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Deborah A. Cobb-Clark, Sonja C. Kassenboehmer and Mathias G. Sinning

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Deborah A. Cobb-Clark[†], Sonja C. Kassenboehmer[†] and Mathias G. Sinning[‡]

[†] Melbourne Institute of Applied Economic and Social Research, The University of Melbourne; and IZA, Bonn

[‡] Research School of Economics, College of Business and Economics, The Australian National University; RWI, Essen; and IZA, Bonn

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Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
***Telephone* (03) 8344 2100**
***Fax* (03) 8344 2111**
***Email* melb-inst@unimelb.edu.au**
***WWW Address* http://www.melbourneinstitute.com**

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 controllability of life events and is a key component of self-control. We find that households with an internal reference person save more both in terms of levels and 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, 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.

JEL classification: G02, G11, I31, R21

Keywords: Non-cognitive skills, locus of control, wealth accumulation, asset portfolios, savings

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 (Sherraden, 1991; Beverly & Sherraden, 1999), 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 (Thaler & Shefrin, 1981; Shefrin & Thaler, 1988; Levin, 1998). 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 (Thaler & Shefrin, 1981; O'Donoghue & Rabin, 1999; Thaler & Benartzi, 2004; Kooreman & Prast, 2010; Bernheim et al., 2013).[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 capturing individuals' beliefs about the extent to which they control the events that affect them. Those with an external locus of control generally 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 (Gatz & Karel, 1993). Importantly, an internal locus of control is a key component of having greater self-control more broadly (Rosenbaum, 1980). Despite a growing recognition that self-control is important in allowing individuals to avoid immediate temptation and achieve their long-term goals, there is little empirical evidence that links measures of self-control to economic well-being generally.

[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.

We investigate the relationship between locus of control and households' saving behavior – as reflected in their wealth accumulation, savings rates, and the way they hold their wealth across asset types – using panel data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. HILDA data are ideal for our purposes because they provide extremely detailed measures of both assets and financial liabilities for a large, nationally-representative sample of households at three separate points in time. The ability to directly examine savings behavior using a longitudinal measure of household wealth accumulation is quite rare in the international context (Bloxham & Bett, 2009). Moreover, the 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. Thus, we are able to assess the role that perceptions of control play in wealth formation – a key component of overall economic well-being – in a way that cannot be done with other data sources. A deeper understanding of the link between locus of control and wealth accumulation is fundamental to the development of policy initiatives to support households' savings behavior.

We find that households in which the reference person has an internal locus of control save more both in terms of levels and 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 in Section 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 & 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 & 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 & Thaler, 1988; Thaler, 1990; Levin, 1998; Graham & 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. In the literature, self-control problems are typically modeled in one of two ways. The first is in the context of time-inconsistent (i.e. present-biased) preferences (see Laibson, 1997; O'Donoghue & Rabin, 1999; DellaVigna, 2009; Mastrobuoni & Weinberg, 2009). The

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

second relies on the dual preference structure proposed by Thaler & Shefrin (1981) in which an individual is at any point in time assumed to be both a farsighted planner and a myopic doer.

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 & Oldfield, 2007) and be more likely to make financial mistakes (Agarwal & 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 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; Smith et al., 2010; Grinblatt et al., 2011).[3] 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).[4]

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.[5] Boyce & 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

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

[4]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 & Mitchell, 2007, 2008; van Rooij et al., 2011; Jappelli & Padula, 2013). Financial literacy, however, is best viewed as an important human capital investment rather than an innate trait (see Jappelli & 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.

[5]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 & Christal, 1961 and Norman, 1963).

of unsecured debt and financial assets held by individuals (Brown & Taylor, 2011). Conscientiousness is associated with more retirement saving, while agreeableness is associated with less (Duckworth & Weir, 2011).

There is virtually no literature linking locus of control to savings behavior. This is surprising, because locus of control is a component of self-control more generally (Rosenbaum, 1980).[6] We are aware of only one study that directly investigates the relationship between perceptions of control and savings behavior. Specifically, Chatterjee et al. (2011) analyze NLSY data and find that, among primary earners in their 30s and 40s, higher self-efficacy (locus of control) is related to greater wealth creation and a higher propensity to hold financial assets. We expand on the work of Chatterjee et al. (2011) in several key ways. In particular, 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 likely to be important given the public-good nature of families' most important asset: housing. In addition, we analyze the relationship between locus 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 & Graham, 1990). This is a substantial improvement over research that examines individual assets in isolation.

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 7,682 households (19,914 individuals) and was

[6]There is a rapidly growing literature that links locus of control to numerous economic outcomes including earnings, unemployment, educational attainment, life satisfaction, and investments in health (see Cobb-Clark & Schurer, 2013; Cobb-Clark et al., 2014, and the references therein).

extended by an additional 2,153 households (5,477 individuals) in 2011. Interviews were 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.

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 define the reference person to be the partner with the most internal locus of control and restrict our analysis to households in which the reference person is between 25 and 75 years old.[7]

We further restrict our sample to households with positive wealth levels, which allows us to use log transformations of wealth in our analysis.[8] Finally, we exclude about 12 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 1,903 couples in 2006 and 1,892 couples in 2010.

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 insurances, trust funds, and col-

[7]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.

[8]As approximately 99 percent of households report positive levels of net worth, our findings are robust to the inclusion of households with non-positive net worth in the analysis.

lectibles), 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, trucks, etc.) and recreational (e.g. boats, caravans, etc.) vehicles, while pension wealth captures the current value of the couple's pension entitlements. Finally, we define total net worth as the sum of financial wealth, business equity, real estate equity, vehicles, and pensions.[9]

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).[10] Bloxham & 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.[11]

3.2 Locus of Control Measure

In 2003, 2004, and 2007, HILDA respondents were asked the seven original items of the Psychological Coping Resources component of the Mastery Module developed by Pearlin & Schooler (1978). Figure 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

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

[10] 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).

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

scales used to measure them – are very similar. For clarity, we use the term "locus of control" when describing our results.[12] 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.

[Insert Figure 1 here]

We use factor analysis to construct an overall index measuring locus of control (see Piatek & 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 & 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. Finally, we construct an indicator variable for having an internal locus of control which equals 1 if the reference person is in the top 50 percent of the locus of control distribution and 0 otherwise.[13]

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

[12] 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).

[13] Our results are robust to the choice of alternative cutoff points including the 25th or the 75th percentile. The correlation in partners' locus of control is 0.7 which is statistically significant at the 1 percent level.

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.

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.

Finally, previous research has found that personality traits are related to various dimensions of wealth, including individuals' marginal utility of income (Boyce & Wood, 2011), their level of retirement saving (Duckworth & Weir, 2011), and the amount of unsecured debt and financial assets they hold (Brown & 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).[14] Appendix Table A1 presents the means and standard deviations of the control variables in 2006 and 2010 by the reference person's locus of control.

[14]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 & Schurer, 2013), we average over the available data to reduce measurement error and standardize the result to have mean 0 and standard deviation 1.

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 $85,000 in 2002 to over $120,000 in 2006 and then falls slightly to $103,000 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 Figure 2).

[Insert Table 1 here]

[Insert Figure 2 here]

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

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

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 ($t = 2002, 2006, 2010$). Equation (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.[15]

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 wealth distribution (see columns 4, 8, and 12). Thus, although the absolute size of the wealth gap – approximately $500,000 – 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 percent of households, those with an internal reference person are about 40 (2002) to 60 (2010) percent 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. 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

[15]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.

quantile regression estimator developed by Koenker & 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. (Fournier & Koske, 2013; Alejo et al., 2011). This conditional distribution effectively corresponds to the error distribution, i.e. $F(Y|X) = F(\varepsilon)$, not the wealth distribution $F(Y)$ itself (Ker, 2011; Froehlich & Melly, 2010).[16] 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 & 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.[17] 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

[16]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 & Basu, 2013). Moreover, an individual's conditional wealth quantile may change as covariates change (Froehlich & Melly, 2010).

[17]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.

influence function (IF) at each quantile τ of the distribution of Y, which is defined as:

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

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,

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

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

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

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 is given by:

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

where W_{it} is the level of net worth of household i ($i = 1, ..., N$) 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 Great Recession. 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.[18]

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).[19] 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 two specifications for each of the wealth models given by equations (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 adds a full set of control variables including the household's permanent income and the characteristics of both partners. 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.[20] Unconditional quantile regression

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

[19] 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.

[20] Complete results are presented in Appendix Tables 2 and 3.

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).[21]

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 \$0.91 in current wealth on average (see Column 1, Panel A). 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 \$0.23 in current net worth for every dollar of net worth they held four years previously, while wealthy households hold \$0.78 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. \$0.23 vs. \$0.11), while the inter-temporal relationship in wealth is −\$0.25 (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.[22]

[Insert Table 3 here]

Households with an internal reference person accumulate significantly more wealth

[21] Specifically, given a model with an interaction term of the form $Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_1 X_2 + e$, the respective average marginal effects of X_1 and X_2 may be written as $\widehat{b}_1 + \widehat{b}_3 \overline{X}_2$ and $\widehat{b}_1 + \widehat{b}_3 \overline{X}_1$, where hats denote estimated parameters and over-bars indicate sample averages. The standard errors may be obtained from a reparameterized model of the form $y = a_0 + c_1 X_1 + c_2 X_2 + b_3 (X_1 - \mu_{X_1})(X_2 - \mu_{X_2}) + e$, where $\widehat{c}_1 = \widehat{b}_1 + \widehat{b}_3 \overline{X}_2$ and $\widehat{c}_2 = \widehat{b}_1 + \widehat{b}_3 \overline{X}_1$.

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

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 $154,624 at the mean to between $167,012 (25th percentile) to $278,234 (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 $65,356 more wealth over a four year period if the reference person is internal, while rich households (75th percentile) accumulate $70,837 more. The size of these locus-of-control wealth gaps is remarkably similar irrespective of how wealthy households are, though they are somewhat smaller than that estimated by OLS at the mean of the distribution ($83,389) 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 households' permanent income and the demographic characteristics, educational attainment, and personality traits of both partners. Permanent income, in particular, is an important determinant of wealth levels with each dollar of permanent income being associated with between $2.55 (poor households) and $5.97 (wealthy households) in current net worth. Nonetheless, the disparity in current wealth levels associated with reference persons' locus of control remains substantial (almost $49,000) and statistically significant among poor (25th percentile) and median households, becoming somewhat smaller (almost $40,000) and statistically insignificant at the 75th percentile and the mean. 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 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 important in understanding their economic well-being.

Finally, 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 $189,938 less in the period encompassing the Great Recession than they did in the previous four year period. 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 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 7.7 percentage points more of their permanent income, while at the 75th percentile this gap is 11.9 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 the demographic characteristics, educational attainment, and personality traits of both partners. 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.

[Insert Table 4 here]

Not surprisingly, households' savings rate was substantially lower in 2006-2010 than it was immediately prior to the Great Recession (2002-2006). Wealth accumu-

lation as a fraction of permanent income earned over the same period was 27.3 percentage points lower in poor households and 36.8 percentage points lower in wealthy households. 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 & 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 – most notably permanent income, education, and personality traits– 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, households find it easier to maintain self-control if they allocate 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). 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 & 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 & 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 & 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 equation (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 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.[23]

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 results in Panel B stem from a model which includes the entire set of control variables.[24]

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) \$0.54 in real estate equity; (ii) \$0.22 in financial wealth; (iii) \$0.15 in pension wealth; (iv) \$0.08 in business equity; and (v) \$0.01 in vehicles (see Panel A). Controlling for households' permanent income as well as the demographic characteristics, human capital, and personality traits of both partners leaves asset portfolios relatively unchanged (see Panel B). The exception is that the share of additional wealth allocated to business equity rises by \$0.03, while the share

[23]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 the household weights and bootstrap the standard errors.

[24]Complete results are presented in Appendix Table 4.

allocated to pension wealth falls by a corresponding amount.

[Insert Table 5 here]

Households in which the reference person is internal hold significantly less financial wealth ($272,017), but significantly more vehicle wealth ($12,000) and pension wealth ($226,557) 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 $0.09 more to building financial wealth than do households with external reference persons. This is counterbalanced by gaps of $0.03 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 Panel B). Nonetheless, the reference person's locus of control remains a significant predictor of the portfolio choices that the household makes. Overall, the combined effect implies that households with an internal reference person and average levels of net worth hold considerably less financial wealth ($74,438), but more pension wealth ($42,488) than otherwise similar households with an external reference person.

It 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 & Fertig, 2013), and personality traits (Brown & 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 $1.8 million. 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. Consistent with the predictions of behavioral savings theory, 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 & 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 & 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 & Weinberg (2009, pg.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 & 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 & 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.

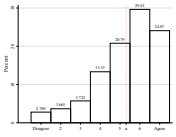
The welfare implications of policies to promote household savings fundamentally depend on whether we have accounted for the role of temptation and self-control (see

O'Donoghue & 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 & 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 & Benartzi, 2004; Kooreman & 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.

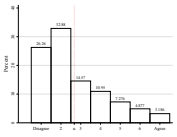
Taken together, our results shed light on the relationship between locus of control, wealth accumulation, savings rates, and portfolio choices. Despite this, they leave a number of questions unanswered. In particular, why does locus of control matter? What is the mechanism linking households' locus of 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.

Figures and Tables

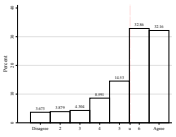
Figure 1: Distribution of subcomponents of locus of control



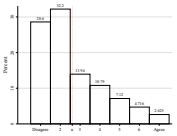
(a) I have little control over the things that happen to me



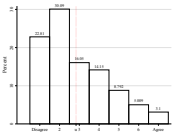
(b) There is really no way I can solve some of the problems I have



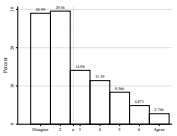
(c) There is little I can do to change many of the important things in my life



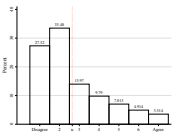
(d) I often feel helpless in dealing with the problems of life



(e) Sometimes I feel that I am being pushed around in life



(f) What happens to me in the future mostly depends on me



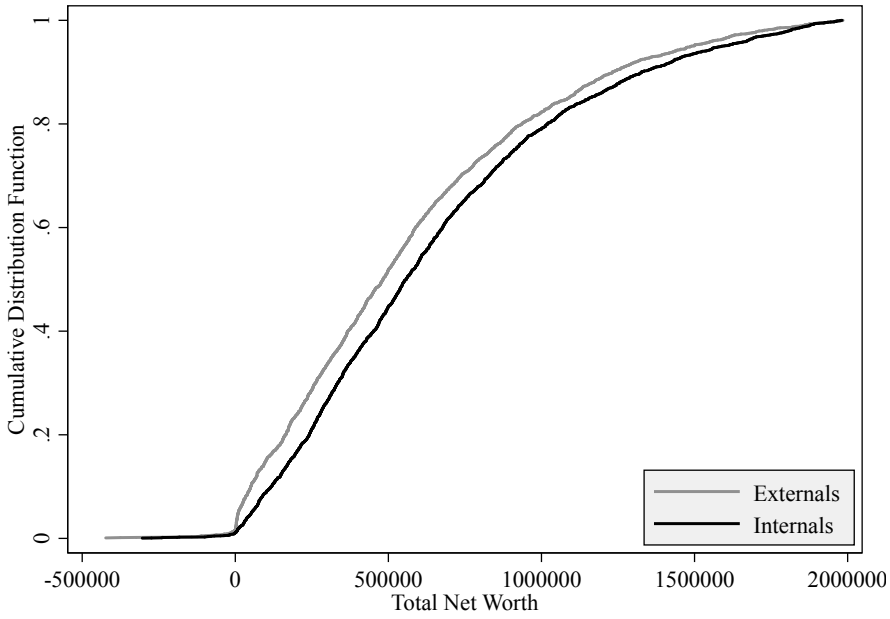
(g) I can do just about anything I really set my mind to do

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	778,110.92	1,043,397.05	955	586,590.54	720,391.73	998
Median Net Worth	483,413.92	877,279.58	955	398,734.18	681,680.63	998
Net Worth if > 0	785,987.45	1,045,506.53	946	598,431.50	721,747.74	982
$\% > 0$	0.990	0.098	955	0.982	0.134	998
Components of Net Worth						
Net Financial Wealth	110,843.20	311,202.46	955	85,487.49	262,519.58	998
Business Equity	82,038.94	444,477.84	955	42,663.63	263,055.88	998
Housing Equity	355,291.55	510,727.24	955	295,267.08	340,370.70	998
Vehicles Equity	34,894.37	64,873.37	955	28,781.98	36,956.92	998
Pensions	195,042.86	285,895.75	955	134,390.37	210,703.95	998
2006						
Net Worth						
Net Worth	1,141,576.42	1,778,903.69	952	826,940.61	1,113,792.86	992
Median Net Worth	670,000.00	791,046.70	952	549,438.20	564,046.98	992
Net Worth if > 0	1,152,087.12	1,782,773.79	944	844,535.10	1,116,606.94	976
$\% > 0$	0.992	0.092	952	0.982	0.135	992
Components of Net Worth						
Net Financial Wealth	140,533.57	515,863.67	952	124,165.47	486,680.42	992
Business Equity	109,929.91	535,407.54	952	58,864.10	384,572.99	992
Housing Equity	602,491.12	1,145,514.43	952	439,037.32	506,516.82	992
Vehicles Equity	37,134.99	49,539.09	952	32,607.87	44,164.19	992
Pensions	251,486.82	376,922.92	952	172,265.85	284,502.38	992
2010						
Net Worth						
Net Worth	1,065,611.11	1,276,958.18	1012	868,776.07	1,089,909.80	931
Median Net Worth	687,185.00	879,021.58	1012	584,400.00	766,318.34	931
Net Worth if > 0	1,080,537.08	1,276,767.00	999	880,870.80	1,089,249.46	917
$\% > 0$	0.988	0.107	1012	0.989	0.105	931
Components of Net Worth						
Net Financial Wealth	124,859.71	412,609.36	1012	90,163.43	289,684.23	931
Business Equity	83,530.35	429,234.33	1012	51,001.13	311,821.41	931
Housing Equity	572,191.97	683,660.11	1012	490,470.72	620,788.09	931
Vehicles Equity	37,915.35	43,921.77	1012	31,890.70	45,691.63	931
Pensions	247,113.73	342,279.88	1012	205,250.09	346,416.65	931

Note: Weighted numbers based on weights provided by HILDA.

Figure 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

	2002				2006				2010			
Percentile	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	35,128	13,718	88,742	0.396	92,753	28,689	207,854	0.446	115,750	24,335	206,040	0.562
20th	25,275	15,257	175,316	0.144	92,562	19,417	337,865	0.274	117,952	25,316	348,860	0.338
30th	36,690	16,736	263,924	0.139	106,244	21,211	460,269	0.231	107,700	21,392	480,600	0.224
40th	40,253	21,187	347,595	0.116	106,944	24,976	568,848	0.188	88,495	23,677	590,600	0.150
50th	85,757	33,279	473,557	0.181	112,609	30,532	692,135	0.163	106,199	32,001	739,635	0.144
60th	112,405	30,471	626,709	0.179	149,101	45,216	865,169	0.172	105,251	39,943	902,830	0.117
70th	158,792	41,609	812,152	0.196	196,045	58,342	1,110,534	0.177	116,233	63,542	1,143,020	0.102
80th	171,346	55,361	1,036,772	0.165	305,281	72,906	1,500,562	0.203	198,061	99,633	1,549,176	0.128
90th	459,919	109,212	1,701,592	0.270	567,641	165,192	2,353,827	0.241	453,667	205,056	2,365,750	0.192
Observations	1,928				1,903				1,892			

Note: See Note to Table 1. Bootstrap standard errors based on 100 replications.

Table 3: Determinants of Net Worth, Unconditional Quantile Regression
(Coefficients and Standard Errors)

	OLS	Q25	Q50	Q75
Panel A				
Lag household net worth	0.91***	0.23***	0.35***	0.78***
	(0.06)	(0.02)	(0.03)	(0.06)
Lag household net worth ×	-0.09	-0.12***	-0.15***	-0.25***
internal locus of control	(0.12)	(0.03)	(0.04)	(0.09)
Internal locus of control	154623.83*	167011.17***	191049.21***	278234.21***
	(84432.54)	(30805.01)	(37236.29)	(71317.48)
Year: 2010	-219362.73***	-26886.79	-34224.51	-94869.81**
	(31046.84)	(19413.06)	(21333.52)	(38245.83)
Constant	343221.29***	146321.25***	345702.09***	548228.94***
	(34772.99)	(23331.50)	(25668.13)	(42001.59)
Average marginal effects:				
Lag household net worth	0.87***	0.16***	0.27***	0.65***
	(0.06)	(0.01)	(0.02)	(0.05)
Internal locus of control	83388.90***	65356.02***	62257.52***	70837.24*
	(30453.29)	(19212.22)	(22313.94)	(40891.51)
Control variables	No	No	No	No
Observations	3,795	3,795	3,795	3,795
Panel B				
Internal locus of control	0.71***	0.11***	0.21***	0.56***
	(0.06)	(0.02)	(0.03)	(0.05)
Lag household net worth	-0.08	-0.10***	-0.13***	-0.22***
	(0.11)	(0.02)	(0.03)	(0.07)
Lag household net worth ×	108009.57	128193.54***	154793.09***	221175.06***
internal locus of control	(81748.50)	(27895.94)	(32947.89)	(66368.35)
Year: 2010	-189937.72***	-22213.43	-23741.63	-77795.85**
	(27577.09)	(17958.73)	(19805.68)	(36612.95)
Permanent income	8.94***	2.55***	3.60***	5.97***
	(1.35)	(0.30)	(0.41)	(0.75)
Constant	2917.64	1786.98	1010.26	-1346.16
	(3110.84)	(2331.27)	(2419.88)	(4341.03)
Average marginal effects:				
Internal locus of control	0.67***	0.06***	0.14***	0.45***
	(0.07)	(0.01)	(0.02)	(0.04)
Lag household net worth	39623.84	48934.20**	48815.68**	39908.66
	(30478.98)	(19220.47)	(21943.33)	(43081.08)
Control variables	Yes	Yes	Yes	Yes
Observations	3,795	3,795	3,795	3,795

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

Table 4: Determinants of Savings Rate, Unconditional Quantile Regression
(Coefficients and Standard Errors)

	OLS	Q25	Q50	Q75
Panel A				
Internal locus of control	0.107	0.019	0.077**	0.119**
	(0.077)	(0.032)	(0.033)	(0.048)
Year: 2010	-0.622***	-0.273***	-0.294***	-0.368***
	(0.078)	(0.032)	(0.033)	(0.048)
Constant	0.802***	0.081***	0.475***	1.068***
	(0.067)	(0.025)	(0.028)	(0.042)
Control variables	No	No	No	No
Observations	3,795	3,795	3,795	3,795
Panel B				
Internal locus of control	0.109	-0.013	0.051	0.131**
	(0.088)	(0.034)	(0.036)	(0.054)
Year: 2010	-0.004	-0.007**	-0.001	0.006
	(0.009)	(0.004)	(0.004)	(0.006)
Constant	0.010	0.032	-0.006	0.011
	(0.089)	(0.040)	(0.043)	(0.063)
Control variables	Yes	Yes	Yes	Yes
Observations	3,795	3,795	3,795	3,795

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

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	0.22	8.73	0.08	4.70	0.54	20.39	0.01	7.63	0.15	5.30
Total net worth × internal	0.09	3.44	0.01	0.71	-0.03	-0.89	-0.01	-3.10	-0.07	-2.22
Internal locus of control	-272016.62	-4.54	-2653.84	-0.12	36113.63	0.53	12000.02	3.58	226556.80	5.27
Average marginal effects:										
Internal locus of control	-175125.15	-4.05	11219.69	0.66	952.77	0.02	6381.51	2.22	156571.17	4.94
Lag household net worth	0.27	14.15	0.09	6.37	0.52	25.19	0.01	7.80	0.11	6.58
Control variables	No		No		No		No		No	
Number of observations	3,795		3,795		3,795		3,795		3,795	
Panel B										
Total net worth	0.22	8.31	0.11	5.46	0.54	17.45	0.01	4.85	0.12	4.45
Total net worth × internal	0.09	3.31	0.01	0.56	-0.03	-0.69	-0.01	-3.14	-0.07	-2.11
Internal locus of control	-166276.04	-2.84	-10642.54	-0.44	55730.88	0.84	9777.44	2.63	111410.27	2.54
Permanent income	-3.04	-4.19	-0.73	-2.04	-0.71	-0.89	0.26	5.79	4.23	7.04
Average marginal effects:										
Internal locus of control	-74438.09	-1.68	-134.28	-0.01	28319.98	0.60	3764.22	1.20	42488.17	1.37
Lag household net worth	0.27	11.20	0.12	6.45	0.53	18.57	0.01	3.65	0.08	4.28
Control variables	Yes		Yes		Yes		Yes		Yes	
Number of observations	3,795		3,795		3,795		3,795		3,795	

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

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Appendix

Table A1: Descriptive Statistics

	2006		2010	
	Internal	External	Internal	External
Income				
Disposable household income	92,603	78,320	101,755	89,129
	(61,980)	(44,193)	(63,835)	(58,414)
Permanent income	90,638	77,372	91,061	79,824
	(50,854)	(38,691)	(46,354)	(38,186)
Demographic characteristics				
Age	47.9	49.6	48.3	50.3
	(12.2)	(12.1)	(12.1)	(12.3)
Female	0.456	0.476	0.484	0.468
	(0.498)	(0.500)	(0.500)	(0.499)
Number of children	1.269	1.225	1.287	1.094
	(1.547)	(1.590)	(1.583)	(1.505)
Ever divorced	0.138	0.136	0.131	0.148
	(0.345)	(0.343)	(0.338)	(0.355)
Education				
Postgrad degree	0.052	0.046	0.062	0.050
	(0.223)	(0.209)	(0.241)	(0.218)
Graduate diploma/certificate	0.086	0.068	0.095	0.067
	(0.281)	(0.252)	(0.294)	(0.251)
Bachelor	0.167	0.139	0.179	0.149
	(0.373)	(0.346)	(0.383)	(0.356)
Diploma	0.108	0.093	0.116	0.107
	(0.311)	(0.290)	(0.320)	(0.309)
Any certificate	0.236	0.250	0.231	0.263
	(0.425)	(0.433)	(0.422)	(0.441)
Year 12	0.112	0.114	0.121	0.117
	(0.316)	(0.318)	(0.326)	(0.322)
Personality traits				
Extroversion (Std.)	0.291	-0.094	0.292	-0.145
	(1.000)	(0.911)	(1.000)	(0.910)
Agreeableness (Std.)	0.185	-0.093	0.182	-0.086
	(0.906)	(0.933)	(0.904)	(0.939)
Conscientiousness (Std.)	0.431	0.034	0.404	0.019
	(0.919)	(0.908)	(0.907)	(0.903)
Emotional stability (Std.)	0.460	-0.029	0.417	-0.096
	(0.826)	(0.876)	(0.838)	(0.912)
Openess (Std.)	0.044	-0.083	0.028	-0.079
	(0.951)	(0.917)	(0.949)	(0.906)
Observations	938	965	989	903

Table A1 (continued): Descriptive Statistics

	2006		2010	
	Internal	External	Internal	External
Demographic characteristics (Partner)				
Age	48.1	49.5	48.5	49.9
	(12.2)	(11.9)	(12.3)	(12.0)
Ever divorced	0.143	0.121	0.128	0.120
	(0.351)	(0.327)	(0.334)	(0.325)
Education (Partner)				
Postgrad degree	0.049	0.040	0.060	0.043
	(0.215)	(0.195)	(0.238)	(0.203)
Grad. dipl./cert.	0.063	0.064	0.064	0.075
	(0.243)	(0.245)	(0.246)	(0.264)
Bachelor	0.167	0.123	0.183	0.134
	(0.373)	(0.329)	(0.387)	(0.341)
Diploma	0.113	0.097	0.116	0.104
	(0.317)	(0.296)	(0.320)	(0.305)
Any cert.	0.240	0.223	0.234	0.237
	(0.428)	(0.417)	(0.424)	(0.425)
Year 12	0.100	0.122	0.114	0.118
	(0.300)	(0.327)	(0.318)	(0.322)
Personality traits (Partner)				
Extroversion (Std.)	0.026	-0.199	0.009	-0.165
	(0.996)	(0.999)	(0.989)	(0.986)
Agreeableness (Std.)	0.062	-0.055	0.009	-0.102
	(0.896)	(0.937)	(0.901)	(0.947)
Conscientiousness (Std.)	0.207	-0.079	0.111	-0.133
	(0.884)	(0.965)	(0.880)	(0.962)
Emotional stability (Std.)	0.160	-0.323	0.090	-0.370
	(0.889)	(0.984)	(0.924)	(0.957)
Openess (Std.)	-0.038	-0.028	-0.042	-0.025
	(0.899)	(0.980)	(0.896)	(0.955)
Observations	938	965	989	903

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 household net worth	0.71***	0.11***	0.21***	0.56***
	(0.06)	(0.02)	(0.03)	(0.05)
Lag household net worth ×	-0.08	-0.10***	-0.13***	-0.22***
internal locus of control	(0.11)	(0.02)	(0.03)	(0.07)
Internal locus of control	108009.57	128193.54***	154793.09***	221175.06***
	(81748.50)	(27895.94)	(32947.89)	(66368.35)
Year: 2010	-189937.72***	-22213.43	-23741.63	-77795.85**
	(27577.09)	(17958.73)	(19805.68)	(36612.95)
Permanent income	8.94***	2.55***	3.60***	5.97***
	(1.35)	(0.30)	(0.41)	(0.75)
Age	2917.64	1786.98	1010.26	-1346.16
	(3110.84)	(2331.27)	(2419.88)	(4341.03)
Female	-20101.62	-56897.65**	-74927.47***	-57934.89
	(31191.75)	(23772.73)	(25977.09)	(48020.29)
Number of children	20582.99**	-1554.92	3066.94	7888.44
	(9725.85)	(7351.44)	(7666.43)	(13180.14)
Ever divorced	7985.51	13704.39	-35663.71	73455.10
	(38672.24)	(28425.15)	(33151.00)	(61163.90)
Postgrad degree	-23779.85	114247.93**	205998.47***	373199.33***
	(108438.70)	(45112.07)	(53894.42)	(108854.53)
Graduate diploma/certificate	-41043.22	152287.37***	251487.00***	482804.87***
	(92297.02)	(35209.45)	(44987.45)	(93454.22)
Bachelor	37224.61	149120.14***	161424.60***	269415.53***
	(76052.88)	(33194.89)	(38045.84)	(73227.95)
Diploma	33736.37	151157.99***	161421.45***	132006.93*
	(71160.17)	(32547.23)	(39240.31)	(74392.57)
Any certificate	-356.52	102661.28***	63322.76**	67302.15
	(48857.34)	(26543.35)	(29368.29)	(52067.31)
Year 12	-4768.15	64003.24*	93803.99**	165458.47**
	(52682.89)	(36572.60)	(37924.85)	(69609.63)
Extroversion (Std.)	-3961.06	-1594.92	-690.32	-34996.32*
	(15637.32)	(9031.86)	(10635.69)	(21193.70)
Agreeableness (Std.)	-48432.14***	-13567.61	-26838.41**	-44494.57**
	(17868.54)	(11552.77)	(12663.65)	(22566.76)
Conscientiousness (Std.)	17557.05	45334.76***	25016.42**	18693.01
	(16294.46)	(10095.72)	(11948.76)	(23204.89)
Emotional stability (Std.)	-12254.05	-1634.65	11860.48	-5321.94
	(16297.13)	(12279.65)	(12761.24)	(23597.27)
Openess (Std.)	33937.45*	-22567.09**	21311.40*	71370.51***
	(19552.10)	(11023.11)	(12304.85)	(22729.67)

Table A2 (continued): Determinants of Net Worth, Unconditional Quantile Regression (Coefficients and Standard Errors)

	OLS	Q25	Q50	Q75
Partner characteristics				
Age	33937.45*	-22567.09**	21311.40*	71370.51***
	(19552.10)	(11023.11)	(12304.85)	(22729.67)
Ever divorced	12237.69***	11691.90***	16074.22***	24240.62***
	(3833.81)	(2315.37)	(2424.67)	(4452.45)
Postgrad degree	-75759.37*	-54366.31*	-49681.50	-74298.25
	(44905.11)	(28457.70)	(33713.85)	(64729.60)
Grad. dipl./cert.	22992.25	126966.85***	95295.86*	144502.25
	(85332.17)	(44068.63)	(54085.89)	(109682.25)
Bachelor	-73254.77	126980.84***	56650.40	9500.87
	(57453.11)	(37458.98)	(43610.04)	(78275.68)
Diploma	-100408.52**	164482.24***	73466.22**	103421.62
	(47532.99)	(30847.68)	(35367.24)	(70081.29)
Any cert.	-32658.27	86370.68***	40241.30	30394.64
	(56369.90)	(32718.98)	(38029.70)	(72057.49)
Year 12	-90656.56**	93429.87***	39336.66	-102382.40**
	(42386.20)	(26821.62)	(29006.68)	(50888.53)
Extroversion (Std.)	-102542.45*	38416.90	-9726.37	-12766.84
	(52441.97)	(35661.37)	(38239.85)	(69826.49)
Agreeableness (Std.)	-3873.93	2212.08	5371.43	4349.57
	(13136.71)	(8828.03)	(10492.63)	(19597.40)
Conscientiousness (Std.)	-54533.81***	-6957.80	-26574.84**	-89560.75***
	(17897.77)	(11826.97)	(12562.93)	(23783.00)
Emotional stability (Std.)	661.68	15364.35	18232.98	1759.09
	(17322.35)	(9805.77)	(11906.22)	(22155.98)
Openess (Std.)	31163.19**	-12920.66	-24940.95**	50293.53**
	(13801.08)	(10768.35)	(12047.14)	(22697.17)
Constant	26800.28	-7538.20	-616.61	21480.11
	(16597.76)	(10629.37)	(12377.09)	(22975.64)
Observations	3,795	3,795	3,795	3,795

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	0.109	-0.013	0.051	0.131**
	(0.088)	(0.034)	(0.036)	(0.054)
Age	-0.004	-0.007**	-0.001	0.006
	(0.009)	(0.004)	(0.004)	(0.006)
Female	0.010	0.032	-0.006	0.011
	(0.089)	(0.040)	(0.043)	(0.063)
Number of children	0.015	-0.011	0.002	-0.011
	(0.028)	(0.011)	(0.012)	(0.018)
Ever divorced	0.012	0.023	0.073	0.068
	(0.099)	(0.050)	(0.052)	(0.080)
Postgrad degree	0.083	0.084	0.124	0.108
	(0.181)	(0.075)	(0.083)	(0.131)
Graduate diploma/certificate	0.174	0.067	0.175**	0.176
	(0.162)	(0.071)	(0.070)	(0.107)
Bachelor	0.258	0.098*	0.168***	0.191**
	(0.166)	(0.054)	(0.059)	(0.086)
Diploma	0.154	-0.022	0.084	0.067
	(0.172)	(0.061)	(0.060)	(0.088)
Any certificate	0.035	0.014	0.022	0.002
	(0.134)	(0.048)	(0.047)	(0.068)
Year 12	0.113	0.066	0.028	-0.033
	(0.134)	(0.058)	(0.062)	(0.090)
Extroversion (Std.)	-0.051	-0.013	-0.010	-0.006
	(0.045)	(0.017)	(0.017)	(0.026)
Agreeableness (Std.)	-0.060	0.011	-0.024	-0.035
	(0.050)	(0.020)	(0.021)	(0.031)
Conscientiousness (Std.)	0.017	-0.009	0.022	0.009
	(0.051)	(0.018)	(0.019)	(0.029)
Emotional stability (Std.)	-0.028	-0.015	-0.016	-0.029
	(0.044)	(0.020)	(0.022)	(0.033)
Openess (Std.)	0.068	0.001	0.002	0.033
	(0.052)	(0.019)	(0.020)	(0.030)

Table A3 (continued): Determinants of Savings Rate, Unconditional Quantile Regression (Coefficients and Standard Errors)

	OLS	Q25	Q50	Q75
Partner characteristics				
Age	0.005	-0.009**	-0.001	0.002
	(0.009)	(0.004)	(0.004)	(0.006)
Ever divorced	-0.179	-0.031	-0.052	-0.040
	(0.110)	(0.053)	(0.054)	(0.081)
Postgrad degree	0.139	0.090	0.314***	0.183
	(0.189)	(0.074)	(0.081)	(0.137)
Grad. dipl./cert.	0.005	0.015	0.146**	-0.033
	(0.144)	(0.064)	(0.071)	(0.104)
Bachelor	-0.115	0.005	0.156***	0.066
	(0.130)	(0.056)	(0.059)	(0.092)
Diploma	-0.048	-0.071	0.074	0.050
	(0.165)	(0.059)	(0.062)	(0.094)
Any cert.	-0.132	-0.068	-0.007	-0.088
	(0.124)	(0.047)	(0.047)	(0.068)
Year 12	-0.188	-0.026	-0.011	0.021
	(0.148)	(0.058)	(0.060)	(0.087)
Extroversion (Std.)	0.029	-0.007	0.014	0.038
	(0.034)	(0.016)	(0.017)	(0.025)
Agreeableness (Std.)	-0.108**	-0.008	-0.014	-0.060*
	(0.053)	(0.020)	(0.021)	(0.031)
Conscientiousness (Std.)	-0.014	0.012	0.008	-0.027
	(0.043)	(0.017)	(0.018)	(0.028)
Emotional stability (Std.)	0.072*	0.034*	0.020	0.028
	(0.042)	(0.019)	(0.019)	(0.029)
Openess (Std.)	0.017	-0.013	-0.009	0.014
	(0.044)	(0.019)	(0.020)	(0.030)
Year: 2010	-0.630***	-0.269***	-0.304***	-0.385***
	(0.077)	(0.031)	(0.032)	(0.048)
Constant	0.775***	0.872***	0.446***	0.628***
	(0.278)	(0.112)	(0.119)	(0.171)
Observations	3,795	3,795	3,795	3,795

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	0.22	8.31	0.11	5.46	0.54	17.45	0.01	4.85	0.12	4.45
Total net worth × internal	0.09	3.31	0.01	0.56	-0.03	-0.69	-0.01	-3.14	-0.07	-2.11
Internal locus of control	-166276.04	-2.84	-10642.54	-0.44	55730.88	0.84	9777.44	2.63	111410.27	2.54
Permanent income	-3.04	-4.19	-0.73	-2.04	-0.71	-0.89	0.26	5.79	4.23	7.04
Age	11920.78	2.13	-1394.68	-0.81	2296.77	0.34	545.53	1.10	-13368.40	-3.38
Female	14612.96	0.26	15917.18	0.78	75702.47	1.16	-495.83	-0.17	-105736.79	-2.72
Number of children	-38502.05	-2.16	10884.14	1.76	55740.45	3.16	985.09	0.96	-29107.63	-3.20
Ever divorced	-60870.98	-0.80	-7392.93	-0.25	17759.48	0.21	-3798.10	-1.00	54302.52	1.15
Postgrad degree	199642.42	1.65	30142.32	0.75	-237606.43	-2.03	-27311.46	-2.82	35133.15	0.54
Graduate diploma/certificate	-61753.94	-0.56	-88703.46	-2.19	905.63	0.01	4899.57	1.12	144652.20	2.02
Bachelor	20197.27	0.22	-12173.09	-0.44	-132635.49	-1.47	-8060.48	-1.43	132671.80	2.62
Diploma	-122002.55	-1.48	20343.05	0.68	-30970.56	-0.38	-7783.05	-1.31	140413.11	2.61
Any certificate	-79942.40	-1.23	6116.99	0.31	-57715.46	-0.81	1132.06	0.27	130408.80	2.55
Year 12	-133682.55	-1.22	-41712.21	-1.61	2059.19	0.02	-28.26	-0.01	173363.82	3.82
Extroversion (Std.)	-50903.55	-2.03	10102.96	1.15	61562.30	2.43	2253.02	1.54	-23014.73	-1.67
Agreeableness (Std.)	-42596.42	-1.48	-18482.07	-1.78	18072.74	0.70	-176.23	-0.10	43181.98	2.44
Conscientiousness (Std.)	53345.23	2.01	-7743.85	-0.79	-75896.89	-3.07	1107.40	0.64	29188.11	1.54
Emotional stability (Std.)	14278.59	0.51	4981.11	0.51	-14254.59	-0.45	-2314.32	-1.44	-2690.78	-0.13
Openess (Std.)	10760.02	0.43	14198.59	1.27	-68935.68	-2.37	-1916.60	-1.15	45893.67	2.60

Table A4 (continued): 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.
Partner characteristics										
Age	6547.61	1.11	-4282.09	-2.19	10397.73	1.50	-737.53	-1.54	-11925.73	-3.08
Ever divorced	-56070.34	-0.81	39003.31	1.26	-66721.53	-0.82	3467.90	0.65	80320.66	1.63
Postgrad degree	-6392.11	-0.06	-136743.07	-2.92	165108.36	1.43	-13184.16	-1.71	-8789.01	-0.13
Grad. dipl./cert.	-179302.45	-1.48	-87416.79	-2.30	208573.86	1.70	146.75	0.03	57998.63	1.06
Bachelor	-194630.79	-2.00	-73848.01	-2.37	309866.47	3.00	-6360.08	-1.35	-35027.58	-0.76
Diploma	22098.55	0.29	-22195.37	-0.66	11944.14	0.13	-4308.71	-0.77	-7538.61	-0.12
Any cert.	-88320.15	-1.22	-31844.78	-1.36	99567.14	1.17	-558.60	-0.14	21156.39	0.45
Year 12	-29018.29	-0.32	-8117.80	-0.22	136530.09	1.36	-13540.80	-2.05	-85853.19	-1.45
Extroversion (Std.)	-23533.23	-1.00	4619.12	0.52	22017.29	0.81	1329.06	1.09	-4432.24	-0.33
Agreeableness (Std.)	-103244.38	-3.67	5533.99	0.56	90889.56	3.06	2333.04	1.23	4487.79	0.24
Conscientiousness (Std.)	19668.51	0.89	-5860.20	-0.59	-13695.58	-0.53	2915.35	1.63	-3028.07	-0.19
Emotional stability (Std.)	5265.35	0.20	16251.33	1.88	-35906.38	-1.26	-1113.25	-0.62	15502.95	0.81
Openess (Std.)	11771.36	0.39	23309.87	2.12	-47206.52	-1.52	-4498.98	-2.75	16624.27	1.12
Number of observations	3,795		3,795		3,795		3,795		3,795	

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