The affects of health shocks and house prices on debt holdings by older Americans

The Effects of Health Shocks on Debt Holdings by Older American Households

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Abstract

We offer an empirical analysis of the effects of health shocks on debt holdings of older Americans using panel data from the Health and Retirement Study. The average older American household owes a surprisingly large amount of mortgage and consumer debt, even in their late seventies. The occurrence of a severe health shock, such as the diagnosis of heart problems, cancer or a stroke, will increase mortgage and consumer debt if a household does not currently have debt, but results in less debt held if the household is already borrowing. If a household has only government insurance then the onset of a sudden severe health problem will increase debt but by less than if the household had only private insurance. If the government wishes to reduce debt owed by older Americans one approach it should consider seriously is the displacement of private insurance by government insurance.

Last altered : 19.07.10 JNC

JEL: D11, D12, D14, D91, I11.

Credit Research Centre Working Paper 10/01

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Both authors would like to thank participants at the NETSPAR Pension Workshop (Amsterdam January 2010) and in particular Maarten Lindeboom for very helpful comments on this paper. Crook would also like to thank the Carnegie Trust for the Universities of Scotland for their generous funding of much of this research. He would also like to thank the Wharton School, University of Pennsylvania and the McIntire School, University of Virginia for providing stimulating research environments during which much of the work was carried out.

Introduction

Older households are becoming an ever increasing proportion of the population in most western economies. The US Census Bureau predicts that the share of the US population aged 65 years or over will rise from 12.97% in 2010 to 19.30% in 2030 and that by 2036 one in every five Americans will be aged 65 years or over (US Census Bureau). Eurostat (2008) predicts that the percentage of the population in the EU 27 countries that is aged 65 years and over will rise from 17.1% in 2008 to 25.4% in 2030. The method of funding the increasing costs of healthcare, particularly in the US, remains the subject of national debate[1]. Since the average annual expenditure on health care for those aged over 65 years is considerably above that for younger people (Seshamani and Gray: 2004) the funding of health care for this age group is a major concern. Many sources of funds may be used by older Americans including using government insurance, private insurance or self payment which may include taking out loans. Yet whilst there is a growing literature concerned with the asset portfolios of the elderly, often with specific emphasis on housing wealth (Venti and Wise 1989, 1990, 2004), Shiener and Weil 1993, Hurd (1999), Coile and Milligan 2006), Yogo (2008)), very few studies indeed have considered the debt holdings of older people and in particular how these are impacted by the occurrence of health shocks. The aim of this paper is to examine the effects of health shocks on the amount of debt owed by older American households. If health shocks result in higher debt levels as older Americans struggle to pay their medical bills, then with an unchanged[2] Medicare unlikely to be made more generous, certain social policy implications follow.

Bucks et al used data from the US Survey of Finance reported that between 2004 and 2007 the percentage of those aged 55-64 and 65-74 that owed any debt rose from 76.3 % and 58.5% to 81.8% and 65.5% respectively (Bucks et al 2008). Souleles and Sinai (2007) used the 1989 to 2002 waves of the Survey of Consumer Finance to conclude that rises in house prices have lead to equity withdrawal. But they do not consider other types of debt and the sample sizes for elderly households are relatively small. Lee et al (2007) used the 2000 wave of the HRS to predict whether a household possesses debt and conclude that

[1] See BBC news website: http://news.bbc.co.uk/1/hi/world/americas/8160058.stm
[2] Medicare is unlikely to give greater benefits since its expenditures are predicted to rise from 2.7% of GDP in 2005 to 7.3% in 2035 (Board of Trustees: 2006)

health status, income, net worth, marital status, race, employment status and housing tenure affect whether or not mortgage or consumer debt is held. But this study does not explain the *size* of debt holdings. Neither study includes an analysis of the dynamics of debt holdings for individual households. So they cannot, for example, observe how, if a shock affects a household's financial position, that household reacts in terms of its holdings of debt. Recent changes in credit markets suggest that this is important. Nor do the papers consider possible cohort effects. The aim of our paper is to use the advantages of a panel dataset that is specifically designed to capture this type of information from exclusively elderly households. By doing this we can examine changes over time.

We find that surprisingly large amounts of debt are held by Americans aged over 65 years. The occurrence of a severe health shock, such as the diagnosis of heart problems, cancer or a stroke will increase total, mortgage and consumer debt if the household does not have debt already yet may result in a decrease in debt held if a household already owes money. If a household prefers only one form of insurance then our results suggest that holding only government insurance would probably result in a smaller increase in debt following a health shock than relying solely on private insurance.

Following this Introduction we briefly review the theoretical analysis of the holding of debt in the presence of health shocks and then explain our estimation strategy. The following sections show our results concerning the effects of age and more importantly health shocks on debt holdings. We then subject our findings to various robustness tests and subsequently consider the separate effects of the possession of government and private health insurance on debt. The last section concludes.

Theoretical Considerations

The observed volume of debt held by an individual depends on demand and supply factors. The standard theory of demand is based on the PIH. This assumes that each point in time, t, an individual chooses his consumption to maximise the expected present value of his utility, u, received over his lifetime subject to an asset evolution equation between adjacent periods. If the inter-temporal subjective discount rate, ρ, differs from the

opportunity cost of funds, *r*, and if the lending rate equals the borrowing rate, then the individual chooses consumption to satisfy the standard Euler equation:

$$u^{'}(c_t) = E_t\left(\frac{(u^{'}(c_{t+1}))(1+r_{t+1})}{(1+\rho_{t+1})}\right), \tag{1}$$

where E_t denotes the expectations operator conditional on information at time *t*, and *c* denotes consumption. We have assumed uncertainty over earnings or rate of return. If the discount and interest rates were indeed the same and the expectation in equation 1 was realised, then the individual's consumption would be constant in all time periods and equal to the annuity value of permanent income. The same would occur if the marginal utility of consumption was linear. Only if permanent income is believed to have changed will consumption change. Differences between consumption and income, y_t, in specific time periods are smoothed away by borrowing and saving. Saving in each period, s_t, is given by the following equation:

$$s_t = -\sum_{j=1}^{\infty}(1+r)^{-j}E_t\Delta y_{t+j} \tag{2}$$

(Deaton: 1992) and borrowing occurs whenever saving is negative. This equation says that if an individual expects his income to rise in the future he will fund consumption today by running down his assets or by seeking credit; if he expects his income to fall he will prefer to save.

Several implications follow. First those who expect their income to fall due to retirement would prefer to save rather than increase debt. Since the fall is expected it does not affect permanent income and so consumption. Second we assume an individual forms an expectation of his life expectancy and as he becomes older we might expect his subjective discount rate to increase and so from equation 1 his consumption and possibly his debt holding to increase as well. Alternatively if an individual discounts future consumption hyperbolically (Liabson: 1997) then his short term subjective discount rate may be even higher still resulting in an even greater demand for debt. Third the model assumes zero bequests. If an individual wishes to make a bequest at the expected end of his life then he will aim to have net assets equal to the amount he wishes to bequest at the expected time

of death. According to the model, ceteris paribus, such an individual will hold relatively less debt to maximise net wealth at time of death.

Consumption in equation (1) is likely to be a function of various factors affecting preferences for example marital status and whether in the labor market. Those aged 50 to 65 are more likely to have dependent children than those over retirement age with consequential greater desired consumption and desire for debt. In additional there are particular individual characteristics that are more likely to affect consumption and so debt holdings of older people than of younger people.

One example is the occurrence of unexpected health shocks. Thus if an individual who is retired suffers an unexpected severe illness and he has health insurance, then his permanent income and his consumption and so his demand for debt may be unaltered. If he is working it is possible that his permanent income may fall but by less than if he did not have health insurance and if he is unable to reduce his consumption in the short term he may temporarily fund the excess consumption using short term debt. If the individual does not have health insurance and is working then his permanent income may fall and his unfunded consumption (e.g. of health care) may increase which may also, in the short term, lead to additional debt being borrowed.

The ability to borrow and the household's demand for debt may depend on whether the household already had debt before the onset of a shock. If the household was indebted then it may find its demand constrained by lenders or it may not wish to borrow more or even to pay some debt back. Alternatively, if the household had no borrowings then a health shock may encourage it to take out a loan.

Eligible Americans aged 65 years and over have access to Medicare, a part-US government funded health care insurance plan. Medicare will pay for up to four types of benefits according to eligibility: hospitalisation care (Part A plan), outpatient care (Part B plan), and prescription costs (Part D plan). If a person has paid 40 consecutive months of Federal Insurance Contributions Act taxes they will receive free hospitalisation care for up to 60 days, although there is a $1068 deductible. If a person has paid less than 40 months of FICA taxes he/she may have to pay up to $423 per month for Medicare coverage. Most Americans have free coverage for Plan A if they wish it. All those who

have Plan B coverage pay at least $96.40 per month as a premium. An individual may choose to be insured for hospitalisation and outpatient care through a private health care plan and, if eligible, Medicare will pay up to a fixed premium per month, the individual paying the rest (Part C plan).

If a household has medical insurance one might expect their level of debt to be lower than otherwise. But the effect may vary according to the household's state of health. If a household's state of health was poor and it had insurance then one would expect its debt to be lower than if the same household's state of health was poor and the household had no insurance.

The effect of the possession of insurance may depend on age. For example Medicare, provides medical insurance at a lower price than would be paid for comparable cover by those ineligible for such aid. Since only those aged over 65 are eligible for Medicare this price effect may cause those who are over 65 and have insurance to be especially well covered compared to those aged under 65 who have to pay a higher price for comparable insurance cover. In short those who have insurance and who are over 65 may have lower debt than those under 65 without access to Medicare.

An older person whose ability to earn labour income should the need arise due to unforeseen contingencies may have a nonlinear marginal utility of consumption function and so have a precautionary saving motive rather than be willing to take on debt. In effect they self-insure against contingencies (see Carroll: 1997).

In addition if income falls due to one of the partners in a household dying the remaining partner may reduce mortgage debts possibly by using payouts from life insurance policies or by paying off mortgage debt after downsizing the family home. There is some evidence to support the sale of the family home following bereavement, though this has not specifically considered the effects on mortgage debt, as we do in the paper. For example using data from the Retirement History Survey for individuals aged 58 to 73, Venti and Wise (1989, 1990) found that home equity was reduced when a household experienced retirement or death of a spouse. Merrill (1984) came to a similar conclusion as did Shiener & Weil (1992). Hurd (2002) found larger declines in housing wealth for households that suffered the loss of a member than for those that did not. Venti & Wise

(2004) also find that housing equity falls slightly for those households that suffer shocks; others that move house do not reduce their equity and believe this is consistent with households not taking reverse mortgages. However debts held by retirees are not measured or specifically considered. Coile and Milligan (2006) also use the HRS for 1992 to 2002 to find that asset holdings decline with age and that sales of various assets including the principal residence follows death of a spouse.

The basic PIH also omits expenditure on durables such as housing and vehicles. A number of authors (Alessie, Devereux and Weber 1997, Brugiavani and Weber 1994) have incorporated durables into the PIH which results in an amended Euler equation. An individual with housing equity may also choose to withdraw such equity by borrowing using his house as collateral. If an individual does not have a bequest motive this may be even more attractive since it allows consumption from housing capital to occur.

On the supply side, older people who do not have a bequest motive may be expected to have an increasing incentive to default as they become older because there is a progressively smaller chance they will wish credit in the future. They may play a finitely repeated game with lenders and adopt the optimal strategy of cheating. On the other hand evidence suggests that the probability of default declines as an individual becomes older and the ECO Act 1974 and Reg B 1976 require that if age is included in a credit scoring model then those aged over 62 years must have additional points added to their score. But lenders are also aware that older individuals have lower income, ceteris paribus, and so would constrain the amount of credit they are willing to grant. But on the other hand older individuals, at the age of retirement tend to have larger amounts of financial and physical capital than younger people, which can be accepted by lenders a collateral.

The PIH often makes assumptions about consumption, income and debt holdings towards the end of a household's life cycle. These have rarely been examined empirically. In this paper we are able to shed light on whether some of these assumptions are indeed valid.

Estimation Strategy

We investigate the effects of health shocks on debt holdings by estimating reduced form fixed effects regression equations with the following structures. These equations combine demand and supply factors which were detailed above. Consider the following static equation as an empirical model that explains the level of a specific type of debt held by household *i* in wave *t*:

$$debt_{it} = \alpha + \beta_1 \, health \;\; state_{it} + \boldsymbol{\beta}_2^T \mathbf{x}_{it} + \delta_t + \upsilon_i + \varepsilon_{it}, \qquad (2)$$

where $health_{it}$ denotes a measure of the state of health of the respondent and spouse (if there is one) for a household, $\mathbf{x}_{it}$ is a vector of demographic (possibly) time varying control variables that represent household preferences, δ_t denotes wave dummy fixed effects and υ_i and ε_{it} denote random variables. The terms β_k are parameters to be estimated.

In the last section we suggested that there may be interactions between age at least 65 and having insurance (the price of health care effect) and the state of health and the possession of insurance. Including such terms in equation (2) gives

$$debt_{it} = \alpha + \beta_1 \, health \, state_{it} + \beta_2 I(age65_{it} = 1).I(insurance_{it} = 1)$$

$$+ \beta_3 health \, state_{it}.I(insurance_{it} = 1) + \boldsymbol{\beta}_5^T \mathbf{x}_{it} + \upsilon_i + \delta_t + \eta_{it}, \qquad (3)$$

where $I(\xi)$ is an indicator function taking on the value 1 if the relational statement ξ is true and υ_i represents household specific effects. Equation (3) nests equation (2) under the restrictions $\beta_2 = \beta_3 = 0$. Equation (3) hypothesises that the state of a household's health in a year affects the volume of debt it holds in that year, for example the debt may be lower if the household has health insurance and both the possession of insurance and being aged at least 65 years may reduce debt.

We are specifically interested in the effects of health shocks, that is a worsening of a household's state of health. To incorporate these we may first difference equation (2), and

argue that instead of first differences in demographics the actual level of the demographics affects the change in debt. Allowing the difference in debt to (possibly) be a partial rather than a complete adjustment, including the interaction terms just referred to, the possibility of the interaction between the occurrence of a health shock and the possession of debt in the previous period, and allowing for the level of debt to depend on the household's state of health in the previous period (perhaps due to high health expenditures in that period) we gain

$$debt_{it} = \gamma\, debt_{it-1} + \beta_1 \Delta\, health\ state_{it} + \beta_2\ health\ state_{it-1} + \beta_3 I(age65_{it} = 1).I(insurance_{it} = 1)$$

$$+ \beta_4 health\ state_{it}.I(insurance_{it} = 1) + \beta_5 \Delta health\ state_{it}.I(debt_{t-1} = 1) + \boldsymbol{\beta}_6^T \mathbf{x}_{it} + \lambda_i + \delta_t + \zeta_{it}, \quad (4)$$

where λ_i represents household specific effects and ζ_{it} is a random error term. Clearly equation (4) nests equation (3) under the restrictions that $\gamma = (\beta_2 - \beta_1) = \beta_5 = 0$. Equation (4) also nests equation (2) under the restriction that (in equation 4) $\gamma = (\beta_2 - \beta_1) = \beta_3 = \beta_4 = \beta_5 = 0$. We refer to equation (4) as a dynamic panel model due to the existence of a lagged dependent variable.

The random variables, υ_i in equation (3) and λ_i in equation (4), can be incorporated as either random or fixed effects. However assuming a random effect assumes the validity of the strong assumptions that $E(\varepsilon_{it} \mid \mathbf{z}_{it}, \upsilon_i) = 0$ for all t and $E(\upsilon_i \mid \mathbf{z}_{it}) = 0$, where $\mathbf{z}_{it}$ is the vector of regressors and that the regressor moment matrix is of full rank. Instead we make less stringent assumptions and regard υ_i as fixed effects so assuming $E(\varepsilon_{it} \mid \mathbf{z}_{it}, \upsilon_i) = 0$, full rank of the time-demeaned regressor moment matrix and that possibly $E(\upsilon_i \mid z_{it}) \neq 0$.

The parameterisations of equation (3) and (4) raise certain issues. In equation (3) we assumed that both household income and gross value of houses were strictly exogenous. However this may not be so and in our robustness checks for the results for equation (4) we instrumented for these variables using variables to be specified later. Secondly, in equation (4) the existence of the endogenous lagged dependent variable requires consideration to avoid inconsistent parameter estimates that would have resulted from

standard first difference LS fixed effects estimators. This results from the correlation between $(debt_{it-1} - debt_{it-2})$ and $(\zeta_{it-1} - \zeta_{it-2})$. We estimated equation (4) using Arellano and Bond (Arellano and Bond: 1991) one step difference GMM estimators. We have a choice of lagged levels or lagged differences in lagged debt to use as instruments for $debt_{it-1}$ and experimented with various specifications, eventually choosing debt levels lagged from period 2 to as far back as was possible in the dataset for each case. Consistency of Arellano Bond estimators with these lags assumes that the first difference in the error term in equation (4) is not AR(2). We apply an Arellano Bond test for the null hypothesis that the first difference in the error term is not AR(2). The validity of the instruments also implies that the sample moments computed with the parameters estimates should be close to zero. We employ the Hansen (1982) test of the null hypothesis that the moment conditions are valid. The interaction term between the occurrence of a health shock and the possession of debt in the previous period was instrumented using lag 2 values of the variable lagged similarly to those of debt. We chose Arellano and Bond first difference GMM estimators rather than Anderson-Hsiao (1982) first difference estimators because Arellano Bond estimators are relatively more efficient since they use more lags of the instruments than does Anderson-Hsiao. Blundell and Bond (1998), using simulation, found that first difference estimators result in downwardly biased estimates when the autoregressive parameter (γ) is above 0.8. However as will be demonstrated later our estimates of (γ) were around 0.45 for mortgages and below 0.25 for total debt and consumer loans.

The Data

To investigate these issues we use eight waves of the Health and Retirement Study series of surveys. The Health and Retirement Study (HRS) itself first collected data in 1992 from a sample designed to be representative of all individuals in the US born between 1931 and 1941 and so aged 50 and over at the time of the survey. The Study of Asset Health Dynamics amongst the Oldest Old (AHEAD) first collected data in 1993 and the sample was designed to be nationally representative of the population of individuals in the US who were born in or before 1923 and so aged 70 and over at the time of the survey. The sample was re-interviewed in 1995, 1998 and every two years thereafter. Both surveys are multistage area probability samples and over sampled blacks and Hispanics.

The two surveys were merged in 1998. The third cohort to be included was the Children of the Depression (CODA) survey which collected data in 1998 from a sample that was representative of the population of individuals born between 1924 and 1930. Subsequently cohorts have been added every six years so that the sample remains representative of individuals aged 50 years and over at the time of the addition. Thus the War Babies (WB) cohort was added in 1998 and represented the population of individuals born between 1942 and 1947 and in 2004 the Early Baby Boomers sample was added which was representative of individuals born between 1948 and 1953. All cohorts were re-interviewed every two years and exits and re-entrants the data forms an unbalanced panel.

In this study we use waves 1 to 8 of the HRS[3], waves 4 -8 of AHEAD, CODA and WB cohorts and waves 7 and 8 of the EBB cohort. We use the Rand imputed values for all variables. We omit waves 2A and 3A (1993 and 1995) from AHEAD because debt figures were not collected in those surveys. The primary sampling unit of each survey is the household financial unit and data is collected for individuals within each unit. The surveys track individuals as partnerships split due to divorce, separation or death and so new sub-households are identified. The assets and wealth values are collected at the level of the sub-household rather than at the level of the individual and so we treat the unit of observation as the sub-household.

To represent the demographics of a household several options are possible and we chose to identify a head of household for each sub household for each year[4]. For each year separately the head of household was identified as follows. If the household consisted of one person then that person was the head. If the household consisted of more than one person of different genders the male was chosen and if of the same gender the oldest person was chosen[5]. This identification is the same as that employed by the Survey of Consumer Finance. An alternative identification might be to take the financial respondent (or family respondent) as the head, but then arbitrary changes in which member of the household who answered these questions between different years would result in

[3] In wave 3 there was a skip error in the questionnaire and the HRS did not ask questions relating to second residences that were liven in for less that two months during the year. We have imputed mortgage debt and value of second residences for this wave. Details available from the authors on request.
[4] An alternative is to take the mean values of continuous variables like age, but this would be problematic in the case of nominal variables like gender and race for example.
[5] The choice of the male is arbitrary and is not to imply any value judgements about the arrangements of any individual families.

misleading changes in demographic characteristics of the household. Another possibility is to take the oldest member of a household. But this may result in individuals who have little decision making involvement in the holding of debts being identified. The identified head of a household may change over time as partnerships dissolve or one partner dies. Notice also that a household is interviewed if at least one member is age-eligible at the time the wave was surveyed. That person may be the female in a partnership and yet in our identification strategy the male would be chosen as the head and so in our sample the age of the head may be below 50 years in some cases.

The surveys collect data separately on three types of debt; mortgages on the primary and secondary residences, other loans and home equity loans on the primary residence and what we will call 'consumer debt' which consists of debt outstanding on credit cards, medical debts, debts on life insurance policies and loans from relations. We are unable to identify loans on vehicles, non residential real estate, or loans on businesses, or loans on various types of financial instruments such as stocks and mutual funds from the questionnaires. We present models for total debt, mortgage debt and consumer loans separately, models for other loans and home equity lines gave implausible results and so are excluded. We model mortgage debt and consumer debt separately because there may be constraints for example associated with the requirement for collateral to borrow a mortgage which may prevent substitution between these two forms of debt.

We can approximately compare the percentage of households that hold debt in our data in 2006 with that in the 2007 SCF using figures for the SCF from Bucks et al (2009). For both mortgage loans, consumer loans and in total the incidence we observe in our data is lower than that in the SCF. For example Bucks et al find that of those where the head is aged 65-74, 42.9% hold debt secured on the Primary Residence and 5.0% hold debt secured on Other Residential Property (their Table 13). In our data we find that in age ranges 65-69 and 70-74 the percentages who have mortgages or other loans or home equity loans on their first or second residence are 41.18% and 28.02% respectively. However our data excludes those who have a mortgage on non-residential property. Nevertheless in our data the incidence is slightly lower. The same indication is given by data on the incidence of consumer loans (though our data excludes loans for vehicle purchase) and of any type of loan. But of course, the SCF has a much smaller sample than

do the HRS surveys for those aged over 50 years and the HRS surveys form a panel whereas the SCF does not[6]. We will exploit the panel property of the data in this paper.

Following Coile and Milligan (2006) we define two measures of a household's state of health in a period. The first is a dummy variable that takes on the value 1 in those periods in which either the head of household or his/her spouse (if one exists) reports that they had ever been told by a doctor that they suffer from cancer, have had a heart attack or heart disease, or a stroke[7]. This represents a type of illness that we call 'severe' in that it is life threatening and requires immediate and extensive treatment. The second is a dummy variable that takes on the value 1 in those periods in which either the head of the household or his/her spouse reports that they have ever suffered from high blood pressure or hypertension or chronic lung disease (except asthma) or psychological problems or arthritis or diabetes. These conditions, though serious, may be regarded as chronic. A severe (chronic) health shock is defined as a change from not ever having suffered a severe (chronic) health problem to having had such a problem. Those (very few) households that reported a deterioration in their state of health *and back again* were removed because the state of health is defined as *ever* having suffered from a condition.

The demographic control variables are age, measured as interval linear slope splines with one knot at age 65 years, household income, marital status dummies (divorced, widowed, single) and employment status dummies (in the labour force, unemployed, retired) and gross value of housing assets. Debt, income and value of housing assets were subject to inverse hyperbolic sine transformations[8]. These covariates have been shown to affect the level of debt held in the literature (Crook & Hochguertel 2008, Cox and Jappelli 1993). We include wave dummies to account for unexplained heterogeneity specific to the wave. All nominal values are deflated to 1992 prices using the CPI. Demographic variables that did not change over time such as years of education, gender and race were not included.

[6] The SCF had a relatively small panel component in 1986 and 1989 only.

[7] An alternative variable on which data is collected is whether an individual has been told by a doctor that he/she has had any of these conditions since their last interview. However respondents were allowed to dispute the results recorder in a previous interview (albeit within the same wave or in a previous year) and then some uncertainty exists for a number of cases as to whether they actually have had the condition or not. For this reason we prefer the 'ever had' question instead.

[8] $x^{'} = \ln(\sqrt{1+x^2} + x)$

Debt Holdings and Age

Since we believe our work is the first in-depth analysis of the volume of mortgage and consumer debt holdings, specifically of the later years of a household's consumption lifecycle we give some attention to how debt varies with certain demographic characteristics.

Table 1 panel a shows descriptive relationships between the percentage of households that hold debt and age, conditional and unconditional on state of health defined as ever having had a severe health shock. The figures relate to 2006. Surprisingly we see that 22.51% of those aged 80-84 years had some form of debt and 9.74% owed money on a mortgage. In general the percentage that have any form of debt declines with age for both those with a poor state of health and those in better health and the greatest reduction occurs between the age ranges of 65-69 and 70-74. When considered for each type of debt separately this is true for mortgage debt , but for consumer debt and other debt and home equity lines the greatest decline occurs between age ranges 55-59 and 60-64. But the effect of having a poor state of health differs between mortgage debt and other loans and home equity lines on the one hand and consumer debt on the other. A similar or slightly lower (depending on age) proportion of those in poor health has a mortgage than those in better health. But the proportion in poor health that have other loans or home equity debt is higher than those in better health in age ranges 60 to 74. For consumer loans a higher proportion of those in poor health have loans than the proportion of those in good health and this is true over all age ranges.

Table 1 panel b shows similar relationships except now we consider if a household has had a health *shock*, that is a deterioration in the state of the respondent's or spouse's health, in the last two years. In age ranges 60-64, and 70-79 the proportion of those who had a shock and who have any type of debt is much higher than the proportion of those that did not have a shock. This is generally true of mortgage debt and at ages 55 to 79 for consumer debt. For other loans and home equity lines the proportions who have debt are roughly the same in both states of health.

Table 2 shows the simple relationships between average[9] debt holdings and age both conditional and unconditional on having debt, and conditional and unconditional on state of health. Perhaps surprisingly we see that the average total debt outstanding to those in their early 70s is $18.3k and average mortgage debt is $14.5k. Even in their late 70s the average US household has $13k debt and $9.8k in mortgage debt. Of course conditional on having debt, the average debt was even higher. For those aged 80-84 the conditional average debt was $28.6k for those with any debt and an astonishing $53.38K for those with mortgage debt, (although the latter were a small proportion of the age group – see Table 1 panel a).

The greatest drop in the volume of total debt outstanding also occurs between age ranges 55-59 and 60-65 for both total and mortgage debt. In contrast the greatest decline in consumer debt occurs between early and late 60s, at approximately the age of retirement. Within each age range surprising patterns emerge with respect to having poor health. Over the age range 55-69 those households where either the respondent or his/her spouse have poor health have more total debt than those in better health but at higher ages generally the reverse is true. The average value of mortgage debt for those in poor health and those in good health is similar at all ages up until age 60-64, thereafter those in poor health have a lower mortgage outstanding. However for other and home equity loans for all ages above 50 and for consumer loans at all ages above 60 those in poor health have more debt outstanding than those in good health.

In Table 2 panel b we see that there seems to be no systematic relationship between the debt held by those who have had a severe health shock in the last two years and those who have not, either for total debt or for each specific type of debt.

Figures 1 and 2 show cohort analyses of total debt at each two-year age range. Each line in Figure 1 shows the value of total debt for households that were in different age cohorts in 1992 and tracks their debt holdings over the next twelve years. Figure 2 shows the proportion of households that hold debt. Households that did not supply an interview in one year may drop out of the cohort for that year and if they supplied information in a later year, re-enter it in that year. The figures clearly show that both the proportion that

[9] We do not show median values, even though the distribution of debt holdings is skewed because, as Table 1a shows, the median in many age groups is zero.

hold any form of debt and the average value of debt held decline with age. The figures also show the substantial differences between the cohorts. For example if we consider the debt holdings of those aged 60-61, we see that those who were aged 56-57 in 1992 have much less debt by the time they reach 60-61 years (in 1996) than those who were aged 52-53 in 1992. This pattern of younger cohorts holding more debt than older cohorts applies approximately to all subsequent ages. This suggests that factors, independent of a head of household's age, have lead household debt holdings to increase over time.

Debt Holdings and Health Shocks

Table 3 shows the results of estimating the parameters of equation (3) for total debt, mortgage debt and consumer debt. Those households in which the respondent or spouse have had severe health problems at sometime in the past hold more debt in total than households which have not had such problems, but having had a *chronic* health problem seems to have no effect. Having any form of health insurance seems to increase debt, but if the household has ever had a severe shock having insurance reduces debt. Being over 65 and so eligible for Medicare and having any insurance reduces debt held. This is all consistent with households borrowing to pay insurance premiums, but if the households have suffered a severe health problem their insurance has paid out most of the health bills (the net effect is 0.681-0.579) with a consequent reduced amount of debt outstanding. However the effect of poor health seems to impact on holdings of consumer debt rather than mortgage debt. In columns 3 and 4 of the table we can see that having had a severe health problem at some time has no effect on mortgage debt, but increases the amount of consumer debt held. This appears to be reduced if the household also has some insurance and being old enough to be eligible for Medicare reduces the amount of both mortgage and consumer debt.

Surprisingly being older increased the amount of mortgage debt the average American has over the age of 65 years but reduces the amount of consumer debt. Consistent with the literature (Venti and Wise 2004), being divorced or widowed and being out of the labour force reduces the amount of debt held.

Table 4 shows the results of estimating equation (4), the dynamic fixed effects model with housing real estate and income treated as strictly exogenous. The model for total debt and for consumer debt passes the Arellano and Bond test for autoregression in the residuals supporting the validity of our instruments and the equation passed the Hansen test for an absence of endogenous instruments. The model for mortgage debt passes the autocorrelation test but fails the Hansen test and so rejects the null hypothesis that the instruments are jointly exogenous. We therefore concentrate on total and consumer debt. We now see that the occurrence of a severe health shock in the last two years results on average in an increase in the volume of total debt and of consumer debt held. Having debt outstanding in the previous period and having a severe health shock over the intervening period is associated with a reduction in total debt and in less consumer debt than not previously borrowing and a shock, (or no previous debt and no shock or having previous debt but no shock). This may indicate a supply effect or more likely a demand effect whereby the household repays debt because of uncertainty over life expectancy. The latter is more likely since lenders would not automatically find out if a household suffered a health shock, unless the borrower began to miss payments.

On the other hand the occurrence of a chronic shock reduces total debt but has no effect on consumer debt. Having debt in the previous wave and a chronic shock is associated with holding more debt than having no previous debt and a shock, (or no previous debt and no shock or having previous debt but no shock). This may indicate a demand effect as the household struggles to fund prolonged expenditures to treat chronic illness and repay debts outstanding. Table 4 also shows that whether or not a household has had a severe health shock *sometime in the past* has no effect on the total debt it holds which, combined with the increase in debt immediately following a severe shock, suggests that the effect of a severe shock is relatively short-lived. On the other hand if a household has ever had a chronic health problem any time in the past it will have more debt in the current period, this suggesting a possible demand effect.

The coefficient on the lagged dependent variable is significant for all three aggregations of debt with the rank order of the lag coefficients being plausible. We would expect that less debt would be repaid between waves from a mortgage loan than from a consumer loan. Most of the other control variables have the expected signs with higher income and high values of homes both being associated with having more total debt and a higher

value of homes being associated with more mortgage debt, but not more consumer debt. A slightly puzzling result is that although higher current household income is associated with more total debt being held, it is not associated with the holding of specific types of debt.

Robustness Tests

In this section we consider the results if alternative assumptions were adopted. When proposing equations (3) and (4) we assumed that observed values of debt were not censored, that is that in the population there were no negative values of debt that in the data was censored to zero. Since in equilibrium the observed amount of debt equals the ex post amounts demanded by and supplied to a household, it is at least conceptually possible that both could take on negative values. To consider the possible effects of censoring let $debt_{it}^{*}$ denote the uncensored volume of debt owed which is observed only if $debt_{it}^{*} > 0$. The observed value of debt, $debt_{it}$, is then given by $debt_{it} = d_{it} \cdot debt_{it}^{*}$ where $d_{it} = 1(debt_{it}^{*}) > 0)$. Given these assumptions equation (3) can then be reformulated as

$$\begin{aligned} debt_{it}^{*} &= \alpha + \beta_1\, health\ state_{it} + \beta_2 I(age65_{it} = 1).I(insurance_{it} = 1) \\ &+ \beta_3 health\ state_{it}.I(insurance_{it} = 1) + \boldsymbol{\beta}_5^{T}\mathbf{x}_{it} + \upsilon_i + \delta_t + \eta_{it}, \end{aligned} \tag{6}$$

Because of censoring, taking first differences to identify directly the parameters on health shocks is not plausible so we cannot set up equation (4) to allow for censoring.

To parameterise model (6) assuming that υ_i is a fixed effect (for reasons given earlier) we use estimators deduced by Honoré (1992). Because of the censoring, conventional first differencing to remove the fixed effects is not possible. Instead it is assumed that two observations for the same case, η_{i1} and η_{i2}, are i.i.d conditional on regressor values and the fixed effects. The distribution of η_{it} is assumed homoskedastic for given i, but may be heteroskedastic across i. Given these assumptions Honoré derives an objective function from orthogonality conditions for a moment estimator to be consistent and asymptotically normal.

The results of estimating equation (6) which are shown in Table 5 are qualitatively similar to those for equation (3) shown in Table 3. If a household has ever had a severe health shock it would on average hold more debt in aggregate and more consumer debt, but not more mortgage debt. Whether or not a household has suffered a chronic health problem does not appear to affect the amount of debt, of any type, held. Having any form of insurance increases the total amount of debt held but having insurance and having had a sever shock sometime in the past reduces it. The latter is also true for consumer debt, but not for mortgage debt.

Secondly we experimented with alternative specifications of the instrument structure in the estimation of equation 4. In our initial specification we assumed that house value and household income were exogenous. This may not be true as variables excluded from the equation may possibly affect both the error term and either or both of these variables. We therefore re-estimated equation (4) instrumenting these variables with their own values lagged in periods t-2 and t-3. Since the mortgage equation showed evidence of AR(2) in the residuals and invalid overidentifying restrictions we collapsed the instruments for this equation alone. That is we used the same instruments for each variable for each time period. Both the AR(2) and the Hansen tests were then passed.

The results are shown in Table 6 and again support those given in Table 4. The occurrence of a severe health shock over the last two years is associated with an increase in total debt and in consumer debt over the two years and from the revised equation for mortgages, an increase in mortgage debt also. If the household has a severe shock and any health insurance as well, its level of debt would be lower than if it had not had insurance. If the household has a severe shock and had debt in the previous period it would have less debt afterwards perhaps choosing to repay the debts it had to reduce risk. But if a household had no debt and a shock occurred (or no debt and no shock or no shock) it would have more debt. So those who have no debt who then face a severe health shock appear to take on debt.

If a household has a recent chronic shock it’s net borrowings would decrease, but would increase if it had debt in the previous period. Being over 65 and having insurance also results in less mortgage debt but has no effect on total or consumer debt. This suggests

that being eligible for Medicare reduces debts which might have been incurred if the household's health deteriorated.

Different Types of Insurance Coverage

The HRS allows us to distinguish between different types of health insurance that a family may have. We may distinguish between cover provided by a government health care plan, a plan provided by a current or former employer of either the respondent or of his/her spouse and other insurance provision. In 2006 the Survey shows that 94.8% of households had some form of health insurance. Of those that had some form of insurance and where we could identify the type they had[10], 25.9% had only government insurance and 37.5% had only private insurance. Table 7 shows the results of estimating equation (4) with those variables indicating whether a household has any insurance replaced by a variable indicating whether a household has government only insurance in column two (or private only insurance in column three). Each estimated parameter is similar in value to the corresponding parameter in Table 4 and the equations for government insurance only passed both diagnostic tests.

The results show that *cet par* households with only government insurance and no private insurance have less debt than those with both government and private insurance or private insurance only. Those with only government insurance and who have had severe health problems sometime in the past have less debt than those who have other types of insurance. In contrast, if a household has had chronic poor health and only government insurance they actually have more debt than if they had private or both types of insurance. When interpreting the equation with private insurance we must be cautious because the equation failed the Hansen test of valid instruments. But tentatively it suggests that, *cet par* those with only private insurance have more debt than those with only government insurance or both, as do those who also have had severe health problems, although those with chronic problems and private only insurance have less debt. The overall conclusions of these results are that those who have had severe health problems have less debt if they have only government insurance rather than only private insurance or both types, and

[10] We could identify whether the housold had only government insurance in 92.32% of cases, whether irt had only private insurance in 91.90% of cases and whether it had any insurance of any kind in 98.92% of cases.

those who have chronic problems have less debt if they have private insurance and no government insurance or both types. But on average, ignoring a household's state of health, those with only private insurance have more debt than do those with only government insurance.

These results suggest that if a household has only government health insurance and is aged over 65 years and had a severe health shock in the last two years, but no severe health problems before that and no debt before that, then on average its debt would be \$2,885[11] higher than if none of these conditions were true. On the other hand if a household had only private health insurance, but otherwise has these same characteristics, then on average its debt would be \$15,6350 higher than if these conditions were true. This suggests that if a household where the head is over 65 years of age prefers only one type of health insurance, has not had a severe health problem before and it wishes to minimise any increase in debt resulting from the occurrence of a severe health shock then on average it is more likely to achieve this by having only government insurance rather than private insurance.

Conclusions

The PIH and other lifecycle models make assumptions about the consumption behaviour of individuals in their later years of life which have implications for the amount of debt older people will have. These assumptions have rarely been tested; most previous studies consider debt holdings throughout the entire lifecycle. In this paper we have used a large panel dataset that was collected specifically from older American households. We have found that, as predicted by the PIH, the amount of debt owed decreases with age. Preferences, as represented by whether in the labor force and marital status still affect the amount of debt owed when a person progresses towards his or her later years of life and do so in the same ways as they affect debt earlier in a person's life. If a household does not owe debt, and one of its members suffers a severe health shock then its mortgage debt,

[11] Computed as $(\exp(2*\psi)-1)/(2*(\exp(\psi))$ where ψ is the sum of the coefficients (from Table 7) on has only government health insurance, age65* has only government health insurance, occurrence of a severe health shock, ever had severe shock*has only government health insurance)

consumer debt and total debt will all increase regardless of whether it has any insurance or not. But if a household has a severe shock and it previously had debt then its total debt, mortgage debt and consumer debt will decline. This may be due to lenders asking for repayment or, more likely, due to borrowers paying off debt because of a fear of being unable to repay if the shock also affects their ability to do so. Households that have chronic illness generally have less debt than those who do not, but if the onset of such illness occurs then the household will increase the amount it owes. We also found that on average if a household prefers to have only one type of health insurance it wishes to protect its consumption against a severe health shock they would be better served by using government insurance rather than private insurance.

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Table 1 Percentage Holding of Debt by Age and Health Shock 2006
Panel a: Whether ever had severe health shock

Age Range	Total Debt: Ever Had Severe Health Shock	Total Debt: Never Had Severe Health Shock	Total Debt: Total	Mortgage Debt: Ever Had Severe Health Shock	Mortgage Debt: Never Had Severe Health Shock	Mortgage Debt: Total
Under 50	79.21	71.99	75.01	59.58	52.83	55.66
50-54	73.48	75.66	75.12	53.94	56.05	55.52
55-59	72.92	73.93	73.62	46.79	53.75	51.58
60-64	64.13	62.38	63.13	41.81	42.14	42.00
65-69	57.68	54.98	56.31	36.59	34.96	35.77
70-74	43.46	48.28	42.97	21.10	22.92	21.84
75-79	34.56	32.68	33.86	14.80	16.47	15.43
80-84	23.86	19.84	22.51	9.80	9.61	9.74
85 and over	13.44	11.96	12.97	4.69	4.64	4.69

Age Range	Other Debt and Home Equity Lines: With Severe Health Shock	Other Debt and Home Equity Lines: Without Severe Health Shock	Other Debt and Home Equity Lines: Total	Consumer Debt: With Severe Health Shock	Consumer Debt: Without Severe Health Shock	Consumer Debt: Total
Under 50	16.19	19.46	18.09	52.87	43.92	47.67
50-54	16.94	14.03	14.76	47.10	44.38	45.06
55-59	15.97	17.01	16.69	47.39	45.79	46.29
60-64	13.09	11.25	12.04	37.84	34.62	35.99
65-69	12.28	10.12	11.19	31.51	29.74	30.61
70-74	9.36	7.10	8.44	24.98	22.89	24.13
75-79	5.05	5.72	5.31	21.62	19.93	20.98
80-84	3.90	3.71	3.83	14.65	11.14	13.47
85 and over	1.75	1.82	1.77	8.22	6.78	7.7

Cases are weighted by household weights. Sample consists of cases where occurrence of severe health shock at any time in the past is not missing. The number of cases with a severe health shock, without a severe health shock and in total is the same for the same age range in all four subpanels. "na" means not avaliable due to less than 20 observations. Ref: hrsr\merge\meds5\med1_h

Panel b: Whether Has Had Severe Health Shock In Last Two Years

Age Range	Total Debt: With Severe Health Shock	Total Debt: Without Severe Health Shock	Total Debt: Total	Mortgage Debt: With Severe Health Shock	Mortgage Debt: Without Severe Health Shock	Mortgage Debt: Total
Under 50	na	70.87	73.98	na	53.98	56.49
50-54	80.31	74.57	74.86	71.16	54.76	55.59
55-59	70.19	74.05	73.82	43.55	52.91	52.34
60-64	77.73	61.62	62.49	45.39	41.56	41.77
65-69	55.54	56.83	56.75	29.35	36.48	36.07
70-74	49.12	42.60	43.01	24.43	21.88	22.03
75-79	45.20	32.84	33.71	22.77	14.71	15.27
80-84	14.72	23.06	22.57	9.99	9.52	9.55
85 and over	11.24	13.10	12.98	5.73	4.42	4.51

Age Range	Other Debt and Home Equity Lines: With Severe Health Shock	Other Debt and Home Equity Lines: Without Severe Health Shock	Other Debt and Home Equity Lines: Total	Consumer Debt: With Severe Health Shock	Consumer Debt: Without Severe Health Shock	Consumer Debt: Total
Under 50	na	13.37	16.14	na	44.65	46.06
50-54	24.74	14.56	15.08	41.34	44.88	44.71
55-59	12.40	16.92	16.64	48.58	45.83	46.00
60-64	18.84	12.11	12.47	37.52	35.04	35.18
65-69	12.68	11.51	11.58	36.58	30.39	30.75
70-74	8.90	8.38	8.41	28.80	23.81	24.12
75-79	5.06	5.29	5.27	24.59	20.56	20.84
80-84	0	4.24	3.99	7.83	14.22	13.84
85 and over	0	2.02	1.89	5.51	7.95	7.79

Cases are weighted by household weights. Sample consists of cases where occurrence of severe health shock in last two years is not missing. The number of cases with a severe health shock, without a severe health shock and in total is the same for the same age range in all four subpanels. "na" means not vailable dues to less than 20 observations. Ref: hrsr\merge\meds5\med1_h

Table 2 Holdings of Debt by Age and Health Shock 2006
Panel a: Whether ever had severe health shock
Total Debt

	Unconditional on Holding Debt			Conditional on Holding Debt		
Age Range	Ever Had Severe Health Shock	Never Had Severe Health Shock	Total	Ever Had Severe Health Shock	Never had Severe Health Shock	Total
Under 50	65502.96	81582.69	74848	82700.52	113319	99778.93
50-54	55381.09	66350.3	63609	75373.4	87690.01	84679.78
55-59	64308.04	55634.03	58335	88188.11	75249.6	79241.03
60-64	42629.86	35737.8	38680	66469.43	57290.18	61271.32
65-69	36984.06	29261.09	33075	64114.04	53223.29	58732.39
70-74	18169.64	18489.65	18300	41809.66	43748.19	42587.04
75-79	12315.82	14828.46	13262	35631.51	45369.51	39173.01
80-84	6677.605	5969.469	6440	27982.87	30087.32	28605.77
85 and over	2149.522	4799.787	2983	15996.47	40133.7	22994.48

Mortgage Debt

	Unconditional on Holding Debt			Conditional on Holding Debt		
Age Range	Ever Had Severe Health Shock	Never Had Severe Health Shock	Total	Ever Had Severe Health Shock	Never Had Severe Health Shock	Total
Under 50	56663.23	72145	65660.92	95102.29	136568.3	117976.6
50-54	44736.17	57740.75	54491.34	82932.61	103017.7	98141.95
55-59	51787.01	44675.31	46890.17	110675.1	83122.85	90907.09
60-64	31045.67	31138.55	31098.9	74251.31	73888.1	74042.46
65-69	28676.64	24362.31	26492.89	78367.14	69683.38	74070.73
70-74	13518.75	15836.75	14463.86	64055.06	69100.13	66213.22
75-79	8711.10	11548.2	9779.897	58862.41	70120.28	63389.62
80-84	5193.79	5205.948	5197.876	52989.07	88549.93	53378.15
85 and over	1642.824	4290.214	2475.396	35090.42	92432.1	53017.22

Other Loans and Home Equity Lines

Age Range	Unconditional on Holding Debt: Ever Had Severe Health Shock	Unconditional on Holding Debt: Never Had Severe Health Shock	Unconditional on Holding Debt: Total	Conditional on Holding Debt: Ever Had Severe Health Shock	Conditional on Holding Debt: Never Had Severe Health Shock	Conditional on Holding Debt: Total
Under 50	3918.93	6187.23	5237.22	24199.48	na	28951.51
50-54	6092.817	4004.55	4526.34	35966.57	28534.98	30666.16
55-59	7156.406	4389.586	5251.279	44816.23	25806	31472.02
60-64	2821.9	2407.117	2584.193	21565.43	21389.52	21471.16
65-69	6226.516	3180.752	4684.86	50697.92	31432.46	41877.22
70-74	3223.648	1319.591	2447.31	34427.38	18576.96	28989.54
75-79	1868.58	1669.706	1793.66	36970.85	29169.29	33800.56
80-84	892.0792	446.4627	742.4186	22894.94	na	19361.25
85 and over	311.35	240.2744	288.9984	17781.59	na	16296.11

Consumer Debt

Age Range	Unconditional on Holding Debt: Ever Had Severe Health Shock	Unconditional on Holding Debt: Never Had Severe Health Shock	Unconditional on Holding Debt: Total	Conditional on Holding Debt: Ever Had Severe Health Shock	Conditional on Holding Debt: Never Had Severe Health Shock	Conditional on Holding Debt: Total
Under 50	4920.799	3250.46	3950.032	9308.119	7401.083	8286.917
50-54	4552.107	4604.997	4591.782	9665.791	10376.11	10190.61
55-59	5364.623	6569.133	6194.003	11320.56	14345.21	13380.87
60-64	8762.289	2192.125	4997.01	23154.88	6332.192	13882.58
65-69	2080.899	1718.029	1897.228	6603.896	5776.851	6197.231
70-74	1427.236	1333.308	1388.939	5713.02	5825.874	5756.666
75-79	1736.128	1610.559	1688.823	8029.722	8080.891	8048.031
80-84	591.7321	317.0578	499.4826	4040.057	2846.429	3708.519
85 and over	195.347	269.2986	218.604	2376.927	3970.426	2814.555

Cases are weighted by household weights. Values are in USD at 1992 prices. Sample consists of cases where occurrence of severe health shock at any time in the past is not missing and the respective type of debt holding is not missing. The number of cases with a severe health shock plus those without a severe health shock equals the number of cases composing the Total. . Na denotes fewer than 20 observations. Ref: hrsr\merge\meds5\med2_h

Panel b: Whether Had Severe Health Shock In Last Two Years
Total Debt

Age Range	Unconditional on Holding Debt: With Severe Health Shock	Unconditional on Holding Debt: Without Severe Health Shock	Unconditional on Holding Debt: Total	Conditional on Holding Debt: With Severe Health Shock	Conditional on Holding Debt: Without Severe Health Shock	Conditional on Holding Debt: Total
Under 50	na	72918.14	75573.29	na	102891.3	102148.9
50-54	87128.66	62263.63	63517.85	108491.5	83492.97	84845.66
55-59	68798.36	58632.74	59256.19	98015.29	79175.01	80273.7
60-64	44395.67	37929.19	38276.96	57112.86	61550.24	61253.38
65-69	24767.58	34460.97	33902.02	44597.83	60641.54	59736.27
70-74	21322.9	18257.62	18449.33	43408.75	42853.76	42893.4
75-79	12916.8	13244.66	13221.59	28576.36	40326.06	39217.29
80-84	6204.045	6514.32	6495.88	na	28243.97	28782.94
85 and over	719.2667	3217.189	3055.318	na	24559.34	23539.7

Mortgage Debt

Age Range	Unconditional on Holding Mortgage Debt: With Severe Health Shock	Unconditional on Holding Mortgage Debt: Without Severe Health Shock	Unconditional on Holding Mortgage Debt: Total	Conditional on Holding Mortgage Debt: With Severe Health Shock	Conditional on Holding Mortgage Debt: Without Severe Health Shock	Conditional on Holding Mortgage Debt: Total
Under 50	na	65213.05	67116.04	na	120808.4	118807.4
50-54	61921.24	53791.17	54201.26	87020.2	98233.67	97509.6
55-59	59016.65	47149.31	47877.12	135513.2	89107.15	91475.29
60-64	33550.45	31109.85	31241.11	73920.82	74846.85	74792.74
65-69	20563.88	27465.62	27067.65	70063.4	75290.01	75044.77
70-74	16438.65	14677.6	14787.74	67298.75	67096.94	67110.93
75-79	10729.95	9533.944	9618.123	47123.4	64831.4	62973.3
80-84	5600.425	5174.89	5200.18	na	54364.97	54470.38
85 and over	692.4697	2653.577	2526.493	na	59985.59	56037.62

Other Loans and Home Equity Lines

Age Range	Unconditional on Holding Debt: With Severe Health Shock	Unconditional on Holding Debt: Without Severe Health Shock	Unconditional on Holding Debt: Total	Conditional on Holding Debt: With Severe Health Shock	Conditional on Holding Debt: Without Severe Health Shock	Conditional on Holding Debt: Total
Under 50	na	4130.749	4614.945	na	na	na
50-54	21519.87	3754.16	4650.283	na	25777.27	30843.37
55-59	5777.051	5136.247	5175.547	na	30359.74	31101.66
60-64	4973.107	2525.237	2656.88	na	20850.33	21301.31
65-69	2017.545	5064.41	4888.722	na	43997.7	42224.59
70-74	3659.35	2132.747	2228.225	na	25457.71	26494.78
75-79	1133.442	1909.094	1854.5	na	36087.14	35162.77
80-84	0	832.3756	782.9078	na	19624.41	19624.41
85 and over	0	328.5913	307.2979	na	16296.11	16296.11

Consumer Debt

Age Range	Unconditional on Holding Debt: With Severe Health Shock	Unconditional on Holding Debt: Without Severe Health Shock	Unconditional on Holding Debt: Total	Conditional on Holding Debt: With Severe Health Shock	Conditional on Holding Debt: Without Severe Health Shock	Conditional on Holding Debt: Total
Under 50	na	3574.341	3842.307	na	8005.463	8341.407
50-54	3687.543	4718.294	4666.302	na	10512.06	10437.78
55-59	4004.663	6347.186	6203.523	8242.903	13848.42	13485.35
60-64	5872.106	4294.102	4378.967	15652.13	12254.01	12448.92
65-69	2186.155	1930.933	1945.649	5975.668	6353.472	6327.55
70-74	1224.895	1447.272	1433.364	4252.994	6078.493	5942.176
75-79	1053.416	1801.623	1748.962	4284.677	8763.866	8391.958
80-84	603.6201	507.0542	512.793	na	3565.272	3704.52
85 and over	26.797	235.0206	221.5273	na	2957.03	2843.761

Cases are weighted by household weights. Values are in USD at 1992 prices. Sample consists of cases where occurrence of severe health shock in the last two years is not missing and the respective type of debt holding is not missing. The number of cases with a severe health shock plus those without a severe health shock equals the number of cases composing the Total. . Na denotes fewer than 20 observations. Ref: hrsr\merge\meds5\med2_h

Table 3

Value of Debt Holding
Static Fixed Effects with Level of Health
(Coefficients)

Dep Var	**Total** ***IH*****(total debt)**	**Mortgage** ***IH*****(mortgage debt)**	**Consumer** ***IH*****(cons debt)**
Age < 65	-0.031	0.502	-0.105***
Age 65 plus	-0.037	0.082**	-0.097**
Divorced	-0.887***	-0.666***	-0.622***
Widow	-0.548***	-0.358**	-0.520***
Single	-0.517	-0.457	-0.487
Out of lab force	-0.455***	-0.483***	-0.136*
Unemployed	0.075	-0.130	0.263*
Retired	-0.411***	-0.495***	-0.126**
Has health insurance	0.515***	0.453***	0.177
Age65 & insurance	-0.321***	-0.287***	-0.120**
Ever had severe h shock	0.681**	-0.076	0.804***
Ever had chronic h shock	0.154	-0.067	0.346*
Severe *has insurance	-0.579***	0.057	-0.683***
Chronic*has insurance	-0.247	-0.210	-0.125
IH income	0.070***	0.045***	0.035**
*IH*Value of homes	0.315***	0.423***	
	0.013**		
Dummy 1994	-0.367***	-0.606***	-0.002
Dummy 1996	-0.692***	-1.117***	0.033
Dummy 1998	-0.840***	-1.344***	-0.022
Dummy 2000	-0.844***	-1.468***	0.180
Dummy 2002	-1.074***	-1.821***	0.113
Dummy 2004	-0.973**	-2.011***	0.350
Dummy 2006	-0.977*	-2.205***	0.506
Constant	4.583	-2.470	8.759***
Rho	0.605	0.681	0.448
R^2	0.195	0.134	0.069
No of obs	83,485	83,485	83,485
No groups	20,143	20,143	20,143

* denotes significance at 10%, ** at 5%, *** at 1%. Results for fixed effects regression. Age variables are interval slope splines. The debt, income and value of homes variables (x) are ln(sqrt(1+x^2)+x). This transformation is indicated by the prefix '*IH*'.Standard errors are robust to clustering by case. Ref:regsv2.log,

Table 4

Value of Debt Holding
Dynamic Fixed Effects Models with Health Shocks and Exogenous House Value and Income
(Coefficients)

Dep Var	Total *IH*(total debt)	Mortgage *IH*(mortgage debt)	Consumer *IH*(cons debt)
IH debt $_{t-1}$	0.220***	0.401***	0.154***
Age < 65	-0.056	0.097	-0.123*
Age 65 plus	-0.054	0.149*	-0.116*
Divorced	-1.446***	-1.057**	-0.183
Widow	-1.305**	-0.871*	-0.140
Single	-0.160	-0.677	-0.084
Out of lab force	-0.109	-0.034	-0.229*
Unemployed	-0.024	-0.191	0.416
Retired	0.011	-0.144	-0.113
Has health insurance	1.109*	0.313	0.238
Age65 & insurance	-0.241*	-0.358***	0.006
Occurrence of severe shock	13.111***	8.621***	4.930***
Occurrence of chronic shock	-12.864***	-0.813	-2.844
Ever had severe shock$_{t-1}$	-0.390	-0.997*	0.610*
Ever had chronic shock$_{t-1}$	1.906**	0.488	0.390
Ever severe*has any insurance	-0.059	0.581	-0.695*
Ever chronic*has any insurance	-1.262*	-0.731**	-0.097
Severe shock*has debt$_{t-1}$	-25.531***	-28.950***	-13.919***
Chronic shock*has debt$_{t-1}$	26.147***	8.410**	11.282*
IH income	0.095***	0.029	0.042*
*IH*Value of homes	0.297**	0.418***	0.006
Dummy 1996	-0.155	-0.391**	0.178
Dummy 1998	-0.123	-0.489	0.080
Dummy 2000	-0.249	-0.995*	0.315
Dummy 2002	-0.439	-1.429**	0.276
Dummy 2004	-0.295	-1.670*	0.585
Dummy 2006	-0.295	-1.996*	0.704
Signif of			
Arellano-Bond test for AR(2)	0.459	0.116	0.676
Hansen test (chi-square(48))	0.359	0.000	0.147
No of obs	43,647	43,528	43,764
No of panels	12,872	12,848	12,882

* denotes significance at 10%, ** at 5%, *** at 1%. Results for fixed effects regression using Arellano and Bond one step GMM estimators with following instruments: lag 2 levels of debt lagged as many periods as possible for level of debt; lag 2 levels of change in level of health interacted with lag one level of debt, lagged as many periods as possible. Age variables are interval slope splines. The debt, income and value of homes variables (x) are ln(sqrt(1+x^2)+x). This transformation is indicated by the prefix '*IH*'. Standard errors are robust to clustering by case. Ref:regsv2_h.log (14,31,65).

Table 5

Value of Debt Holding
Static Tobit Fixed Effects Models with Level of Health
(Coefficients)

Dep Var	Total *IH*(total debt)	Mortgage *IH*(mortgage debt)	Consumer *IH*(cons debt)
Age < 65	-0.109	0.075	-0.367***
Age 65 plus	-0.223***	-0.065	-0.429***
Divorced	-1.040***	-0.733*	-1.451***
Widow	-0.790***	-1.054**	-1.256***
Single	-0.278	-0.527	-1.057
Out of lab force	-0.508**	-0.433	-0.534
Unemployed	0.188	-0.098	0.659**
Retired	-0.526***	-0.865***	-0.420***
Has health insurance	0.743**	0.446	0.351
Age65 & insurance	-0.281***	0.267*	-0.286*
Ever had severe h shock	1.190***	-0.138	1.703***
Ever had chronic h shock	0.304	-0.116	0.897
Severe *has insurance	-0.950***	0.116	-1.200***
Chronic*has insurance	-0.479	-0.424	-0.385
IH income	0.108***	0.111***	0.077*
*IH*Value of homes	0.543***	1.846***	0.041**
Dummy 1994	-0.326**	-0.993***	0.234
Dummy 1996	-0.615**	-1.980***	0.636
Dummy 1998	-0.641	-2.318***	0.642
Dummy 2000	-0.549	-2.626***	1.447
Dummy 2002	-0.884	-3.685***	1.338
Dummy 2004	-0.568	-4.158***	2.338
Dummy 2006	-0.447	-4.695***	2.919
No of moment condns	186,601	186,601	186,601
No of panels	17280	17280	17280

* denotes significance at 10%, ** at 5%, *** at 1%. Results for fixed effects tobit regression. using Honore's least squares criterion. Age variables are interval slope splines. The debt, income and value of homes variables (x) are ln(sqrt(1+x^2)+x). This transformation is indicated by the prefix '*IH*'.Standard errors are robust to clustering by case. Ref:regsv2_h.log,

Table 6

Value of Debt Holding
Dynamic Fixed Effects Models with Health Shocks and Endogenous House Value and Income
(Coefficients)

Dep Var	Total *IH*(total debt)	Mortgage *IH*(mortgage debt)	Consumer *IH*(cons debt)
IH debt $_{t-1}$	0.217***	0.439***	0.159***
Age < 65	-0.717	0.200	-0.122*
Age 65 plus	-0.052	0.190	-0.107
Divorced	-0.882	-1.628	-0.062
Widow	-0.784*	-1.392	-0.029
Single	0.086	-0.872	-0.048
Out of lab force	0.080	0.437	-0.107
Unemployed	0.138	-0.070	0.501*
Retired	0.093	0.214	-0.043
Has health insurance	0.781	0.560	0.169
Age65 & insurance	-0.226	-0.459***	0.012
Occurrence of severe shock	9.514***	15.767***	4.300***
Occurrence of chronic shock	-9.030***	-3.078	-1.743
Ever had severe shock$_{t-1}$	0.050	-1.679	0.674*
Ever had chronic shock$_{t-1}$	1.495**	0.654	0.353
Ever severe*has any insurance	-0.299	0.925	-0.712**
Ever chronic*has any insurance	-0.973*	-1.321**	-0.100
Severe shock*has debt$_{t-1}$	-17.884***	-52.807***	-11.641***
Chronic shock*has debt$_{t-1}$	18.601***	23.245	7.367
IH income	0.685**	0.544	0.331
*IH*Value of homes	0.247***	0.078	-0.029
Dummy 1996	-0.191	-0.532	0.129
Dummy 1998	-0.149	-0.723	0.037
Dummy 2000	-0.198	-1.417	0.330
Dummy 2002	-0.362	-1.958	0.287
Dummy 2004	-0.182	-2.343	0.593
Dummy 2006	-0.185	-2.834	0.691
Signif of			
Arellano-Bond test for AR(2)	0.11	0.956	0.323
Hansen test (chi-square(68))	0.061	0.190	0.064
No of obs	43,647	43,528	43,764
No of panels	12,872	12,848	12,882

* denotes significance at 10%, ** at 5%, *** at 1%. Results for fixed effects regression. using Arellano and Bond one step GMM estimators with following instruments for total and consumer debt: lag 2 levels of debt lagged as many periods as possible for level of debt; lag 2 levels of house value for house value and of income for income lagged zero and one period; lag 2 levels of change in level of health interacted with lag one level of debt, lagged as many periods as possible. Instruments for mortgage debt are the same as for total and consumer debt but are collapsed. Age variables are interval slope splines. The debt, income and value of homes variables (x) are log(sqrt(1+x^2)+x). This transformation is indicated by the prefix '*IH*'.Standard errors are robust to clustering by case. Ref:regsv2_h.log(15 ,34, 66)

Table 7

Health Shocks and Insurance
Dynamic Fixed Effects Models with Health Shocks and Exogenous House Value and Income
(Coefficients)

Dep Var	**Total *IH*(total debt)**	**Total *IH*(total debt)**
IH debt $_{t-1}$	0.231***	0.185***
Age < 65	-0.048	-0.042
Age 65 plus	-0.030	-0.027
Divorced	-1.270**	1.149**
Widow	-0.935*	-0.805*
Single	0.021	-0.080
Out of lab force	-0.264	-0.290
Unemployed	-0.418	-0.358
Retired	-0.090	-0.111
Has private only health insurance		3.677***
Has govt. only health insurance	-1.822**	
Age65 & private only insurance		-0.137
Age65 & govt. only insurance	-1.822**	
Occurrence of severe shock	11.966***	6.655***
Occurrence of chronic shock	-11.793**	-10.116***
Ever had severe shock$_{t-1}$	-0.011	-0.858***
Ever had chronic shock$_{t-1}$	-0.105	2.834***
Ever severe*has private only insurance		2.458***
Ever chronic*has private only insurance		-4.995***
Ever severe* has govt. only insurance	-1.450***	
Ever chronic*has govt. only insurance	2.941***	
Severe shock*has debt$_{t-1}$	-22.518***	-14.393***
Chronic shock*has debt$_{t-1}$	20.517**	23.114***
IH income	0.099***	0.096***
*IH*Value of homes	0.298***	0.297***
Dummy 1996	-0.149	-0.156
Dummy 1998	-0.183	-0.185
Dummy 2000	-0.363	-0.374
Dummy 2002	-0.615	-0.633
Dummy 2004	-0.472	-0.517
Dummy 2006	-0.546	-0.595
Signif of		
Arellano-Bond test for AR(2)	0.487	0.216
Hansen test (chi-square(48))	0.372	0.027
No of obs	40,186	40,619
No of panels	12,369	12,453

* denotes significance at 10%, ** at 5%, *** at 1%. Results for fixed effects regression using Arellano and Bond one step GMM estimators with following instruments: lag 2 changes in debt lagged as many periods as possible for level of debt; lag 2 changes in change in level of health interacted with lag one level of debt, lagged as many periods as possible.. Age variables are interval slope splines. The debt, income and value of homes variables (x) are ln(sqrt(1+x^2)+x). This transformation is indicated by the prefix '*IH*'. Standard errors are robust to clustering by case. Ref:regsv9_h.log (14, 31)

Figure 1

Mean Value Total Debt Holdings by Cohort

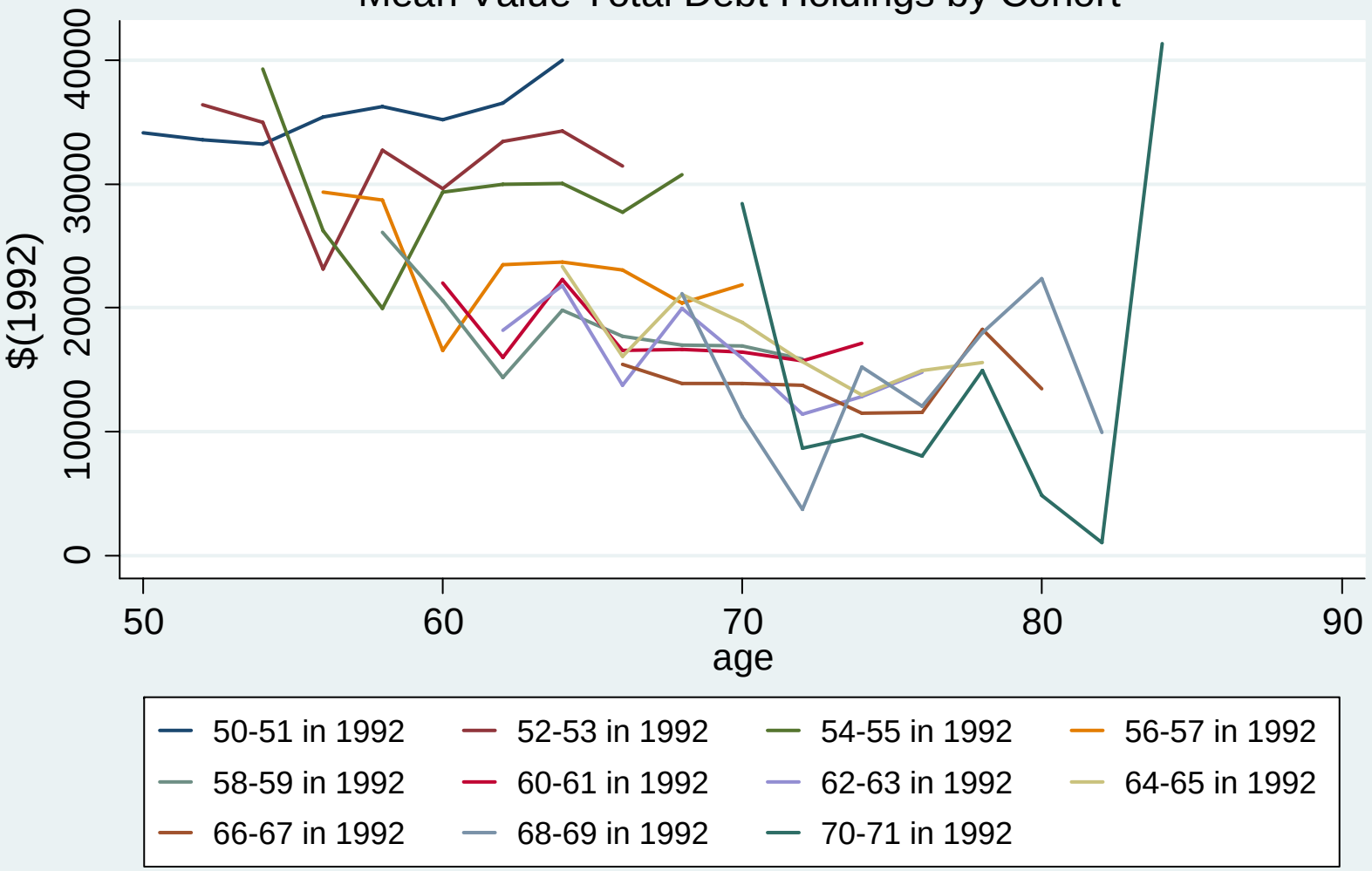

Figure 2

Incidence Total Debt Holdings by Cohort