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Debt and Risk Preference: A Household Level Analysis

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Abstract:

We explore the relationship between risk preference and the level of unsecured debt at the household level within the context of a two period theoretical framework, which predicts that debt is a function of risk aversion. We test the predictions of our theoretical framework for a sample of households drawn from the U.S. *Panel Study of Income Dynamics* (*PSID*) and the U.S. *Survey of Consumer Finances* (*SCF*). Using a sequence of questions from the 1996 *PSID* and the 1989 to 2004 *SCF*, we construct measures of risk preference allowing us to explore the implications of interpersonal differences in risk preference for the accumulation of unsecured debt at the household level. Our empirical findings, which accord with our theoretical priors, suggest that risk preference is an important determinant of the level of unsecured debt acquired at the household level with risk aversion serving to reduce the level of unsecured debt accumulated by households.

Key Words: Debt; Financial Assets; Risk Aversion; Risk Preference.

JEL Classification: D18; D84; D91.

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I. Introduction

Both sides of the Atlantic have witnessed a massive increase in consumer debt over the last decade. For the US, recent figures from the Federal Reserve reveal that debt levels (consumer credit and mortgage debt) were nearly $11,804 billion by the end of 2005 (Federal Reserve, 2007). Despite such figures, amongst academic economists research into the determinants of debt at the household level is surprisingly scarce. This is somewhat puzzling as the most common reasons for debt problems, which include income shocks and unemployment, are active areas of research in the economics literature.

There are, however, a small number of empirical studies on debt, which explore its determinants at the household or individual level. For example, Godwin (1997) explores the dynamics of households' use of consumer credit and attitudes towards credit using U.S. panel data. The findings suggest that there was considerable mobility in debt status during the 1980s, with the majority of households in a different debt quintile in 1989 relative to 1983. In a more recent U.S. study, Crook (2001) explores the factors that explain U.S. household debt over the period 1990 to 1995 using data from the *Survey of Consumer Finances* and finds that income, home ownership and family size all impact positively on the level of household debt; whilst Brown *et al*. (2005) conduct empirical analysis based on British panel data and find that financial expectations are important determinants of unsecured debt at the individual and the household level.

In this paper, we focus on one particular influence on debt accumulation at the household level, namely risk preference. Given the uncertainty surrounding the capacity to acquire and repay debt it is surprising that inter-personal differences in risk preferences have not attracted much attention in the empirical literature on household

debt.[1] Households generally acquire debt to increase current consumption with repayments being made in the future. Typically, this may be due to life cycle reasons, short term liquidity constraints or other market imperfections. Given that debt repayments are generally financed from household income, it is apparent that if income in the future is subject to risk (such as redundancy, unemployment or changes in real wages), then the risk preference of the individual will potentially play a key role in the decision to acquire debt, given the distribution of future income and interest rates. Intuitively, one might predict that the more risk averse an individual is, the lower will be the debt he/she incurs if there is a non zero probability that the individual cannot repay the debt in the future.

From a theoretical perspective, the issue of how consumers with different risk preferences choose an optimal level of debt cannot be analysed separately from the saving decision. One puzzle in consumer behaviour concerns why households borrow and save at the same time. Four possible explanations are given. Firstly, if, in a world of certainty, the return on saving is above that on borrowing then it is in the consumer's interest to borrow to the maximum extent possible, and save some of the debt thus raised. Secondly, some forms of saving and borrowing are for prescribed purposes. For example, some borrowing channels are restricted to financing certain types of expenditure over a fixed medium term period, such as, for example, a 5 year loan for a home appliance with no prepayment option, or 'zero interest' catalogue purchases. In this case, we could observe individuals with such loans who are also saving in response to short run favourable income shocks. Thirdly, a pure liquidity reason may determine short term simultaneous savings and debt. In other words, there may be no fundamental reason to save or borrow, but the potentially unmatched timing of income and outgoings

[1] One exception lies in the economic psychology literature: Donkers and Van Soest (1999) find that risk averse Dutch homeowners tend to live in houses with lower mortgages.

means that a household has both debt and savings over a period of time. Finally, in a world of uncertainty over interest rates and labour income, an individual may both borrow and save in order to diversify his/her financial portfolio. Consider a household in a long term debt position, such as a young household with rising mean income expectations that engages in debt to finance consumption (for example, of a durable good), while facing risk in future income and interest rates. In these circumstances, if there is positive correlation between interest rates on debt, interest rates on savings and future income, then the more risk averse the household, the more it will attempt to hedge its risks on future debt and income by saving. In the present example with positive correlation between rates of interest and income, the risk on future income is an outside risk, but the household can control its choice of both debt and savings as financial instruments. Hence, a risk averse individual may be observed both borrowing and saving at the same time.

Without risk aversion or market imperfections (such as credit tied to goods purchase), the only motivation for joint borrowing and savings is to make money if, on average, the savings rate is above the borrowing rate. But with risk aversion, in the presence of uncertain future income and interest rate streams, the nature of an individual's risk preference will play an important role in the decision to use debt in order to finance current consumption. From the theoretical point of view, there is a vast literature on precautionary savings that has analysed the role of risk preferences in life cycle decisions. In a portfolio context, savings can also be used to hedge against outside risk and against the risk on debt itself, as discussed above. However, in the context of empirical analysis, there are obvious problems in measuring risk preferences at the household or individual level. Consequently, the role played by attitudes towards risk in personal financial decisions has attracted somewhat limited attention in the empirical

literature.[2] In order to redress this imbalance in the existing economics literature, we aim to explore the relationship between risk preference and unsecured debt in the presence of savings from both a theoretical and an empirical perspective.

II. Theoretical Background

We can capture the influences on borrowing and saving described above within a simple life cycle example, which serves to inform our subsequent empirical analysis. We aim to derive closed form solutions for optimal borrowing and saving, so we use a mean-variance specification for the utility function.[3] This can be regarded as an approximation to an underlying more general utility function. In this case, with a finite life, the value function is also mean-variance in disposable resources. Hence, if we restrict attention to a two period problem, our asset behaviour will conveniently reflect that same problem for a multi-period horizon.

There are two assets: $S \geq 0$ is the stock of the savings asset, which has a gross return of R_S; and $D \geq 0$ is the stock of debt, which has a gross cost of R_D. The individual has labour income of y_t in periods $t = 1,2$ and starts life with given stocks, S_1 and D_1. So in period 1, disposable resources, w_1, are given by:

$$w_1 = y_1 + R_{S1}S_1 - R_{D1}D_1 \tag{1}$$

These resources are used in period 1 for either consumption or net financial asset holding, so that the budget constraint for period 1 is given by:

$$w_1 = c_1 + S_2 - D_2 \tag{2}$$

Since period 2 is the final period, all available resources are then consumed:

[2] Exceptions can be found in the experimental and behavioural economics literature, see for example, Thaler and Sheffrin (1981), Thaler and Benartzi (2004), Benhabib and Bisin (2005).

[3] With a general utility function the coefficient of risk aversion will be a function of current and future consumption so that risk preferences will then depend on current and future consumption and its determinants.

$$c_2 = w_2 = y_2 + R_{S2}S_2 - R_{D2}D_2 \tag{3}$$

In period 1, the labour income and the interest rates of period 2 are unknown and have a joint probability distribution. Utility in each period is denoted by:[4]

$$u(c_t) = Ec_t - \frac{b}{2}\text{var}(c_t); \quad t = 1,2 \tag{4}$$

which is discounted at rate, β. Hence, the trade-off between the mean and variance of consumption is given by:

$$-\frac{\partial E[u(c_t)]/\partial E[c_t]}{\partial E[u(c_t)]/\partial \text{var}(c_t)} = \frac{2}{b} \tag{5}$$

where $(b/2)$ is the coefficient of risk aversion, i.e. the focus of our paper. The individual's choice problem is as follows:

$$\begin{aligned} &\max_{c_1, S_2, D_2} c_1 + \beta\left[Ec_2 - \frac{b}{2}\text{var}(c_2)\right] \\ &st. \quad c_2 = y_2 + R_{S2}S_2 - R_{D2}D_2 \\ &\qquad w_1 = c_1 + S_2 - D_2 \\ &\qquad S_2, D_2 \geq 0 \end{aligned} \tag{6}$$

Since the individual will always consume all initial wealth over his/her lifetime, we can use the first period budget constraint to eliminate c_1, yielding:

$$\begin{aligned} &\max_{S_2, D_2} w_1 - S_2 + D_2 + \beta\left[Ec_2 - \frac{b}{2}\text{var}(c_2)\right] \\ &st. \quad c_2 = y_2 + R_{S2}S_2 - R_{D2}D_2 \\ &\qquad S_2, D_2 \geq 0 \end{aligned} \tag{7}$$

Let μ_S, μ_D and μ_y denote the means of second period interest rates and labour income respectively; and let:

[4] First period utility is linear in first period consumption because during the initial period income is certain and consequently has zero variance. If first period utility were quadratic in consumption, then income would enter the expressions for optimal debt and savings. However, the inter-temporal rate of substitution, equation (5), would no longer be equal to the risk preference parameter itself, but to the risk preference parameter plus expected consumption. For this reason, we have adopted a mean-variance specification.

$$\begin{bmatrix} \sigma_{SS} & \sigma_{SD} & \sigma_{Sy} \\ \sigma_{SD} & \sigma_{DD} & \sigma_{Dy} \\ \sigma_{Sy} & \sigma_{Dy} & \sigma_{yy} \end{bmatrix} \tag{8}$$

denote the variance-covariance matrix of these variables. Using the definition of c_2 given by equation (3), problem (7) becomes:

$$\max_{S2,D2} w_1 - S_2 + D_2 +$$
$$\beta\left[\mu_y + \mu_S S_2 - \mu_D D_2 - \frac{b}{2}(\sigma_{yy} + \sigma_{SS} {S_2}^2 + \sigma_{DD} {D_2}^2 + 2\sigma_{yS} S_2 - 2\sigma_{yD} D_2 - 2\sigma_{SD} S_2 D_2) \right]$$
$$st. \quad S_2, D_2 \geq 0$$

(9)

with interior solution:

$$D_2 = A_{D2} + B_{D2}(2/b) \tag{10}$$

$$S_2 = A_{S2} + B_{S2}(2/b) \tag{11}$$

where:

$$A_{D2} = \frac{(\sigma_{SS}\sigma_{yD} - \sigma_{SD}\sigma_{yS})}{(\sigma_{SS}\sigma_{DD} - \sigma_{SD}^2)} \tag{12}$$

$$B_{D2} = \frac{(\sigma_{SS}(1-\beta\mu_D) - \sigma_{SD}(1-\beta\mu_S))}{\beta(\sigma_{SS}\sigma_{DD} - \sigma_{SD}^2)} \tag{13}$$

$$A_{S2} = \frac{(\sigma_{SD}\sigma_{yD} - \sigma_{yS}\sigma_{DD})}{(\sigma_{SS}\sigma_{DD} - \sigma_{SD}^2)} \tag{14}$$

$$B_{S2} = \frac{(-\sigma_{DD}(1-\beta\mu_S) + \sigma_{SD}(1-\beta\mu_D))}{\beta(\sigma_{SS}\sigma_{DD} - \sigma_{SD}^2)} \tag{15}$$

Equations (12) to (15) have a common denominator, $\sigma_{SS}\sigma_{DD} - \sigma_{SD}^2$, which is equal to one minus the correlation coefficient between interest rates, savings and debt, multiplied by the product of the corresponding variances. In equations (13) and (15) in particular, the numerator represents the hedging component. For example, if $\sigma_{SD} = 0$, then

equations (13) and (15) reduce to the expected returns on debt and savings, $(1-\beta\mu_D)$ and $(1-\beta\mu_S)$, divided by the deflation for risk and time preference; whereas if $\sigma_{SD} \neq 0$ then hedging between savings and debt occurs. On the other hand, the possible corner solutions of problem (9) are as follows: $\{S_2 = 0, D_2 > 0\}$, $\{S_2 > 0, D_2 = 0\}$ and $\{S_2 = 0, D_2 = 0\}$. In order to analyse the relationship between debt and risk preference, we will briefly comment on the corner solutions below, beginning with the $\{S_2 = 0, D_2 > 0\}$ corner, which occurs when the lifetime marginal expected payoff of savings is negative evaluated at zero savings. In this corner solution case, the optimal level of debt is given by:

$$D_2 = \frac{2(1-\beta\mu_D)}{b\beta\sigma_{DD}} + \frac{\sigma_{Dy}}{\sigma_{DD}} \tag{16}$$

so long as the following inequality is satisfied:

$$\beta(\sigma_{yD}\sigma_{SD} - \sigma_{DD}\sigma_{yS}) < \left(\frac{2}{b}\right)\left[\sigma_{DD}(1-\beta\mu_S) - \sigma_{SD}(1-\beta\mu_D)\right] \tag{17}$$

There are two points particularly worthy of note here. Firstly, with mean-variance utility the variance of future labour income, σ_{yy}, acts as a deadweight loss: utility is lower the higher the variance of income, but the impact of the variance cannot be reduced through debt or saving. Hence, for all types of solution (whether interior or corner), σ_{yy} does not appear in the debt or savings equations. Secondly, equation (17) is the condition for a corner solution with no savings. It indicates that the first order condition for savings is strictly negative when debt is set at its optimal value given by equation (16). The left-hand side of equation (17) represents the discounted relative covariance of debt rates with savings rates and income; whereas the right-hand side represents the difference in the expected returns on debt and savings, weighted by the corresponding covariances. If this condition restricting the covariances is satisfied, then the marginal return on savings

is negative when savings is equal to zero, and the effect of risk preference on debt depends only on the mean; that is, on the sign of $(1-\beta\mu_D)$, which, in turn, depends on the relative magnitude of expected borrowing rates, μ_D, with respect to the time preference parameter, β. For example, if $\mu_D < 1/\beta$ then the expected return on debt is negative, $(1-\beta\mu_D)$ is positive, and debt is increasing in $(2/b)$, i.e. decreasing in risk aversion. Also, note the effect of the covariance between debt and income on the optimal size of debt: in equation (16), if $\sigma_{yD} > 0$, then the consumer will take on more debt, since when the interest rate on debt is high, income will also be high, so the consumer can afford to repay more debt.

In the corner solution case with zero debt, the optimal level of savings is given by:

$$S_2 = \frac{2(1-\beta\mu_S)}{b\beta\sigma_{SS}} - \frac{\sigma_{yS}}{\sigma_{SS}} \tag{18}$$

so long as the following inequality is satisfied:

$$\beta(\sigma_{yS}\sigma_{SD} - \sigma_{SS}\sigma_{yD}) > \left(\frac{2}{b}\right)\left[\sigma_{SS}(1-\beta\mu_D) - \sigma_{SD}(1-\beta\mu_S)\right] \tag{19}$$

Here the interpretation is analogous to that of the zero savings corner: again the effect of risk preference on savings depends on its mean return, once the condition on the covariances determined by equation (19) is satisfied. In this case, the marginal return on debt is negative at zero debt, and a positive covariance between savings interest rates and income will result in lower savings at the optimum.

To summarise, equations (10), (13) and (16) show that the optimally chosen stock of debt is a linear function of the coefficient of risk aversion. In the interior solution case, the sign of equation (13) determines whether debt is increasing in $(2/b)$, i.e. decreasing in risk aversion; in the corner solution cases this role is played by the sign

of the expected return on debt. Identical considerations can be made for the optimal savings equations (11), (15) and (18). Inequalities (17) and (19) serve to determine whether a corner solution with zero savings or with zero debt, respectively, is optimal.

In sum, the analysis of the set of potential solutions – interior and corner – presented above indicates that risk preference, i.e. the parameter *b*, plays an important role in determining debt as well as saving at the household level. In the remaining empirical sections of the paper, we focus on the relationship between unsecured debt and risk preference at the household level: firstly, to explore whether our theoretical prediction that debt is influenced by risk preference is supported from an empirical perspective; and, secondly, to determine the nature of this relationship.

III. Data and Methodology

Measurement of Risk Preference

The obvious problem with exploring the relationship between household debt and risk preference from an empirical perspective lies in locating a suitable measure of risk preference. For this purpose, we exploit data from two U.S. surveys: the *Panel Study of Income Dynamics* (*PSID*), which is a representative panel of individuals ongoing since 1968 conducted at the Institute for Social Research, University of Michigan; and the Survey of Consumer Finances (*SCF*), which is a cross-section survey of the balance sheet, pension, income, demographic characteristics and use of financial institutions of U.S. families developed since 1983 by the U.S. Federal Reserve Board.[5]

The *PSID* 1996 Survey includes a Risk Aversion Section which contains detailed information on individuals' attitudes towards risk. The Risk Aversion Section contains five questions related to hypothetical gambles with respect to lifetime income. To be

[5] Chatterjee *et al*. (2007) calibrate their general equilibrium model characterised by unsecured consumer credit and risk of default using data on debt and default from the *PSID* and *SCF*.

specific, all heads of household were asked the following question (M1): *Suppose you had a job that guaranteed you income for life equal to your current total income. And that job was (your/your family's) only source of income. Then you are given the opportunity to take a new, and equally good, job with a 50-50 chance that it will double your income and spending power. But there is a 50-50 chance that it will cut your income and spending power by a third. Would you take the new job?*[6] The individuals who answered 'yes' to this question, were then asked (M2): *Now, suppose the chances were 50-50 that the new job would double your (family) income, and 50-50 that it would cut it in half. Would you still take the job?* Those individuals who answered 'yes' to this question were then asked (M5): *Now, suppose that the chances were 50-50 that the new job would double your (family) income, and 50-50 that it would cut it by 75%. Would you still take the new job?* Individuals who answered 'no' to Question M1 were asked (M3): *Now, suppose the chances were 50-50 that the new job would double your (family) income, and 50-50 that it would cut it by 20 percent. Then would you take the job?* Those individuals who replied 'no' were asked (M4): *Now, suppose that the chances were 50-50 that the new job would double your (family) income, and 50-50 that it would cut it by 10 percent. Then would you take the new job?*

We use the responses to this series of questions to create a six point risk aversion index for the head of household *h*, RA_h as follows:

$$RA_h = \begin{cases} 0 \;\; if \;\; M1 = Yes \;\&\; M2 = Yes \;\&\; M5 = Yes & 7.23\% \\ 1 \;\; if \;\; M1 = Yes \;\&\; M2 = Yes \;\&\; M5 = No & 12.89\% \\ 2 \;\; if \;\; M1 = Yes \;\&\; M2 = No & 15.66\% \\ 3 \;\; if \;\; M1 = No \;\&\; M3 = Yes & 14.48\% \\ 4 \;\; if \;\; M1 = No \;\&\; M3 = No \;\&\; M4 = Yes & 18.87\% \\ 5 \;\; if \;\; M1 = No \;\&\; M3 = No \;\&\; M4 = No & 30.51\% \end{cases} \tag{20}$$

[6] As Luoh and Stafford (2005) point out, it is important to acknowledge that the question states that the new job will be 'equally as good' such that there is no difference in the non monetary characteristics of the jobs. Without such a qualification, individuals may be less willing to accept the gamble if there are non monetary attachments to their current job (Barsky *et al*., 1997).

where the percentages of individuals in each category are also shown. The sample, comprising 2,560 observations, relates to all heads of household aged 18 or over in 1996. Thus, the index is increasing in risk aversion such that if an individual rejects all the hypothetical gambles offered, the risk aversion index takes the highest value of 5, whilst if the individual accepts all gambles offered the risk aversion index takes the value of zero. It is interesting to note the low (high) percentage of respondents with the lowest (highest) value of the risk aversion index. Intermediate cases lie in between these two extreme values such that individuals are ranked according to their reluctance to accept the hypothetical gambles. The series of questions, thus, enables us to place individuals into one of six categories of risk aversion. Furthermore, as stated by Barsky *et al*. (1997), who find that this risk preference measure does predict actual risky behaviour such as smoking, drinking alcohol, not having insurance, choosing risky employment and holding risky financial assets, 'the categories can be ranked by risk aversion without having to assume a particular form for the utility function,' p.540.

With respect to the *SCF*, in the 1989, 1992, 1995, 1998, 2001 and 2004 cross-sectional surveys, individuals are asked: *which of the following statements comes closest to the describing the amount of financial risk that you are willing to take when you save or make investments? Take substantial financial risks expecting to earn substantial returns; Take above average financial risks expecting to earn above average returns; Take average financial risks expecting to earn average returns; Or not willing to take any financial risks*. The responses to this question thus enable us to categorise individuals according to their attitude towards taking financial risks, with those individuals who indicate that they are not willing to take any financial risks being the most risk averse.[7] We are thus able to construct an alternative measure of risk preference

[7] Shaw (1996), who explores the relationship between income growth and risk aversion, bases her empirical measure of risk aversion on the above *SCF* question.

thereby enabling us to explore the robustness of our empirical findings. We use the responses to the *SCF* question to create a four point risk aversion index:

$$RA_{ht} = \begin{cases} 0 & \textit{Take substantial financial risks for substantial returns} \quad 5.38\% \\ 1 & \textit{Take above average financial risks for above average returns} \quad 19.35\% \\ 2 & \textit{Take average financial risks for average returns} \quad 40.91\% \\ 3 & \textit{Not willing to take any financial risks} \quad 34.36\% \end{cases} \tag{21}$$

The sample relates to heads of household aged 18 and over in the 1989, 1992, 1995, 1998, 2001 and 2004 *SCF*s, comprising 123,070 observations. It is interesting to note the similar percentage across both surveys, which characterises the least (most) risk averse category at around 5-7% (30-34%).

The Measurement of Unsecured Debt and Financial Assets

Detailed information pertaining to unsecured debt is available in the *PSID* for 1984, 1989, 1994, 1999, 2001 and 2003, although the Risk Aversion Section is only available in the 1996 *PSID*. In each of these years, the head of household is asked the following question: *Aside from the debts that we have already talked about, like any mortgage on your main home or vehicle loans, do you (or anyone in your family) currently have any other debts such as for credit card charges, student loans, medical or legal bills, or on loans from relatives? If you added up all of these debts (for all of your family), about how much would they amount to right now?* Thus, the responses to this question yield information pertaining to the level of unsecured debt at the household level at time *t*, which is denoted by d_{ht}. In the *SCF*, unsecured debt (d_{ht}) is the summation of the outstanding balances on: credit cards and charge cards; and the outstanding balances on other consumer loans (such as loans for household appliances, furniture, hobby or recreational equipment, medical bills, loans from friends or relatives, loans for a business or investment or other loans).

In the theoretical framework presented in Section II, we analyse the relationship between debt and risk preference in the presence of savings, i.e. the household's financial assets. Hence, it is important to incorporate financial assets in our econometric analysis. For both the *PSID* and the *SCF* we are able to measure the level of household financial assets. To be specific, for the *PSID*, the head of family is asked to specify the amount of shares of stock in publicly held corporations, mutual funds, investment trusts, money in current (i.e. checking) or savings accounts, money market funds, certificates of deposit, and government savings bonds or treasury bills. Similarly, for the *SCF* individuals are asked to specify the monetary value of checking accounts, mutual funds, money market funds, government savings bonds and other types of asset. We then aggregate across the individuals within the family to obtain a measure at the household level at time *t* of financial assets, which is denoted by a_{ht}.

For the *PSID* our sample is restricted to all heads of household aged 18 or over. We analyse an unbalanced panel of data drawn from the 1984, 1989, 1994, 1999, 2001 and 2003 waves with risk preferences, which are only measured at 1996, being time invariant in the panel. The panel data set comprises 14,329 observations where 87% of individuals are in the sample for the entire period.[8] For the *SCF* we analyse a pooled cross-section data set, which combines cross-sections for individuals in the 1989, 1992, 1995, 1998, 2001 and 2004 surveys comprising total observations of 123,070. One advantage with the *SCF* is that the risk preference question is included in each of these cross-sections.

Methodology

[8] The minimum (maximum) number of times an individual is in the *PSID* is 3 (6) times. The mean of the risk aversion index does not differ significantly by the number of times an individual is in the panel, i.e. the hypothesis that the mean of the risk aversion index does not differ by the number of times the individual is in the sample cannot be rejected at the 1 per cent level. In addition, our results are robust to analysing a balanced panel.

Given that d_{ht} cannot be negative, it is treated as a censored variable in our econometric analysis. Since the distribution of debt is highly skewed, we specify a logarithmic dependent variable following Gropp *et al.* (1997). Note, that for households reporting zero debt, $\ln(d_{ht})$ is recoded to zero, as there is no reported debt between zero and unity in either the *PSID* or the *SCF*. Following Bertaut and Starr-McCluer (2002), we employ a censored regression model to ascertain the determinants of $\ln(d_{ht})$, which allows for the truncation of the dependent variable. Over time, both data sets reveal that around 45% of households do not have any unsecured debt where the median amount of debt is \$500 and \$300, for the *PSID* and *SCF* respectively.[9] In Figures 1A and 1B, the distributions of log debt for those heads of household with positive amounts of debt, i.e. $\ln(d_{ht}) > 0$, are shown for the *PSID* and *SCF* respectively. The distributions are similar, although debt in the *SCF* appears to be skewed towards the upper end of the distribution, with the median levels of debt being \$6,500 and \$4,000 in the *PSID* and *SCF* respectively.

As indicated in the theoretical analysis presented in Section II, debt and financial assets represent two components of the household's financial portfolio. Hence, arguably when exploring the factors that influence debt, financial liabilities and assets should be modelled simultaneously, see Brown and Taylor (2008). Whilst household debt remains our primary interest, employing a bivariate tobit model allows for the possibility of inter-dependent decision-making with respect to financial assets and liabilities by specifically jointly modelling both liabilities and assets. Financial assets are also defined as a logarithmic variable, $\ln(a_{ht})$, for the same reasons which apply to debt, as

[9] All monetary variables have been deflated with 2004 as the base year.

explained above. The bivariate tobit model is specified as follows where we pool over time:

$$\ln\left(d_{ht}^{*}\right) = \beta_1' X_{ht} + \beta_2 RA_{ht} + \varepsilon_{1ht} \tag{22}$$

$$\ln\left(d_{ht}\right) = \ln\left(d_{ht}^{*}\right) \qquad if \quad d_{ht}^{*} > 0 \tag{23}$$

$$\ln\left(d_{ht}\right) = 0 \qquad otherwise \tag{24}$$

$$\ln\left(a_{ht}^{*}\right) = \gamma_1' X_{ht} + \gamma_2 RA_{ht} + \varepsilon_{2ht} \tag{25}$$

$$\ln\left(a_{ht}\right) = \ln\left(a_{ht}^{*}\right) \qquad if \quad a_{ht}^{*} > 0 \tag{26}$$

$$\ln\left(a_{ht}\right) = 0 \qquad otherwise \tag{27}$$

where the debts (assets) of household *h* are given by d_{ht} (a_{ht}) such that $h=1,\ldots,n_h$, X_{ht} denotes a vector of head of household and household characteristics, some of which are time invariant, year binary indicators, and ε_{1ht} and ε_{2ht} are the stochastic disturbance terms, $\varepsilon_{1ht}, \varepsilon_{2ht} \sim N\left(0,0,\sigma_{1ht}^2,\sigma_{2ht}^2,\rho\right)$, where the covariance is given by $\sigma_{1ht,2ht} = \rho\sigma_{1ht}\sigma_{2ht}$. In the bivariate tobit model, the disturbance terms, ε_{1ht} and ε_{2ht}, are jointly normally distributed with variances σ_{1ht} and σ_{2ht}. If the correlation term, ρ, is zero, then assets and debt are independent. If $\rho \neq 0$, then this implies a degree of inter-dependence between d_{ht} and a_{ht}. The bivariate approach is particularly interesting in that it encompasses all of the scenarios analysed in the theoretical section, i.e. the corner and the interior solutions.[10]

[10] In the *PSID* (*SCF*), the percentage of households with $a_{ht} > 0$ and $d_{ht} > 0$, i.e. the interior solution in the theoretical framework presented in Section II, is 46.56% (22.73%); turning to the three possible corner solutions, the percentage of households with $a_{ht} = 0$ and $d_{ht} > 0$ is 8.78% (29.85%); the percentage of households $a_{ht} > 0$ and $d_{ht} = 0$ is 30.45% (29.56%); finally, the percentage of households with $a_{ht} = 0$ and $d_{ht} = 0$ is 14.21% (17.85%).

The estimated coefficient β_2 serves to inform us about the relationship between the level of unsecured debt and risk preference at the household level. In our set of explanatory variables, we include controls for a number of influences which may affect the level of unsecured debt at the household level. Such controls include the following head of household characteristics: a quadratic in age; gender; ethnicity; marital status; whether the head of household is currently employed; whether the head of household's spouse is employed; whether the head of household owns a business; education; and whether the head of household has reported good health over the past 12 months. Household controls include: household size; household income (earned, other non labour income and wealth);[11] and housing tenure. Table 1 presents summary statistics for the variables used in the empirical analysis.

IV. Results

The Determinants of Unsecured Debt

As described above, the bivariate tobit specifications conveniently encompass both the interior and corner solutions from our theoretical framework. The results from estimating the bivariate tobit models for both the *PSID* and *SCF* are shown in Tables 2 and 3 respectively, where the debt equation is reported in the first column and the financial asset equation in the second column. Panel A includes the risk aversion index, as defined above, which is increasing in risk aversion. It is apparent from Tables 2 and 3 Panel A that the risk aversion index is negatively related to debt for both the *PSID* and the *SCF*, consistent with the theoretical prediction that debt is a function of risk preference. For all specifications, marginal effects are reported, which are calculated by multiplying the estimated coefficient through by the scaling factor:

[11] The definition of wealth includes the net value of property (i.e. the current value minus any outstanding mortgage) and businesses.

$\Phi\left(\left\{\beta_1' X_{ht} + \beta_2 RA_{ht}\right\}/\sigma\right)\beta_2$, Φ denotes the cumulative distribution of the standard normal, where an approximation to the scaling factor, $\Phi\left(\left\{\beta_1' X_{ht} + \beta_2 RA_{ht}\right\}/\sigma\right)$, is the proportion of uncensored observations. Focusing on the marginal effect relating to the risk preference measure, to ascertain the association with household debt, the marginal effect is multiplied through by the standard deviation of the index. The standard deviation of RA_{ht} for the *PSID* (*SCF*) is 1.6404 (0.8664), hence, the impact of a one standard deviation increase in the risk aversion index is 17.37 (11.59) percentage points. Thus, the effect of risk aversion upon the level of debt over the time period appears to be relatively large. Interestingly, risk preference has no significant impact upon financial assets for the *PSID* and a small negative influence for the *SCF*.[12,13] In terms of our theoretical analysis, these findings suggest that the magnitudes of equations (13) and (15) differ.

Turning briefly to the other head of household characteristics, a number of additional common findings are found across the two data sets. Log debt is increasing in: age albeit at a decreasing rate; having an employed spouse; and education. Male heads of household, non-white heads of household and heads of household in good health are all inversely associated with the level of debt. Similarly, there is general consensus in the findings related to household characteristics. Total household labour

[12] It should be acknowledged that the tobit estimator is sensitive to the presence of non-spherical disturbances, i.e. specifically heteroscedasticity and non-normality, which, if present, render the tobit estimates inconsistent. Hence, the specification is tested for non-spherical disturbances by comparing the tobit results to those from a Censored Least Absolute Deviations (*CLAD*) estimator via a Hausman test, where *CLAD* estimates are consistent and are not dependent upon assumptions of homoscedasticity and normality, see Powell (1984). The results of the Hausman test suggest that non normality and heteroscedasticity are not problematic since the null hypothesis that the tobit estimator is consistent and efficient cannot be rejected. Hausman tests were also conducted on the specifications which follow, where the null hypothesis could not be rejected.

[13] We have explored the implications of selection bias via a simultaneous equation specification for strictly positive values of debt and financial assets, which should be inconsistent in the presence of selection bias. These estimates were compared to the bivariate tobit specification where we test for consistency via a Hausman test. The results confirm the consistency of the bivariate tobit specification.

income, non labour income, renting and owning a home with a mortgage are all positively associated with debt. Household characteristics, which are inversely related to debt, include household wealth and home ownership without a mortgage. These findings generally tie in with the results found in the existing literature, see Brown and Taylor (2008), Crook (2001) and Gropp *et al*. (1997).[14]

In Tables 2 (*PSID*) and 3 (*SCF*) Panel B, we replace the risk aversion index with binary indicators denoting the head of household's response to the risk attitudes questions described in Section III, where the least risk averse category is the reference category, i.e. $RA_{ht} = 0$. Given that the intervals of potential income loss specified in the hypothetical gamble at 10%, 20%, 33%, 50% and 75% are somewhat irregular in the *PSID* risk preference measure, the dummy variable specification is particularly interesting for this dataset. It is apparent that there is a monotonic relationship, where statistically significant, between the level of risk aversion and household debt for both the *PSID* and the *SCF* samples.[15] Clearly, throughout each panel and data set, the ρ parameter is statistically significant suggesting a degree of inter-dependence between financial assets and debt.[16]

Modelling Risk Preference

[14] Arguably, an important omission from the empirical analysis thus far is the price of debt, i.e. the rate of interest, which potentially may influence both the level of debt and the effect that risk preference has on the level of debt. For the *SCF*, we have information in each year on the average interest rate households pay for outstanding debt. The results presented for the *SCF* are robust to the inclusion of this additional covariate. Although this information is not available in the *PSID* it should be noted, however, that year dummy variables, which arguably may capture the effect of interest rates, are included throughout the empirical analysis.

[15] Testing across the models in panels A and B reveals no significant difference in terms of model performance between using the risk preference index versus the set of binary indicators.

[16] Using a nested tobit estimator as an alternative specification, whereby we condition on households reporting a strictly positive level of financial assets, i.e. the interior solution case depicted by equations (10) and (11) in the theoretical analysis, we find that the magnitude of the association between risk preference and household debt is similar to that found from the bivariate tobit specifications. Similarly, the inverse association between risk aversion and the level of unsecured debt is confirmed with a univariate debt equation. Full results are available on request.

From a policy-maker's perspective, it is important to ascertain the determinants of debt at the household level in order to evaluate the potential financial pressure that households may experience following, for example, a deterioration in their financial situation. Evidence of a link between risk preference and the level of unsecured debt may inform policy-makers of the determinants of household debt, but the natural question arises as to what factors influence risk preference. Hence, we estimate a risk aversion equation as an ordered probit model as follows:

$$RA_{ht} = \lambda' X_{ht} + \phi' Z_{ht} + \nu_{ht} \tag{28}$$

We model risk preference conditional upon the control variables used to model debt, X_{ht}, see above, which importantly contains information relating to income and wealth, plus an additional set of explanatory variables, Z_{ht}, which act as over-identifying instruments. The over-identifying instruments, which are discussed in detail below, differ across the two data sets, due to data availability. We then re-estimate our pooled bivariate tobit models replacing RA_{ht} with a value purged from identifiable influences, defined as $\hat{\nu}_{ht}$, i.e. the residual from equation (28), in order to ascertain whether a relationship remains between debt and risk preference.

Table 4, column 1, presents the results from the *SCF* of estimating the risk preference model, i.e. equation (28). The over-identifying instruments used to model risk preference, Z_{ht}, include: expectations about the performance of the U.S. economy and interest rates over the next five years; reasons for saving (future major expenses in the next 10 years, illness, rainy day or to enjoy life); attitudes towards credit (i.e. does the respondent think it is good or bad); and whether the respondent was suspicious about the study before the interview (which may be correlated with unobserved personality traits). We present the marginal effects associated with being in the most risk averse

category (where around 30% of heads of household lie). The factors, which positively influence the probability of being in this category, i.e. the most risk averse category, include: reasons for saving; expectations about the future of the economy; and being suspicious about the interview. Negative influences on the probability of being in the most risk averse category are: whether major expenses are expected in the future; whether he/she plans to save for the future; the natural logarithm of the amount he/she expects to inherit; attitudes towards credit; and having life insurance.

We replicate the results for the *PSID*, where although a Risk Aversion Section is only included in the 1996 *PSID*, over the period 1969 to 1972, an index of risk avoidance is available in four waves of the *PSID*, which we include in the set of over-identifying instruments. This is derived from questions relating to the head of household's actual behaviour relating to seat belt usage, smoking and purchases of medical insurance and car insurance. It is possible that individuals are in the sample between 1 to 4 times during the period 1969 to 1972. Hence, we take an average of the risk avoidance index, which is increasing in risk aversion, over a maximum of four years as our early measure of risk preference: $\bar{r}^{T=1969-1972}$. In terms of modelling risk preference in 1996 using the *PSID*, the controls we include in Z_{ht} are: the early risk preference measure, i.e. $\bar{r}^{T=1969-1972}$, recoding missing values to the midpoint category; a control for whether the head of household was in the *PSID* during the period 1969-72; and the log of the expected pay-off of the gamble in the *PSID*. The log of the expected pay-off from the hypothetical gamble is calculated as follows: $ev_h = 1/2(p_1 \times LY) + 1/2(p_2 \times LY)$ where p_1 and p_2 denote the doubling or cutting of

family income, as indicated by RA_{ht},[15] and life time income is proxied by $LY = Y \times (65 - age)$ where Y is household labour income in 1996 and the term in parenthesis denotes a proxy for the number of years the head of household has until retirement. The second column in Table 4 presents the results for the *PSID* focusing again on the marginal effects associated with being in the most risk averse category (around 34% of heads of household are in this category, which is similar to the *SCF*). Risk avoidance over 1969-72 is associated with a higher probability of being in the most risk averse category in 1996, where a one standard deviation increase in the early risk avoidance measure is associated with a 2.44 percentage point increase in the probability of being in the most risk averse category. Perhaps not surprisingly, a higher expected pay-off from the gamble is associated with a lower probability of being in the most risk averse category, where a one percent increase in the expected payoff is associated with approximately a 1 percentage point higher probability of being in the most risk averse category.

Having eradicated the influence of observable characteristics, which potentially influence risk preference, for both data sets, we ascertain whether the inverse relationship between risk preference, $\hat{v}_{ht}$, (now orthogonal to observables) and unsecured debt remains. This is explored in Table 5, Panels A and B for the *PSID* and *SCF* respectively.[18] Across both data sets, the estimated marginal effect remains negative and statistically significant in the debt equation. A one standard deviation increase in $\hat{v}_{ht}$ reduces the level of debt by around 11.34 (3.95) percentage points in the

[15] To be specific: if $RA = 0$, $ev = 0.5(2LY) + 0.5(0.25LY)$; if $RA = 1$, $ev = 0.5(2LY) + 0.5(0.5LY)$; if $RA = 2$, $ev = 0.5(2LY) + 0.5(0.66LY)$; if $RA = 3$, $ev = 0.5(2LY) + 0.5(0.8LY)$; if $RA = 4$, $ev = 0.5(2LY) + 0.5(0.9LY)$; finally, if $RA = 5$, $ev = LY$.

[18] The standard errors have been adjusted via bootstrapping to account for the inclusion of the generated risk preference variable in the debt and financial asset equations.

PSID (*SCF*), this is calculated from the marginal effects reported in Panel A (C) using the method described above. Hence, although the influence of risk preference is moderated once observable effects have been controlled for, a relatively large association between risk preference and the level of unsecured debt remains.[19]

V. Conclusions

In this paper, we have contributed to the growing literature on debt accumulation at the household level focusing in particular on the role of risk preference in the decision to acquire unsecured debt. Given the uncertainty surrounding the decision to acquire debt, it is surprising that inter-personal differences in risk preferences have not attracted much attention in the empirical literature on household debt. Our theoretical analysis suggests that the optimal level of debt is a function of risk preference. Our empirical analysis has explored our theoretical priors by investigating the relationship between risk preference and debt accumulation using U.S. household level data drawn from the *PSID* and the *SCF*. Our empirical findings accord with our theoretical prediction that unsecured debt at the household level is influenced by risk preference. Furthermore, our empirical analysis suggests that risk aversion is inversely associated with the amount of unsecured debt accumulated at the household level.

[19] In both the *PSID* and the *SCF*, the over-identifying instruments are jointly insignificant in the outcome equation and are jointly significant in the risk attitudes equation (at the 1% level) thereby endorsing the validity of our over-identifying instruments. Since the choice of over-identifying instruments is always open to debate, we have experimented with changes in the set of instruments and we find that our results are robust to such changes.

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TABLE 1: Summary Statistics

	PSID		SCF	
	MEAN	STD DEV	MEAN	STD DEV
Log Debt $\ln(d_{ht})$	4.5032	*4.22*	4.4647	*4.42*
Log Financial Assets $\ln(a_{ht})$	6.4876	*3.97*	4.7761	*5.09*
Risk Aversion Index RA_{ht} (0-5 *PSID*; 0-3 *SCF*)	3.1606	*1.64*	0.9576	*0.87*
Variables in X_{ht}				
Age	40	*11.61*	50	*16.30*
Age squared	1782	*983.58*	2822	*1742.11*
Male (0-1)	0.7556	*0.42*	0.7853	*0.41*
Non white (0-1)	0.4462	*0.49*	0.1929	*0.39*
Married (0-1)	0.6345	*0.48*	0.6151	*0.49*
Employed (0-1)	0.8266	*0.38*	0.7299	*0.44*
Spouse employed (0-1)	0.4889	*0.50*	0.3603	*0.48*
Owns a business (0-1)	0.1413	*0.35*	0.3228	*0.47*
Years of schooling (8-17)	13.2663	*2.37*	13.7129	*2.99*
Good health (0-1)	0.8965	*0.30*	0.9519	*0.21*
Household size (1+)	2.7091	*1.46*	2.6566	*1.44*
Log household labour income	9.7279	*2.72*	8.8248	*4.52*
Log household other income (i.e. non labour)	2.0598	*3.19*	3.7052	*4.54*
Log household wealth	9.5605	*3.76*	11.2606	*3.66*
Rented home (0-1)	0.2826	*0.45*	0.2594	*0.44*
Home ownership (with a mortgage) (0-1)	0.5428	*0.50*	0.4239	*0.49*
Home ownership (without a mortgage) (0-1)	0.1345	*0.34*	0.2558	*0.44*
Average interest rate	–	–	4.7761	*5.09*
Variables in Z_{ht}				
Expectations about the economy (0=worse – 2=better)	–	–	1.2065	*0.73*
Expectations about interest rates (0=worse – 2=better)	–	–	1.5982	*0.62*
Expect major expenses within 10 years (0-1)	–	–	0.5166	*0.50*
Plan to save (0=next few months – 4=longer than 10 years)	–	–	2.1863	*1.34*
Log amount of money he/she expects to inherit	–	–	1.6874	*4.19*
Save for a rainy day – unemployment (0-1)	–	–	0.0169	*0.13*
Save for rainy day – ill health (0-1)	–	–	0.0469	*0.21*
Save to a rainy day – other (0-1)	–	–	0.2859	*0.45*
Save to remain liquid (0-1)	–	–	0.0165	*0.13*
Save to enjoy life (0-1)	–	–	0.0042	*0.06*
Do not save (0-1)	–	–	0.1992	*0.39*
Attitude towards credit (0=bad idea – 2=good idea)	–	–	0.9846	*0.81*
Think credit should be paid off (0=hardly ever – 3=always)	–	–	1.9474	*1.23*
Have life insurance (0-1)	–	–	0.7351	*0.44*
Suspicious about interview (0=no – 2=very)	–	–	0.4757	*0.64*
Early risk preference $\bar{r}^{T=1969-1972}$ (0=least – 6=most risk averse)	3.1844	*1.37*	–	–
Log expected value of the gamble	13.2862	*3.04*	–	–
OBSERVATIONS	14,329		123,070	

TABLE 2: Simultaneous Modelling of Debt and Assets; Pooled Bivariate Tobit Models – *PSID*

	LOG (HOUSEHOLD DEBT)		LOG (HOUSEHOLD FINANCIAL ASSETS)	
PANEL A: RISK AVERSION INDEX	M.E.	TSTAT	M.E.	TSTAT
Head of household characteristics				
Age	0.0331	*(2.01)*	-0.0030	*(0.79)*
Age squared	-0.0007	*(3.30)*	0.0001	*(1.36)*
Male	-0.4074	*(5.01)*	0.0335	*(1.90)*
Non white	-0.6597	*(9.14)*	-10.4043	*(5.69)*
Married	0.1701	*(1.90)*	0.1306	*(6.21)*
Employed	0.1177	*(1.30)*	0.0649	*(3.14)*
Spouse employed	0.3332	*(4.32)*	0.0228	*(1.22)*
Owns a business	0.0139	*(0.17)*	0.1108	*(5.41)*
Years of schooling	0.1644	*(11.64)*	0.0510	*(16.45)*
Good health	-0.2678	*(2.81)*	0.1437	*(7.02)*
Household characteristics				
Household size	-0.0490	*(2.10)*	-0.0374	*(6.91)*
Log household labour income	0.1259	*(9.92)*	0.0495	*(18.88)*
Log household other income	0.0354	*(3.35)*	-0.0007	*(0.30)*
Log household wealth	-0.1165	*(10.84)*	0.0764	*(2.13)*
Rented home	0.3568	*(2.79)*	0.0044	*(0.15)*
Home ownership (with a mortgage)	0.6273	*(5.21)*	0.1594	*(5.64)*
Home ownership (without a mortgage)	-0.3876	*(3.13)*	0.1158	*(3.88)*
Risk preference measures				
Risk aversion index	-0.1059	*(5.91)*	-0.0043	*(1.06)*
ρ		0.1269	*(14.13)*	
LR $\chi^2(44)$		65,760.37	*p=[0.000]*	
PANEL B: RISK AVERSION DUMMY VARIABLES	M.E.	TSTAT	M.E.	TSTAT
Risk aversion index = 1	-0.1254	*(0.96)*	-0.0343	*(1.12)*
Risk aversion index = 2	-0.0554	*(0.44)*	0.0044	*(0.15)*
Risk aversion index = 3	-0.1280	*(1.72)*	0.0011	*(0.04)*
Risk aversion index = 4	-0.2316	*(1.89)*	-0.0033	*(0.12)*
Risk aversion index = 5	-0.5463	*(4.61)*	-0.0365	*(1.37)*
ρ		0.1264	*(14.05)*	
LR $\chi^2(52)$		65,751.77	*p=[0.000]*	
Left Censored	6,491		2,740	
OBSERVATIONS		14,329		

Notes: (i) year dummy variables are included; (ii) the omitted category of the risk aversion measure in Panel B is where the risk aversion index equals 0, i.e. the least risk averse category.

TABLE 3: Simultaneous Modelling of Debt and Assets; Pooled Bivariate Tobit Models – *SCF*

	LOG (HOUSEHOLD DEBT)		LOG (HOUSEHOLD FINANCIAL ASSETS)	
PANEL A: RISK AVERSION INDEX	M.E.	TSTAT	M.E.	TSTAT
Head of household characteristics				
Age	0.0497	*(11.47)*	0.0503	*(13.82)*
Age squared	-0.0009	*(2.20)*	0.0000	*(1.59)*
Male	-0.2383	*(6.88)*	0.1213	*(4.11)*
Non white	-0.0649	*(2.24)*	-0.9997	*(9.30)*
Married	0.0291	*(0.88)*	0.5105	*(7.99)*
Employed	1.2121	*(4.72)*	0.4425	*(4.30)*
Spouse employed	0.8874	*(2.79)*	-0.3450	*(5.81)*
Owns a business	-0.9764	*(4.54)*	0.6565	*(30.20)*
Years of schooling	0.0760	*(17.97)*	0.3232	*(6.30)*
Good health	-0.2016	*(4.14)*	0.3369	*(7.36)*
Household characteristics				
Household size	0.0149	*(1.70)*	-0.0890	*(12.20)*
Log household labour income	0.0106	*(3.18)*	0.0182	*(5.94)*
Log household other income	0.0312	*(10.37)*	-0.0156	*(6.02)*
Log household wealth	-0.0894	*(3.19)*	-0.3228	*(8.70)*
Rented home	0.2978	*(6.11)*	-0.4937	*(11.54)*
Home ownership (with a mortgage)	0.9425	*(2.27)*	-0.1136	*(2.87)*
Home ownership (without a mortgage)	-0.9222	*(9.45)*	0.4308	*(10.42)*
Risk preference measures				
Risk aversion index	-0.1338	*(2.55)*	-0.0389	*(4.30)*
ρ		0.1578	*(4.65)*	
LR $\chi^2(44)$		49,480.70	*p=[0.000]*	
PANEL B: RISK AVERSION DUMMY VARIABLES	M.E.	TSTAT	M.E.	TSTAT
Risk aversion index = 1	-0.0444	*(0.94)*	-0.0676	*(3.73)*
Risk aversion index = 2	-0.0263	*(1.95)*	0.1231	*(6.40)*
Risk aversion index = 3	-0.2057	*(4.38)*	-0.5867	*(3.41)*
ρ		0.1264	*(14.05)*	
LR $\chi^2(48)$		49,977.20	*p=[0.000]*	
Left Censored	58,354		58,707	
OBSERVATIONS		123,070		

Notes: (i) year dummy variables are included; (ii) the omitted category of the risk aversion measure in Panel B is where the risk aversion index equals 0, i.e. the least risk averse category.

TABLE 4: Instrumented Risk Preference

	RISK AVERSION INDEX (*SCF*)		RISK AVERSION INDEX (*PSID*)	
	M.E. $RA=3$	TSTAT	M.E. $RA=5$	TSTAT
Head of household characteristics				
Age	0.0025	*(5.29)*	0.0013	*(2.77)*
Age squared	0.0001	*(4.16)*	0.0004	*(2.00)*
Male	-0.1281	*(30.91)*	-0.0953	*(9.33)*
Non white	0.0295	*(8.69)*	0.0380	*(4.45)*
Married	0.0457	*(12.39)*	0.0352	*(3.35)*
Employed	-0.0050	*(1.27)*	0.0312	*(3.29)*
Spouse employed	0.0176	*(6.15)*	0.0082	*(0.89)*
Owns a business	-0.0813	*(29.56)*	-0.0559	*(5.94)*
Years of schooling	-0.0251	*(48.70)*	-0.0138	*(8.49)*
Good health	-0.0248	*(15.23)*	0.0151	*(1.32)*
Expectations about the economy	0.0069	*(3.16)*	–	–
Expectations about interest rates	-0.0087	*(3.32)*	–	–
Expect major expenses within 10 years	-0.0326	*(13.25)*	–	–
Plan to save	-0.0169	*(17.70)*	–	–
Log amount of money expects to inherit	-0.0023	*(8.33)*	–	–
Save for a rainy day – unemployment	0.0350	*(3.74)*	–	–
Save for rainy day – ill Health	0.0579	*(9.20)*	–	–
Save to a rainy day – other	0.0144	*(5.54)*	–	–
Save to remain liquid	0.0033	*(0.36)*	–	–
Save to enjoy life	-0.0341	*(2.06)*	–	–
Do not save	-0.0478	*(14.08)*	–	–
Attitude towards credit	-0.0193	*(13.50)*	–	–
Think credit should be paid off	-0.0254	*(20.07)*	–	–
Have life insurance	-0.0314	*(10.45)*	–	–
Suspicious about interview	0.0310	*(15.73)*	–	–
Early risk preference $\bar{r}^{T=1969-1972}$	–	–	0.0178	*(5.97)*
Log expected value of the gamble	–	–	-0.0077	*(4.63)*
Household characteristics				
Household size	0.0138	*(13.41)*	0.0007	*(0.27)*
Log household labour income	-0.0039	*(9.87)*	0.0008	*(0.06)*
Log household other income	0.0003	*(1.01)*	-0.0034	*(3.09)*
Log household wealth	-0.0147	*(47.54)*	0.0003	*(0.34)*
Rented home	-0.0187	*(3.41)*	-0.0409	*(2.34)*
Home ownership (with mortgage)	-0.0644	*(12.37)*	-0.0299	*(0.17)*
Home ownership (without mortgage)	-0.0294	*(5.47)*	0.0803	*(3.81)*
LR $\chi^2(d)$	37,051.81 *p=[0.000]*		1004.72 *p=[0.000]*	
OBSERVATIONS	123,070		14,329	

Notes: (i) year dummy variables are included; (ii) a control for whether the head of household is in the sample during 1969-72 is also included as a covariate in the risk preference equation for the *PSID*; (iii) for the *SCF* (*PSID*) d=36 (24).

TABLE 5: Simultaneous Modelling of Debt and Assets – Instrumented Risk Preference

PANEL A: PSID INSTRUMENTED RISK PREFERENCE – BIVARIATE TOBIT

Dependent Variable =	LOG (HOUSEHOLD DEBT)		LOG (HOUSEHOLD FINANCIAL ASSETS)	
	M.E.	TSTAT	M.E.	TSTAT
Unobserved risk preference $\hat{v}_{ht}$	-0.0636	*(4.01)*	-0.0047	*(1.24)*
ρ		0.1278 *(4.23)*		
LR $\chi^2(44)$		65,769.21 *p=[0.000]*		
Left Censored	6,491		2,740	
OBSERVATIONS		14,329		

PANEL B: SCF INSTRUMENTED RISK PREFERENCE – BIVARIATE TOBIT

Dependent Variable =	LOG (HOUSEHOLD DEBT)		LOG (HOUSEHOLD FINANCIAL ASSETS)	
	M.E.	TSTAT	M.E.	TSTAT
Unobserved risk preference $\hat{v}_{ht}$	-0.0489	*(10.24)*	0.0254	*(2.33)*
ρ		0.1562 *(4.24)*		
LR $\chi^2(44)$		49,560.01 *p=[0.000]*		
Left Censored	58,354		58,707	
OBSERVATIONS		123,070		

Notes: (i) year dummy variables are included; (ii) T Statistics are based on bootstrapped standard errors.

Figure 1A: Distribution of Log Debt over Time – $\ln\left(d_{ht}\right) > 0$ *PSID*

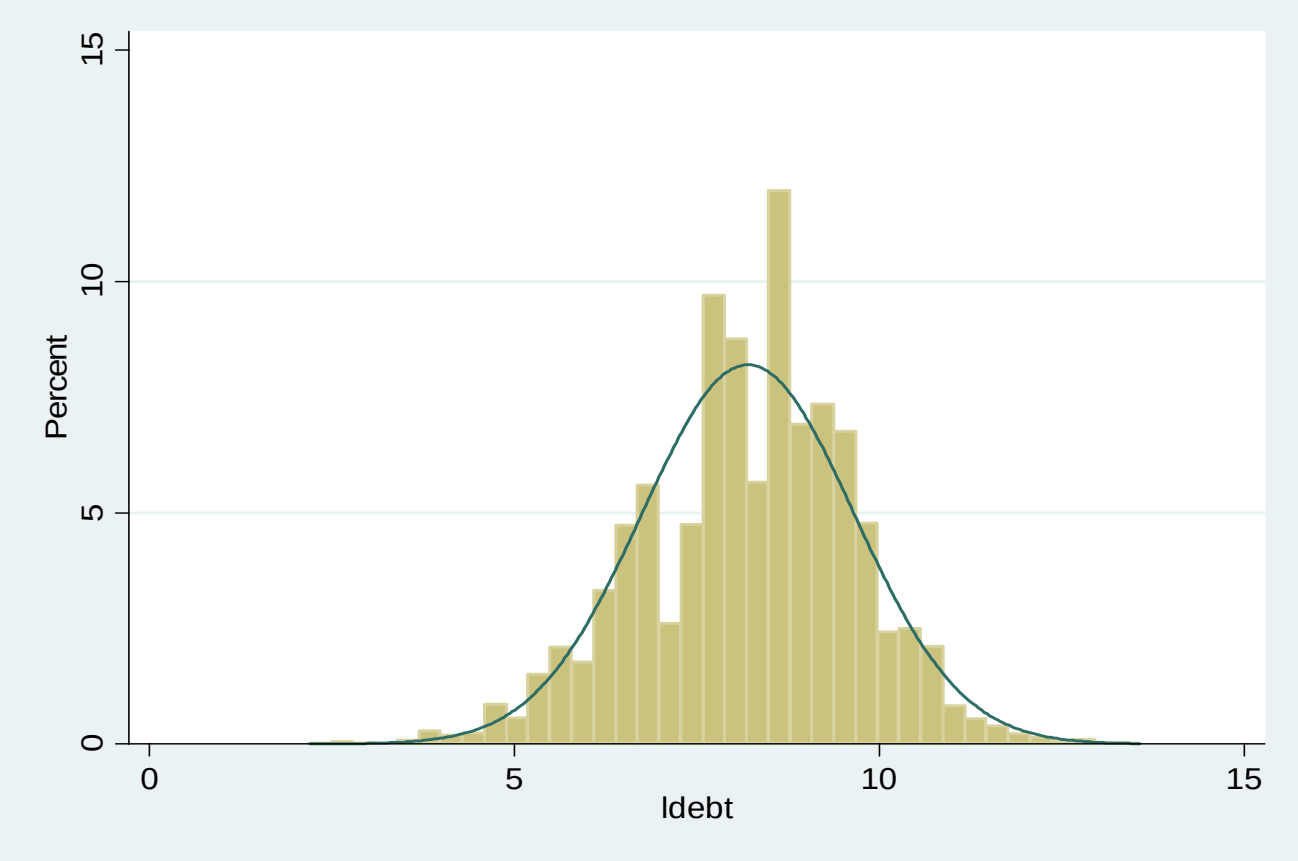

Figure 1B: Distribution of Log Debt over Time – $\ln\left(d_{ht}\right) > 0$ *SCF*