but significantly more pension wealth.

Unfortunately, differences in sample selection and estimation strategies make it nearly impossible to directly compare the magnitude of results derived from different studies of savings behavior, even when concepts are defined and measured similarly. Our results, however, lead us to conclude that perceptions of control may be as important as human capital and cognitive skills in explaining heterogeneity in wealth accumulation and portfolio allocations. Banks et al. (2010), for example, are unable to find substantive effects of numeracy on replacement rates or well-being in retirement, while Cooper and Zhu (2013) argue that education affects financial decisions mainly through mean income. In contrast, we find substantial effects of locus of control on savings behavior despite controlling for educational attainment and permanent income. Interestingly, Perry and Morris (2005) show that individuals with an internal locus of control *believe* they have more capacity to manage their finances by controlling spending, paying their bills on time, planning for the future, and saving. Our results indicate that these beliefs may also translate into savings behavior that leads to very real gains in economic well-being.

As Mastrobuoni and Weinberg (2009, p.165) note, however, "not all individuals struggle with self-control equally in real-world markets". Economic conditions and self-control problems may interact in ways that generate poverty traps, for example. Poverty can potentially undermine self-control if willpower is more costly when consumption is low (Shefrin and Thaler, 1988), if imperfect credit markets limit the usefulness of self-control (Bernheim et al., 2013), or if the marginal propensity to spend on temptation goods falls as consumption rises (Banerjee and Mullainathan, 2010). Unfortunately, our analysis does not permit us to examine whether the rich exercise more self-control than the poor. We do find, however, that the relative wealth payoff associated with having an internal locus of control is much greater at the 25th percentile of the wealth distribution than it is at the 75th percentile. For the poor, economic well-being and self-control may be very closely linked.

The welfare implications of policies to promote household savings fundamentally depend on whether we have accounted for the role of temptation and self-control (see O'Donoghue and Rabin, 1999). Policies that are optimal in the absence of self-control problems, e.g. the removal of credit constraints, can have unintended consequences when temptation is taken into account (see Banerjee and Mullainathan, 2010). Moreover, many experts are using the insights gained from behavioral savings models to design new programs that assist households in meeting their savings goals through commitment devices and strategically-chosen default options (e.g. Thaler and Benartzi, 2004; Kooreman and Prast, 2010). Our results show that households in which the reference person has an external locus of control save less and allocate less wealth to their pensions making them a sensible group to target for intervention.

Taken together, our results shed light on the relationship between locus of control, wealth accumulation, savings rates, and portfolio choices. Despite this, they leave a number of questions unanswered. In particular, why does locus of control matter? What is the mechanism linking households' locus of control to their savings behavior? In keeping with the psychological evidence, we have focused on the role of locus of control as one important component of self-control. Yet with observational data we cannot rule out other plausible, potentially-related hypotheses. Future research which explored these mechanisms using a variety of research strategies and data sources would be extremely valuable.

Appendix

Table A1
Descriptive statistics.

	2006			2010		
	Internal	External	*t*-value of difference	Internal	External	*t*-value of difference
Income						
Disposable household income	86,001	75,919	4.25	97,183	82,705	4.63
	(55,357)	(44,290)		(67,661)	(50,431)	
Permanent income	87,714	78,705	4.23	90,608	78,883	5.55
	(48,326)	(41,361)		(44,272)	(36,035)	
Demographic characteristics						
Age	47.4	49.7	−3.98	49.1	50.7	−2.58
	(12.2)	(12.0)		(12.1)	(12.0)	
Female	0.512	0.469	1.83	0.477	0.468	0.35
	(0.500)	(0.499)		(0.500)	(0.499)	
Number of children	1.321	1.212	1.48	1.278	1.096	2.30
	(1.560)	(1.560)		(1.531)	(1.486)	
Ever divorced	0.144	0.126	1.12	0.128	0.142	−0.79
	(0.351)	(0.332)		(0.334)	(0.349)	
Education						
Postgrad degree	0.048	0.042	0.56	0.055	0.060	−0.45
	(0.214)	(0.202)		(0.228)	(0.238)	
Graduate diploma/certificate	0.091	0.061	2.39	0.103	0.062	2.87
	(0.288)	(0.240)		(0.305)	(0.241)	
Bachelor	0.170	0.146	1.40	0.162	0.156	0.35
	(0.376)	(0.353)		(0.369)	(0.363)	
Diploma	0.109	0.091	1.32	0.126	0.110	0.96
	(0.312)	(0.287)		(0.332)	(0.313)	
Any certificate	0.212	0.230	−0.93	0.215	0.255	−1.83
	(0.409)	(0.421)		(0.411)	(0.436)	
Year 12	0.106	0.132	−1.68	0.123	0.118	0.30
	(0.309)	(0.339)		(0.328)	(0.322)	
Personality traits						
Extroversion (Std.)	0.304	−0.081	8.40	0.282	−0.136	8.21
	(1.006)	(0.929)		(1.028)	(0.914)	
Agreeableness (Std.)	0.224	−0.095	7.27	0.193	−0.093	5.96
	(0.911)	(0.941)		(0.871)	(0.970)	
Conscientiousness (Std.)	0.415	0.023	8.96	0.401	0.040	7.75
	(0.940)	(0.909)		(0.914)	(0.870)	
Emotional stability (Std.)	0.422	−0.028	11.12	0.448	−0.065	11.53
	(0.831)	(0.878)		(0.831)	(0.875)	
Openess (Std.)	0.046	−0.088	3.07	0.028	−0.054	1.71
	(0.936)	(0.915)		(0.929)	(0.904)	
Above average financial risk taker	0.118	0.085	2.33	0.106	0.067	2.68
	(0.323)	(0.279)		(0.308)	(0.250)	
Planning horizon: Less than a year	0.317	0.411	−4.17	0.372	0.521	−5.81
	(0.465)	(0.492)		(0.484)	(0.500)	
Observations	881	904		755	715	
Demographic characteristics (Partner)						
Age	47.9	49.3	−2.61	49.3	50.6	−2.15
	(12.2)	(11.7)		(12.2)	(11.7)	
Ever divorced	0.145	0.109	2.30	0.126	0.124	0.15
	(0.352)	(0.311)		(0.332)	(0.329)	
Education (Partner)						
Postgrad degree	0.056	0.038	1.85	0.060	0.054	0.43
	(0.230)	(0.191)		(0.237)	(0.227)	
Grad. dipl./cert.	0.057	0.075	−1.47	0.068	0.076	−0.53
	(0.233)	(0.263)		(0.253)	(0.264)	
Bachelor	0.146	0.132	0.85	0.170	0.126	2.37
	(0.353)	(0.339)		(0.376)	(0.332)	
Diploma	0.120	0.090	2.06	0.119	0.102	1.01
	(0.325)	(0.286)		(0.323)	(0.303)	
Any certificate	0.232	0.193	2.00	0.213	0.218	−0.24
	(0.422)	(0.395)		(0.409)	(0.413)	
Year 12	0.101	0.132	−2.07	0.118	0.127	−0.52
	(0.301)	(0.339)		(0.323)	(0.333)	

(*continued on next page*)

Table A1
(Continued)

	2006			2010		
	Internal	External	*t*-value of difference	Internal	External	*t*-value of difference
Personality traits (Partner)						
Extroversion (Std.)	−0.023	−0.217	4.09	−0.024	−0.211	3.61
	(0.978)	(1.021)		(0.986)	(1.006)	
Agreeableness (Std.)	0.020	−0.056	1.79	−0.009	−0.068	1.26
	(0.891)	(0.893)		(0.896)	(0.873)	
Conscientiousness (Std.)	0.185	−0.043	5.26	0.108	−0.128	4.83
	(0.885)	(0.943)		(0.899)	(0.974)	
Emotional stability (Std.)	0.131	−0.311	9.89	0.057	−0.402	9.26
	(0.905)	(0.981)		(0.938)	(0.960)	
Openess (Std.)	0.009	−0.022	0.70	−0.048	−0.012	−0.73
	(0.910)	(0.964)		(0.907)	(0.934)	
Above average financial risk taker	0.101	0.075	1.94	0.091	0.073	1.23
	(0.302)	(0.264)		(0.287)	(0.260)	
Planning horizon: Less than a year	0.327	0.424	−4.23	0.399	0.494	−3.66
	(0.469)	(0.494)		(0.490)	(0.500)	
Observations	881	904		755	715	

Note: Weighted numbers based on weights provided by HILDA. Standard deviations in parentheses.

Table A2
Determinants of net worth, unconditional quantile regression (coefficients and standard errors).

	OLS	Q25	Q50	Q75
Lag hh net worth	0.58***	0.11***	0.20***	0.50***
	(0.08)	(0.02)	(0.03)	(0.06)
Lag hh net worth x internal locus of control	0.14	−0.10***	−0.13***	−0.19***
	(0.09)	(0.02)	(0.04)	(0.07)
Internal locus of control	−31477.56	118609.46***	146188.77***	199808.68***
	(63035.38)	(29043.25)	(35062.56)	(64400.90)
Year: 2010	−202000.73***	14833.57	10805.79	−42281.35
	(33085.18)	(19386.01)	(22128.19)	(39549.92)
Permanent income	7.01***	2.54***	3.60***	4.88***
	(1.43)	(0.30)	(0.40)	(0.70)
Age	2183.52	1101.34	1280.88	3483.22
	(3347.74)	(2322.33)	(2669.60)	(4603.91)
Female	−4079.75	−25602.03	−56882.62**	−30754.10
	(34880.63)	(26126.59)	(28567.37)	(51471.86)
Number of children	21021.54*	−517.51	4057.38	−7707.86
	(12433.44)	(8063.26)	(8495.47)	(13377.49)
Ever divorced	66472.22	665.97	−50464.22	58500.76
	(53368.10)	(30119.22)	(36189.12)	(63501.80)
Postgrad degree	4839.74	70562.31	87006.30	289478.02**
	(98157.53)	(47816.14)	(53735.24)	(114145.34)
Graduate diploma/certificate	6125.55	151624.79***	160850.19***	314760.61***
	(82660.33)	(38892.93)	(48236.98)	(92746.26)
Bachelor	83150.94	176430.43***	112832.87***	199908.95***
	(75481.38)	(32820.55)	(40918.47)	(73636.78)
Diploma	54301.46	183103.80***	122316.76***	54441.58
	(68706.18)	(34680.01)	(41216.43)	(73704.64)
Any certificate	31763.12	140278.85***	74194.24**	55265.37
	(46279.44)	(29390.59)	(32674.49)	(54728.91)
Year 12	−3279.00	75465.32**	52854.99	63657.23
	(53568.00)	(37896.43)	(41363.30)	(73485.99)
Extroversion (Std.)	6168.36	−9639.88	822.38	−24199.48
	(17264.60)	(9650.53)	(11357.54)	(22016.60)
Agreeableness (Std.)	−74289.53***	−24110.22**	−34033.77**	−45696.66*
	(20146.75)	(12239.14)	(14329.40)	(23973.51)
Conscientiousness (Std.)	27239.33	44712.38***	17545.31	−7991.24
	(18470.36)	(11235.16)	(12965.93)	(24041.83)
Emotional stability (Std.)	5150.76	−8982.58	−5999.41	−3791.88
	(20245.25)	(12684.25)	(14065.99)	(24870.31)
Openess (Std.)	38106.18**	−20491.59*	21730.61	38957.61
	(19130.66)	(11770.25)	(13427.74)	(23855.97)
Above average financial risk taker	144708.41*	45557.22	89004.21**	199320.80**
	(85007.74)	(30422.41)	(39949.17)	(92266.58)
Planning horizon: Less than a year	−69977.38**	−106561.13***	−144182.56***	−199014.19***
	(27947.62)	(22368.26)	(25388.87)	(43036.75)

(*continued on next page*)

Table A2 (*continued*)

	OLS	Q25	Q50	Q75
Partner characteristics				
Age	38106.18**	−20491.59*	21730.61	38957.61
	(19130.66)	(11770.25)	(13427.74)	(23855.97)
Ever divorced	144708.41*	45557.22	89004.21**	199320.80**
	(85007.74)	(30422.41)	(39949.17)	(92266.58)
Postgrad degree	−69977.38**	−106561.13***	−144182.56***	−199014.19***
	(27947.62)	(22368.26)	(25388.87)	(43036.75)
Grad. dipl./cert.	14419.41***	13016.92***	17167.18***	18784.05***
	(4080.91)	(2276.49)	(2743.84)	(4803.76)
Bachelor	−106680.01**	−58908.32*	−20012.66	−72157.93
	(49121.00)	(31096.63)	(37624.90)	(67738.35)
Diploma	69022.16	106428.96**	100117.10*	149662.84
	(85913.75)	(44894.69)	(54878.57)	(108163.44)
Any certificate	22279.12	85679.49**	57349.03	158205.05*
	(67307.21)	(38316.21)	(45360.51)	(81653.08)
Year 12	−28933.65	125809.70***	74950.27*	190532.64**
	(52722.44)	(32993.79)	(39708.99)	(76761.44)
Extroversion (Std.)	24490.11	68890.60**	38590.90	99345.33
	(60868.22)	(33896.85)	(40627.84)	(76369.14)
Agreeableness (Std.)	−13886.03	83330.54***	23547.15	1034.89
	(45200.27)	(29582.47)	(32311.38)	(53908.86)
Conscientiousness (Std.)	−13387.53	18570.00	4082.14	48210.96
	(58810.60)	(39080.27)	(42315.46)	(72804.17)
Emotional stability (Std.)	−681.81	6477.02	3193.48	6417.96
	(15633.79)	(9454.83)	(11367.92)	(21048.73)
Openess (Std.)	−34376.13**	−13798.17	−20646.73	−60557.50**
	(16692.72)	(12065.27)	(14106.79)	(26177.73)
Above average financial risk taker	779.86	15527.90	13012.84	4181.27
	(17370.43)	(10518.00)	(12837.62)	(22960.75)
Planning horizon: Less than a year	22512.25	−16751.59	−20103.85	47115.78*
	(14846.73)	(11134.61)	(13099.88)	(24157.22)
Constant	33544.30*	−15015.14	−5516.78	23859.52
	(18122.89)	(11647.92)	(13233.39)	(23985.67)
Observations	3,255	3,255	3,255	3,255

Note: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A3
Determinants of savings rate, unconditional quantile regression (coefficients and standard errors).

	OLS	Q25	Q50	Q75
Internal locus of control	1.650	−1.185	2.759	12.562**
	(14.467)	(4.090)	(3.848)	(6.404)
Age	−0.292	−0.189	0.298	0.756
	(1.695)	(0.446)	(0.431)	(0.749)
Female	0.284	6.223	4.303	2.650
	(14.972)	(4.790)	(4.599)	(7.396)
Number of children	−9.920	−0.918	0.340	−2.144
	(6.033)	(1.404)	(1.348)	(2.013)
Ever divorced	−14.830	−4.285	5.784	4.413
	(37.417)	(6.100)	(5.495)	(9.051)
Postgrad degree	−9.500	4.915	12.914	−17.414
	(24.269)	(9.342)	(9.162)	(15.036)
Graduate diploma/ certificate	3.346	−2.048	8.549	−4.371
	(21.525)	(8.368)	(7.424)	(11.635)
Bachelor	−3.610	4.605	15.834***	7.923
	(38.972)	(6.752)	(6.106)	(10.044)
Diploma	3.096	−4.942	5.110	−4.689
	(25.917)	(7.157)	(6.218)	(9.904)
Any certificate	2.173	−0.126	7.623	1.729
	(16.488)	(5.906)	(5.098)	(8.028)
Year 12	−0.889	4.045	2.260	−8.182
	(17.362)	(7.032)	(6.644)	(10.866)
Extroversion (Std.)	6.576	−0.298	−1.714	−0.215
	(8.789)	(1.982)	(1.827)	(2.900)
Agreeableness (Std.)	−11.961*	−2.685	−2.989	−6.113*
	(7.128)	(2.435)	(2.220)	(3.558)
Conscientiousness (Std.)	2.016	−0.602	2.331	−2.764
	(8.892)	(2.280)	(1.998)	(3.301)
Emotional stability (Std.)	−5.460	−0.483	−2.366	−2.491
	(11.396)	(2.596)	(2.299)	(3.862)
Openess (Std.)	0.560	−0.274	−1.136	5.699
	(7.391)	(2.249)	(2.130)	(3.481)

(*continued on next page*)

Table A3 (*continued*)

	OLS	Q25	Q50	Q75
Above average financial risk taker	0.673	−4.375	5.176	15.346
	(29.488)	(6.991)	(6.830)	(12.348)
Planning horizon: Less than a year	−32.248**	−14.056***	−18.038***	−19.035***
	(16.157)	(4.261)	(3.975)	(6.208)
Partner characteristics				
Age	−0.315	−1.605***	−0.438	0.435
	(1.883)	(0.446)	(0.435)	(0.765)
Ever divorced	−9.701	6.357	−2.617	−7.300
	(26.510)	(6.367)	(5.820)	(9.324)
Postgrad degree	36.799	14.333	28.440***	26.066*
	(29.302)	(8.945)	(8.475)	(15.590)
Grad. dipl./cert.	34.756	4.596	14.467*	2.696
	(25.462)	(7.778)	(7.407)	(11.692)
Bachelor	17.082	9.774	13.709**	14.768
	(23.382)	(6.590)	(6.506)	(11.205)
Diploma	24.163	−5.390	7.281	11.656
	(25.094)	(7.176)	(6.458)	(11.059)
Any certificate	2.554	1.012	0.827	−0.548
	(20.578)	(5.742)	(5.102)	(8.103)
Year 12	4.839	1.963	3.160	7.984
	(25.129)	(6.855)	(6.317)	(10.168)
Extroversion (Std.)	−0.879	−0.661	0.892	2.437
	(6.545)	(1.904)	(1.825)	(2.921)
Agreeableness (Std.)	−16.483**	−0.512	−0.430	−6.081
	(6.887)	(2.356)	(2.275)	(3.704)
Conscientiousness (Std.)	−0.239	1.688	1.620	−1.373
	(7.402)	(2.089)	(1.963)	(3.291)
Emotional stability (Std.)	4.778	2.171	1.889	2.573
	(6.694)	(2.253)	(2.076)	(3.432)
Openess (Std.)	5.502	−0.693	−0.027	1.964
	(7.366)	(2.193)	(2.124)	(3.325)
Above average financial risk taker	5.081	−15.673**	5.763	24.447**
	(46.355)	(7.022)	(6.267)	(11.755)
Planning horizon: Less than a year	−4.952	3.958	−7.317*	−20.248***
	(13.029)	(4.240)	(3.888)	(6.135)
Year: 2010	−66.046***	−27.439***	−29.114***	−39.686***
	(13.693)	(3.922)	(3.499)	(5.611)
Constant	132.157**	95.140***	49.776***	59.947***
	(51.350)	(14.415)	(13.260)	(21.540)
Observations	3,255	3,255	3,255	3,255

Note: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A4
Determinants of asset portfolios (marginal effects and t-statistics).

	Financial Wealth		Business Assets		Real Estate		Vehicles		Pensions	
	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.
Total net worth	0.16	5.22	0.12	7.10	0.56	15.97	0.01	4.17	0.15	6.55
Total net worth × internal	0.11	3.21	−0.01	−0.47	−0.01	−0.28	−0.00	−1.79	−0.08	−2.68
Internal locus of control	−207412.77	−3.32	23204.85	0.90	62220.08	0.88	9049.31	2.08	112938.52	2.79
Permanent income	−3.84	−5.11	−0.41	−1.08	−0.14	−0.16	0.22	5.66	4.18	8.47
Age	12989.17	2.20	−1600.65	−0.75	7395.74	1.06	327.27	0.55	−19111.53	−4.61
Female	7202.06	0.11	12231.55	0.48	74125.10	0.93	478.47	0.15	−94037.19	−2.32
Number of children	−39534.08	−1.86	17496.52	2.82	44433.88	1.99	321.95	0.33	−22718.26	−2.20
Ever divorced	−67391.40	−0.82	−7397.69	−0.22	22347.22	0.24	−593.96	−0.15	53035.83	1.03
Postgrad degree	125892.56	1.05	−23997.45	−0.41	−153543.51	−1.15	−18224.00	−2.07	69872.40	1.08
Graduate diploma/certificate	−54843.88	−0.55	−90690.28	−1.92	3052.60	0.03	6814.91	1.54	135666.64	2.39
Bachelor	−80177.63	−0.83	−17058.02	−0.49	−36569.38	−0.37	−3148.18	−0.58	136953.20	2.71
Diploma	−113295.05	−1.26	12469.95	0.36	−38814.23	−0.38	−1072.55	−0.20	140711.88	2.53
Any certificate	−116535.18	−1.68	886.89	0.03	1814.27	0.02	4998.71	1.37	108835.31	2.15
Year 12	−229380.31	−2.50	−65044.29	−1.81	142624.73	1.47	1985.87	0.42	149814.01	2.54
Extroversion (Std.)	−43689.18	−1.57	6613.37	0.63	57626.62	1.92	1885.48	1.48	−22436.28	−1.57
Agreeableness (Std.)	−44918.70	−1.37	−9778.29	−0.69	28750.48	0.78	−783.84	−0.45	26730.36	1.38
Conscientiousness (Std.)	−9643.24	−0.33	−8586.30	−0.67	4661.33	0.14	637.13	0.32	12931.07	0.74
Emotional stability (Std.)	45796.79	1.43	13072.90	0.94	−67882.57	−2.07	−3553.03	−1.86	12565.90	0.60

(*continued on next page*)

Table A4
(Continued)

	Financial Wealth		Business Assets		Real Estate		Vehicles		Pensions	
	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.	dy/dx	t-stat.
Openess (Std.)	7240.29	0.23	20956.60	1.64	−79999.79	−2.08	−1515.46	−0.86	53318.36	2.87
Above average financial risk taker	−4501.45	−0.04	47389.09	1.23	−9902.50	−0.10	−3163.77	−0.71	−29821.37	−0.79
Planning horizon: Less than a year	−178122.31	−3.91	27691.30	1.43	199107.16	4.25	−977.28	−0.33	−47698.86	−1.76
Partner characteristics										
Age	4958.94	0.86	−3517.60	−1.52	4132.88	0.60	−474.94	−0.85	−5099.28	−1.17
Ever divorced	13807.44	0.17	25808.46	0.70	−120644.09	−1.20	−1213.01	−0.21	82241.20	1.42
Postgrad degree	72352.59	0.64	−154096.80	−2.91	121402.75	1.07	−9352.43	−1.38	−30306.10	−0.44
Grad. dipl./cert.	−123736.12	−1.12	−112109.98	−2.66	165052.82	1.31	1478.38	0.30	69314.91	1.21
Bachelor	−61514.48	−0.71	−84984.91	−2.45	178945.92	1.89	−3100.86	−0.54	−29345.67	−0.68
Diploma	74714.58	0.89	−34309.36	−0.88	−25181.00	−0.25	−8797.15	−1.42	−6427.07	−0.11
Any certificate	−34423.40	−0.48	−31226.39	−1.10	24789.59	0.31	−4843.86	−1.00	45704.06	1.01
Year 12	46076.73	0.59	5170.55	0.13	26219.70	0.32	−9671.54	−1.38	−67795.43	−1.07
Extroversion (Std.)	−49752.02	−2.09	−4330.59	−0.47	44421.13	1.66	2149.50	1.85	7511.98	0.46
Agreeableness (Std.)	−106499.95	−3.75	5157.93	0.41	85910.95	2.51	1050.39	0.62	14380.68	0.77
Conscientiousness (Std.)	41863.72	1.39	2406.80	0.25	−41002.23	−1.29	2235.63	1.12	−5503.92	−0.33
Emotional stability (Std.)	25042.39	0.71	11817.96	0.96	−38669.03	−0.97	−2267.87	−1.15	4076.55	0.20
Openess (Std.)	9649.35	0.33	23704.75	1.87	−37920.19	−1.08	−5701.90	−3.29	10267.98	0.59
Above average financial risk taker	81859.86	0.91	102468.70	2.53	−85382.33	−0.85	9708.35	2.42	−108654.58	−2.39
Planning horizon: Less than a year	−177928.45	−3.56	−140.91	−0.01	209287.57	4.12	−4321.81	−1.43	−26896.39	−0.90
Number of observations	3,255		3,255		3,255		3,255		3,255	

Note: *t*-values based on bootstrap standard errors (100 replications).

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