Can Debt Affect Your Health?

Cross Country Evidence on the Debt-Health Nexus

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Abstract

We investigate the relationship between household debt and health outcomes for OECD countries over the period 1995 to 2012. Using a dataset of aggregated, standardized and objective measures of household debt and health outcomes, we estimate an instrumental variable (GMM) model in order to deal with endogeneity and reverse causality concerns between health and debt. We find that higher household debt is linked to poorer general health. The results are also significant in extreme cases where households are among the most financially distressed (over-indebted). We also find a link between debt maturity and health. Long-term household debt reduces life expectancy and increases premature mortality. The opposite holds for the relation between short and medium term debt and health. The results are robust after controlling for other socio-economic factors (including GDP per capita, government expenditure on health, percentage of rural population and alcohol consumption) that affect health.

JEL Classification: D12, D14, I12

Keywords: Debt, Endogeneity, Health, Generalized Method of Moments, Household debt, Indebtedness, OECD countries

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Abstract

We investigate the relationship between household debt and health outcomes for OECD countries over the period 1995 to 2012. Using a dataset of aggregated, standardized and objective measures of household debt and health outcomes, we estimate an instrumental variable (GMM) model in order to deal with endogeneity and reverse causality concerns between health and debt. We find that higher household debt is linked to poorer general health. The results are also significant in extreme cases where households are among the most financially distressed (over-indebted). We also find a link between debt maturity and health. Long-term household debt reduces life expectancy and increases premature mortality. The opposite holds for the relation between short and medium term debt and health. The results are robust after controlling for other socio-economic factors (including GDP per capita, government expenditure on health, percentage of rural population and alcohol consumption) that affect health.

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1. Introduction

Over the past decade household debt has risen to record levels in many OECD countries (Guiso & Sodini, 2013). Between 1995 and 2008, the real value of consumer debt expanded by approximately 150% in Europe. In the US, consumer debt grew by approximately 60% during the same period, albeit from a much higher base level (Chmelar, 2013). The increase in household debt is not limited to the US but it is common to most industrialized countries, even though variation in overall debt still exists.

The observed increase in debt could have both positive and negative influences on households. From a macroeconomic perspective, the provision of credit allows households to smooth consumption through fluctuations in income and general economic conditions. Given the uncertainties over the timing of future consumption, debt could improve welfare by allowing households to increase consumption, and thus stimulate aggregate demand leading to resultant increases in economic growth. Therefore, debt can promote consumption and reduce liquidity constraints facing households. However, highly leveraged households could become more vulnerable in terms of their capacity to service debt in the face of unexpected income or macroeconomic shocks. Furthermore, high levels of debt could expose households to liquidity and solvency problems as loans fall due for repayment (Guiso & Sodini, 2013; Jappelli & Pagano, 1989). This in turn could lead to a decline in consumption and reduce economic growth. Literature exploring the impact of debt on economic growth provides mixed results. Bacchetta and Gerlach (1997) and Cecchetti et al. (2011) show that household debt leads an increase in economic growth. Beck et al. (2012) find that in contrast to corporate credit, household debt is not positively associated with economic growth or reductions in income inequality. Beyond a given threshold household, corporate and government debt can retard economic growth and

reduce welfare. For further evidence on the relationship between debt, economic growth and macroeconomic stability, see Sutherland and Hoeller (2012).

In addition to the importance of debt for economic growth, debt could also be related to the general health of the population. Evidence suggests that as well as socio-economic determinants (such as education, income and wealth) household debt plays a role in influencing health outcomes (Drentea & Lavrakas, 2000; Jacoby, 2002). Debt can influence health in several ways. High debt repayments could be a source of anxiety leading to psychological distress and poor mental and physical health, which in turn may worsen financial welfare (Keese & Schmitz, 2012). Stress caused by debt could lead to an increase in unhealthy behaviours, such as smoking, consumption of alcohol and poor dietary habits (Bailis et al., 2001; Drentea & Lavrakas, 2000; Gathergood, 2012). Indebted households accrue debt to pay for basic necessities and are more likely to reduce spending on high quality goods and services including food and health care. Debt could reduce the availability of future resources for healthcare investments and lead to a vicious circle where greater debt can be both a cause and consequence of poor health (Jacoby, 2002). Following the foreclosure crisis in the US, Currie and Tekin (2011) find that foreclosure has diminishing effects on health.

Overall, prior literature provides useful evidence on the influence of household debt on health. However, empirical evidence is confined to single country settings, which rely on subjective measures of debt and health (drawn from survey evidence on self-reported health status and socio-economic characteristics). While such evidence provides valuable insights for policy makers in a given jurisdiction, it does not provide the necessary information to assess the impact of debt on health in a cross-country context. Consequently, it is difficult to identify empirical regularities across countries with respect to the debt-health nexus.

It is against this background we explore the relationship between debt and health from a macroeconomic perspective. In order to do so, we investigate the relationship between the overall level of household debt and health outcomes for a sample of 29 OECD countries over the period from 1995 to 2012. Specifically, we examine whether common patterns in household debt and health outcomes are present in macroeconomic cross-country data; and whether excessive levels of debt affect health.

Drawing on insights afforded by previous research, our measures of health outcomes include years of life expectancy at birth, life expectancy at age 65 and premature mortality (Kennelly et al., 2003; Or, 2000; Or et al., 2005). The use of these health indicators complements and augments previous research, which uses self-reported health conditions from surveys conducted in individual countries. The measures of debt used in this study serve as an indicator of the ability of households to meet future expenses or absorb financial shocks. We use an objective measure of household debt. Household debt refers exclusively to consumer credit. Consumer credit corresponds to the outstanding amounts of loans at the year-end granted by the resident Monetary Financial Institutions (MFIs sector for consumption purposes). Consumer credit includes loans related to credit cards as well as overdrafts. It excludes housing loans and other loans (such as those for business purposes).We use three measures of household debt and a set of indicators of debt maturity and over-indebtedness. The measures of household debt comprise: ratio of debt to gross disposable income; growth of debt to gross disposable income; and real growth rate of debt per capita. To the best of our knowledge, previous literature does not offer insights as to the role played by debt maturity on health. By examining aggregate level of household debt maturities using standardized country-level indicators, we also consider the role played by debt maturity on health. In the absence of previous empirical evidence, we contend

that households with greater access to short-term funds are able to respond quickly to unexpected health shocks and consequently enjoy better health. However, long-term debt could leave households vulnerable to future income shocks and put health at risk.

By way of preview, we find an inverse relationship between household debt and health. This result is robust with respect to different measures of debt. Over-indebted households show poorer health than lower-debt counterparts. Differences in health between these types of households increase when the level of debt increases. Our findings also suggest that debt maturity matters. Long-term debt can reduce life expectancy and increase premature mortality. The opposite appears to hold when considering short and medium-term debt. The results remain robust after dealing with the possible endogenous nature of household debt and controlling for traditional socio-economic factors that affect health.

Our work contributes to the established literature in a number of ways. First, we rely on cross-country data, which includes comparable objective measures of health status and household debt. As such, our findings identify empirical regularities across countries with respect to the relationship between debt and health. Second, the use of aggregate data allows us to compare our results with survey data based on self-reported health measures in particular countries. Third, our econometric approach allows us to deal with double causality issues when household debt or other covariates depend on health outcomes. Negative financial shocks can be harmful to health, especially if this leads to a reduction in economic resources that might otherwise be used to address future health problems. Given that debt can be both a cause and an effect of poor health outcomes, we use instrumental variable techniques to deal with this type of endogeneity problem where household debt or other covariates depend on health outcomes. Furthermore, the negative effect of debt on health is likely to impact on the capacity to generate

future income, which in turn could contribute to the deterioration in the financial resilience of households to respond to unexpected shocks.

Overall, this paper represents a first attempt to provide cross-country empirical evidence in relation to the link between debt and health. The findings of this study are of interest to government agencies tasked with the design and execution of policy initiatives that target health outcomes in conjunction with debt advice, and financial literacy programmes to help consumers better manage their debt and debt decisions. The rest of the paper proceeds as follows. Section 2 provides a review of salient literature. In Section 3, the empirical model and the data set used are discussed. Section 4 presents the results of the empirical analysis, while Section 5 concludes.

2. Literature review

Previous research suggests that unemployment, lack of education, low social class and income are associated with poor health (Arber et al., 2014; Braveman et al., 2011; Cutler et al., 2011). A small literature extends the aforementioned research to examine the relationship between health and debt. Münster et al. (2009) find that over-indebtedness in Germany is negatively associated with physical health. Evidence also suggests that debt can result in a decline in physical health due to socio-economic hardship and material deprivation (Cohen et al., 2007; Reading & Reynolds, 2001). Debt can also be a significant source of anxiety leading to psychological distress and poor mental and physical health (Berger et al., 2013; Drentea & Lavrakas, 2000; Matthews & Gallo, 2011).

Much of the research that has sought to establish a link between debt and health, however, relies on self-reported survey data (Or, 2000). The common use of subjective data in the analyses of household debt and health could pose difficulties in drawing cross-country comparisons and identifying empirical regularities across countries. Grafova (2007) uses US

survey data covering the period 1999-2003 to examine relationship between debt and unhealthy behaviour. Results suggest that there is positive association between unhealthy behaviours and debt. Bridges and Disney (2010) find a positive association between self-reported credit card debt and depression in the UK for the period of 1999-2005. Keese and Schmitz (2012) use national survey data from Germany between 1999- 2009 to analyse the association between household debt and different self-reported health outcomes. The authors find indebtedness impacts adversely on physical and mental health. Using UK household survey data from 1991-2008, Gathergood (2012) finds that adverse psychological effects of high debt results from the perceived social stigma associated with over-indebtedness. Sweet et al. (2013) investigate the relationship between self-reported debt and health using secondary data from 8,400 respondents in four national survey waves between 1994 and 2008 in the US. The authors find that high financial debt relative to available assets is associated with greater perceived stress and depression and poorer self-reported general health.

As discussed above, previous research suggests that debt can lead to changes in mental and physical health. However, a small number of papers have been concerned about the bias introduced by the potential reverse causation from health to debt (Gathergood, 2012). For example, an unexpected health shock might increase demand for debt in order to cover day-to-day expenses. Several studies have approached the problem of endogeneity due to possible double causality either through employing different sampling techniques or through modelling methodology. Keese and Schmitz (2012) address endogeneity problems (resulting from the idea that bad health causes debt) by using a subsample of individuals who have been working constantly between 1999 and 2009. In doing so, the authors exclude all those who possibly lost their job or left the labour market due to health problems at least once in the observation period

and might subsequently have problems to repay debt. Bridges and Disney (2010) use a bivariate probit model to investigate the relationship between health status and financial stress.

Based on the aforementioned insights, the rest of this paper uses standardised comparable macroeconomic data to investigate the relationship between household debt and health outcomes for a sample of 29 OECD. We rely on instrumental variable techniques to deal with potential reverse causality between health outcomes and household debt.

3. Data and Empirical Strategy

Data

Our data set comprises an unbalanced panel of OECD countries covering the period 1995-2012. The data used to construct the health related variables is collected from the World Development Indicators published by the World Bank. This source provides homogenous data for comparisons between countries. Appendix I provides a detailed description of the data, including definitions of health outcomes, debt indicators and control variables. Measures of health outcomes include years of life expectancy at birth, life expectancy at age 65, and premature mortality. These measures provide objective, relatively accurate and comparable figures across countries despite measurement problems in capturing general health status at macroeconomic level. Life expectancy at birth and age 65 provide relevant information of the two most vulnerable groups of the population. In addition, our indicator of premature mortality, also referred to as Potential Years of Life Lost (PYLL), is considered as a comparable measurement of health status in cross-country studies (Or, 2000). This indicator provides a weighed measure of premature mortality of deaths that are, a priori, preventable. Descriptive

statistics (shown in Table 1) suggest that the average life expectancy at birth is 77.82 years with standard deviation of 3.02. Life expectancy at 65 is slightly lower ranging from 73.09 and 74.79.

The data source of household debt is the Statistical Package on Lending to Households published by The European Credit Research Institute (ECRI). ECRI collects and standardizes data on the retail credit market based on monetary aggregates collected from national authorities, financial institutions and central banks. The standardization of these data in terms of definitions and aggregates facilitates comparisons over time and between countries as shown in previous studies (Jappelli et al., 2013; Kösters et al., 2004). Our key independent variables include four measures of household debt comprising: household debt as a percentage of gross household disposable income (GDI); growth rate of household debt; real growth of debt per capita; and debt maturity. Household debt as a percentage of GDI provides a proxy of financial leverage of households. The growth rate of this variable captures changes in the level of leverage year by year. In a similar way, real growth rate of debt per capita reflects the accumulation of debt. These measures are useful to provide evidence about how potential accumulated debt problems may cause health issues. By distinguishing between different terms of debt, we can assess the differential impact between short-term (< 1 year), medium-term (1-5 years) and long-term debt (> 5 years). This is particularly relevant since short-term debt is thought to have a greater effect on health compared to long-term debt (Drentea & Lavrakas, 2000). In the present study, data relating to debt maturities is only available for EU-27 countries.

Table 1 presents descriptive statistics of health outcomes, debt indicators and control variables used in the empirical analysis. The first group of variables in Table 1 presents the measures for health outcomes. Health status includes a number of indicators of mortality. The empirical analysis presented in this study uses life expectancy at birth as a pertinent summary

measure, but also for life expectancy at age 65. The average life expectancy at birth in our sample is 77.82 years (median value of 78.4 years). The average life expectancy at age 65 is 8.94 years (median value of 9 years). We also examine cross-country variations in health using the Potential Years of Life Lost (PYLL) as a summary measure of premature mortality. This provides an explicit way of weighting deaths occurring at younger ages, which are, a priori, preventable. Number of PYLL is expressed as a rate per 100,000 inhabitants. The average PYLL value in our sample is 4,280.3 (ranging from 3,304 in percentile 25^{th} to 4,770 in percentile 75^{th}).

Turning to our measures of household debt, we find that the average level of leverage to disposable income is 10.67% with values ranging from 6.2% in percentile 25^{th} to 14.01% in percentile 75^{th}. We also compute the growth rates of leverage to disposable income and debt per capita. On average, we observe positive growth rates in our sample. However, as might be expected, some fluctuations between positive and negative growth rates occur during the analysed period as described in the 25^{th} and 75^{th} percentile of the distribution. In terms of debt maturity, long-term debt represents an average of 38% of the total household debt, followed by medium-term (32.6%) and short-term debt (25.6%). Standard deviations for debt maturities range between 18.1% and 20.8%. This suggests that there is substantial variation across countries and years in our sample. Appendix II provide regional-level descriptive statistics for debt and health indicators. One-way ANOVA results suggest that there are significant differences on mean values for debt and health among countries and regions (results are available upon request).

Specific country conditions can affect the health status of the population. Control variables similar to those used in previous studies include: real GDP per capita; rural population as a percentage of total population; and government health expenditure as a percentage of GDP. The

GDP per capita variable is included to control for different levels of income across OECD countries (French, 2012). Our measure of rural population has been widely used in literature exploring environmental factors affecting health (Balia & Jones, 2008). Similarly, government health expenditure controls for differences in health care resourcing across countries (Kennelly et al., 2003). This measure provides an approximation of the health care input, which could be an important variable in determining health levels. Alcohol consumption is a well-known risk factor for health and is expected to have a negative effect on health outcomes (Or et al., 2005). To account for general consumption of alcoholic beverages this study uses litres consumed per head of population aged above 15 years old. Educational spending and tobacco consumption have been considered as determinants of health in previous studies (Or et al., 2005). However, these have been excluded as these are found to be highly correlated to GDP per capita and alcohol consumption in our data, respectively.

Table 2 presents a correlation matrix of the variables employed in the empirical analysis. The correlation between the covariates used is low, thus removing concerns regarding possible multi-collinearity.

Insert table 1 near here

Insert table 2 near here

Empirical Strategy

We adopt a parsimonious model consistent with previous literature where cross-country differences of health status depend on country-level variables and health behaviours (Jiménez-Rubio, 2011b; Kennelly et al., 2003; Or, 2000; Or et al., 2005). We expand the health production

functions developed in the previous literature by introducing different types of debt indicators. Our estimable model has the general form:

$$H_{it} = \alpha + \beta' DEBT_{it} + \delta' X_{it} + f_j + \varepsilon_{it} \quad (1)$$

where H is one of the three measures of health outcome: years of life expectancy at birth, life expectancy at age 65, and premature mortality. *DEBT* captures different measures of household debt (leverage to disposable income, growth rate of debt and maturity); X is a vector of control variables which affect health outcomes. f denotes regional fixed effects which capture unobserved geographical characteristics constant over time which could affect health. ε is a stochastic error term. α is a constant term. β and δ are the unknown coefficients to be estimated. The subscripts i, j and t refer to country, region (Asia Pacific, Australasia, Eastern Europe, North America and Western Europe) and time respectively.

We control for possible endogeneity that can arise due to double causality given that household debt, public health expenditure and alcohol consumption can be both a cause and an effect of poor health outcomes. Real GDP per capita is treated as exogenous on the grounds that current GDP per capita could be mainly affected by past and current economic conditions rather than projections of current life expectancy and premature mortality. Considering GDP per capita as exogenous variable in a health production function context is consistent with previous research in this area (Jiménez-Rubio, 2011a, b; Kennelly et al., 2003; Or et al., 2005). Poor health can induce households to take on additional debt and encourage unhealthy behaviours. Ultimately, a population in poor health can generate additional costs for healthcare. To address this potential endogeneity, we use the Generalised Methods of Moments estimator (GMM-IV)

which allows for heteroscedasticity of unknown form (Hansen, 1982). GMM does not require distributional assumptions on the error terms. It is also more efficient than 2SLS because it accounts for heteroscedasticity (Hall, 2005)

We conduct endogeneity tests under the null hypothesis that the specified endogenous regressors can actually be treated as exogenous, where the test statistic is distributed as x^2 with degrees of freedom equal to the number of regressors tested (Baum et al., 2007). Endogenous regressors are instrumented using total credit provided to non-financial corporations as a percentage of GDP, one-year lag of endogenous regressors along with the full set of exogenous variables. Valid instruments must be correlated with the endogenous variable; and uncorrelated with the error terms (i.e. the unobserved differences in health outcomes). A Hansen-Sargan test of instrument validity is conducted, and the rejection of the null hypothesis indicates the validity of the instrument set employed (Baum et al., 2007; Cameron & Trivedi, 2005).

4. Results

Table 3 presents the results of a regression analysis based on the estimation of health outcomes as specified in Equation (1) for two different health indicators: life expectancy at birth and life expectancy at 65. Table 4 reports an additional health indicator, premature mortality. In this case negative coefficients indicate an inverse relationship with mortality and hence a positive impact on health.

As discussed above, endogeneity can arise when causality is reversed, namely when household debt, public health expenditure, alcohol consumption depend on health outcomes. To address this, we use a two-stage efficient GMM estimator. All variables are in logarithmic form, and so regression coefficients are interpreted as elasticities.

Insert Table 3 near here

Insert Table 4 near here

For each health indicator, each column corresponds to a reduced equation where health is a function of different measures of household debt along with a set of control variables, comprising: real GDP per capita; geo-economic characteristics of the population (rural population); government expenditure on health; and unhealthy habits of the population (alcohol consumption).

A priori we expect that household debt is a significant determinant of health. Specifically, we expect a negative relationship between debt and the two measures of life expectancy, and a positive association between debt and premature mortality. Results in Table 3 (columns 1–3) show a negative and statistically significant effect of the debt-to-income ratio, growth rate of debt-to-income ratio and real growth rate of debt per capita on life expectancy at birth and life expectancy at 65. The higher estimated coefficients in the model for life expectancy at 65 suggest important adverse debt effects on older individuals. In terms of maturities (column 4, Table 3) the estimated coefficient for long-term debt is negative and statistically significant. The respective coefficients imply a decrease in years of life expectancy at birth and at 65 of approximately 0.12 and 0.25 percentage points respectively with a ten percentage point increase in long-term debt.

Similar results hold for premature mortality in Table 4. These results could be consistent with the view that accumulation of debt is most likely to have a detrimental influence on health due to increased psychological distress. Real growth rate is included to capture the accumulation of debt. This variable is significant in all regressions.

When compared to results in Table 3, both short and medium term debt are also statistically significant. However, a negative sign suggests that higher levels of short and medium term debt reduce premature mortality levels. This could be because households with greater access to short-term funds are able to respond quickly to unexpected health shocks.

Control variables all exhibit statistical significance at either the 1% or 5% level. Control variable coefficients are positive for life expectancy at birth and 65. This suggests that higher levels of real GDP per capita, presence of rural population and government expenditure on health influence positively the aggregate level of health in the observed countries. This relationship is mirrored in Table 4, where these controls are shown to have a negative effect on potential years of life lost. Furthermore, according to the results, alcohol consumption reduces life expectancy, and has a positive effect on premature mortality. These results are consistent with previous literature.

To check the robustness of our results we vary the definition of debt. We test whether excessive levels of debt lead to deterioration of health using different levels of over-indebtedness as independent variables: moderate (75th percentile), medium (85th percentile) and high (95th percentile). Each indicator takes value one if leverage to disposable income ratio of country *i* in year *t* is above 75th, 85th and 95th percentile of the sample distribution in year *t* and zero otherwise. These indicators capture extreme cases where households have a high probability of being financially distressed. Hence, the marginal effect of over-indebtedness is equal to the change in debt from low to high debt levels. Results (presented in Table 5) suggest a significant inverse relationship between the level of excessive debt and life expectancy, and a positive relationship with premature mortality. Moreover, the size of the coefficients indicates that the effect of over-indebtedness on health is increasing in severity with higher levels of debt. For

example, being highly over-indebted (95th percentile) is associated with 1.3 percent less years of life expectancy at birth when compared to non-highly over-indebted individuals. Similar results hold for years of life expectancy at age 65. Likewise, the higher the debt burden, the more likely the premature mortality. The size of the coefficient for the latter relationship is particularly high. The movement from low/medium levels of debt to high levels of debt produces a 27.4 percent increase in premature mortality. Overall, the results of this robustness test provide support for the main finding of this study, which is that debt has an adverse influence on health.

Finally, we check for the robustness of the results by considering the effect of the recent financial crisis in health outcomes. We re-estimate all models including an indicator variable for the financial crisis which is equal to one after 2008 and zero otherwise. Our results remain quantitatively and qualitatively unchanged. In fact, the coefficient for financial crisis is statistically insignificant across all regressions. (The results of robustness checks using the financial crisis dummy are not presented here but are available upon request). This also is consistent with recent findings of a non-relationship between economic decline and health (Catalano et al., 2011).

5. Conclusion

The level of household debt has important implications for the economic growth. Recently, a small literature has established an empirical association between household debt and health. This evidence is confined to single country settings and is reliant on subjective measures of both debt and health. Using data on both household debt and health for OECD countries during the period 1995-2012, this study moves beyond traditional socio-economic determinants of health to examine the relationship between household debt and health outcomes. Instrumental variable models are estimated to control for the potential double causality between debt and health.

The results of the empirical analysis suggest a negative and significant association between the level of household debt and health across countries. In terms of debt maturity, long-term debt has a negative effect on health outcomes. However, short term and medium term debt appear to contribute to reductions in premature mortality. Furthermore, high levels of over-indebtedness result in larger negative health outcomes when compared with low-debt counterparts. Real GDP per capita, the presence of rural population and government expenditure on health also exert a positive impact on health.

Overall, the results of this study suggest that high-debt households have lower life expectancy and higher levels of premature mortality (controlling for differences in socio-economic characteristics). A vicious debt-health cycle may prevail where poor health could reduce the capacity to work and generate future income, which in turn leads to an increased debt burden as households cannot afford to meet financial commitments. This affects health and quality of life, and may increase income and health inequalities. Policy initiatives that bring together health care professionals, debt advisers and debt collection agencies to support financially distressed households may mitigate some of these aforementioned effects.

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Table 1. Descriptive Statistics

	Variable Code	Mean	Standard deviation	P(25)	P(50)	P(75)
Health outcomes	Years of life expectancy at birth	77.82	3.02	76.43	78.42	79.98
	Years of life expectancy at age 65	8.94	0.85	8.41	9.03	9.57
	Potential years of life lost (rate for 100 000 population)	4280.36	1499.36	3304.6	3831.6	4770.8
Debt Indicators	Debt to disposable income (%)	10.67	6.2	6.12	9.92	14.01
	Growth rate of debt to disposable income (%)	5.63	15.81	-2.84	1.77	9.16
	Real growth rate of debt per capita (%)	7.37	18.3	-3.42	3.34	13.58
	Short-term debt (%)	25.16	20.83	11.98	20.65	29.82
	Medium-term debt (%)	32.61	18.11	19.16	27.89	45.07
	Long-term debt (%)	38.28	19.82	21.82	37.66	55.64
Control Variables	Real GDP per capita (thousand US dollars)	30.44	17.49	16.47	30.05	36.58
	Rural population (%)	25.79	11.53	16.87	24.91	34.19
	Government expenditure on health (%)	6.35	1.33	5.37	6.2	7.34
	Alcohol consumption (Litres per capita)	10.07	2.97	8.35	10.2	12.1

Table 2. Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Debt to disposable income	**(1)**	1									
Growth rate of debt to disposable income	**(2)**	-0.193*	1								
Real growth rate of debt per capita	**(3)**	-0.224*	0.940*	1							
Short-term debt	**(4)**	0.0191	0.006	0.005	1						
Medium-term debt	**(5)**	-0.403*	0.354*	0.371*	-0.476*	1					
Long-term debt	**(6)**	0.435*	-0.333*	-0.339*	-0.428*	-0.402*	1				
GDP per capita	**(7)**	0.197*	-0.347*	-0.293*	0.0452	0.0277	-0.00765	1			
Rural population	**(8)**	-0.0459	0.226*	0.203*	-0.0758	-0.0227	0.0530	-0.521*	1		
Government expenditure on health	**(9)**	0.257*	-0.383*	-0.368*	0.0448	-0.278*	0.284*	0.397*	-0.440*	1	
Alcohol consumption	**(10)**	0.0864	0.0833	0.0271	-0.151*	0.290*	0.296*	-0.0338	0.125*	0.143*	1

Note: This table reports cross-correlations of the variables employed in the study. Appendix I for variable definition. *p<0.05

Table 3: IV-GMM regressions of life expectancy on household debt indicators

	Dependent variable							
	Log (Years of life expectancy at birth)				Log (Years of life expectancy at age 65)			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Explanatory variables								
Log (debt to disposable income)	-0.006** (-4.67)				-0.012** (-3.45)			
Growth rate of debt to disposable income		-0.045** (-3.76)				-0.099** (-2.70)		
Real growth rate of debt per capita			-0.046** (-4.03)				-0.097** (-2.72)	
Log (Short-term debt)				0.001 (0.05)				0.003 (0.51)
Log (Medium-term debt)				-0.001 (-0.17)				0.009 (1.50)
Log (Long-term debt)				-0.012** (-7.37)				-0.025** (-4.64)
Control variables								
Log (GDP per capita)	0.016** (4.65)	0.017** (4.99)	0.014** (3.37)	0.031** (6.73)	0.023* (2.31)	0.030** (3.07)	0.075** (10.37)	0.082** (10.17)
Log (Rural population)	0.007** (4.84)	0.007** (5.19)	0.005** (3.31)	0.026** (5.52)	0.013** (3.40)	0.013** (3.52)	0.015** (3.47)	0.064** (5.66)
Log (Government expenditure on health)	0.025** (4.47)	0.018** (2.88)	0.016* (2.10)	0.068** (7.81)	0.043** (2.82)	0.021 (1.21)	0.088** (4.23)	0.190** (9.28)
Log (Alcohol consumption)	-0.033** (-7.33)	-0.041** (-9.12)	-0.005 (-0.61)	0.001 (0.15)	-0.029* (-2.31)	-0.041** (-3.14)	-0.002 (-0.12)	0.016 (0.95)
Constant	-0.394 (-0.90)	0.808 (1.71)	1.097 (1.81)	-0.182 (-0.26)	-15.327** (-10.55)	-13.049** (-8.86)	-5.485** (-3.89)	-10.569** (-5.11)
Observations	276	257	271	174	276	257	290	157
Adjusted R-squared	0.83	0.82	0.65	0.75	0.76	0.75	0.60	0.65
Wald test	208.09	164.76	93.47	54.40	191.43	182.04	85.35	81.04
[p-value]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Endogeneity	6.72	6.39	8.92	6.58	9.37	6.17	6.21	10.30
[p-value]	0.08	0.09	0.03	0.25	0.02	0.10	0.10	0.07
Hansen-Sargan	12.10	9.45	18.58	16.52	12.10	10.86	21.51	18.98
[p-value]	0.74	0.85	0.23	0.42	0.74	0.76	0.12	0.59
Regional fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table shows two-stage IV- GMM regressions. Z-statistics are reported in parenthesis. The Wald statistic tests the relevance of the variables in the model. Rejection of the null hypothesis implies explanatory variables matter. Endogeneity tests of the endogenous regressors are implemented under the null hypothesis that the specified regressors can be treated as exogenous. Endogenous regressors (household debt indicators, public health expenditure, alcohol consumption) are instrumented using one-year lags as instrument. We also include as external instruments credit to non-financial corporations as a percentage of GDP along with the exogenous variables. The Hansen-Sargan's statistic tests the validity of the instruments used, and rejection implies that the instruments are not valid. All variables have been winsorized at 1% from the top and bottom tails. ** p<0.01, * p<0.05.

Table 4: IV-GMM regressions of premature mortality on household debt indicators

	Dependent variable			
	Log (Potential years of life lost (PYLL))			
	1	**2**	**3**	**4**
Explanatory variables				
Log (debt to disposable income)	0.049** (4.44)			
Growth rate of debt to disposable income		0.253* (2.42)		
Real growth rate of debt per capita			0.191* (2.07)	
Log (Short-term debt)				-0.026* (-2.11)
Log (Medium-term debt)				-0.034* (-2.33)
Log (Long-term debt)				0.052** (4.89)
Control variables				
Log (GDP per capita)	-0.252** (-8.77)	-0.264** (-8.60)	-0.260** (-9.00)	-0.431** (-16.16)
Log (Rural population)	-0.095** (-7.04)	-0.094** (-7.04)	-0.092** (-7.11)	-0.201** (-7.22)
Log (Government expenditure on health)	-0.260** (-5.10)	-0.217** (-3.77)	-0.210** (-3.88)	-0.435** (-6.88)
Log (Alcohol consumption)	0.453** (10.21)	0.517** (11.91)	0.520** (12.91)	0.656** (10.89)
Constant	39.354** (11.01)	29.312** (7.12)	31.567** (6.17)	23.423** (5.34)
Observations	256	238	266	160
R-squared	0.84	0.83	0.77	0.81
F-test	339.05	280.49	105.86	62.83
[p-value]	0.00	0.00	0.00	0.00
Endogeneity	4.70	3.19	5.11	7.59
[p-value]	0.20	0.36	0.16	0.18
Hansen-Sargan	12.40	10.14	12.43	23.22
[p-value]	0.72	0.81	0.65	0.11
Regional fixed effects	YES	YES	YES	YES
Time trend	YES	YES	YES	YES

Note: This table shows two-stage IV- GMM regressions. Z-statistics are reported in parenthesis. The Wald statistic tests the relevance of the variables in the model. Rejection of the null hypothesis implies explanatory variables matter. Endogeneity tests of the endogenous regressors are implemented under the null hypothesis that the specified regressors can be treated as exogenous. Endogenous regressors (household debt indicators, public health expenditure, alcohol consumption) are instrumented using one-year lags as instrument. We also include as external instruments credit to non-financial corporations as a percentage of GDP along with the exogenous variables. The Hansen-Sargan's statistic tests the validity of the instruments used, and rejection implies that the instruments are not valid. All variables have been winsorized at 1% from the top and bottom tails. ** $p<0.01$, * $p<0.05$.

Table 5: IV-GMM regressions of Health Outcomes on Over-indebtedness indicators

	Dependent variable								
	Log (Years of life expectancy at birth)			Log (Years of life expectancy at age 65)			Log (Potential years of life lost)		
	1	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Over-indebtedness indicators									
Moderate (75th percentile)	-0.006** (-2.87)			-0.019** (-2.67)			0.058** (3.21)		
Medium (85th percentile)		-0.010** (-4.84)			-0.025** (-2.79)			0.082** (3.48)	
High (95th percentile)			-0.013** (-3.47)			-0.100** (-2.86)			0.274** (2.69)
Control variables									
Log (GDP per capita)	0.019** (5.56)	0.020** (6.37)	0.021** (6.28)	0.026** (2.62)	0.029** (3.11)	0.041** (3.97)	-0.274** (-10.10)	-0.281** (-10.73)	-0.298** (-11.23)
Log (Rural population)	0.008** (5.35)	0.009** (5.72)	0.008** (5.28)	0.016** (3.87)	0.017** (3.91)	0.016** (3.89)	-0.106** (-7.90)	-0.110** (-7.79)	-0.100** (-6.98)
Log (Government expenditure on health)	0.027** (4.52)	0.021** (3.63)	0.020** (3.27)	0.051** (3.26)	0.035* (2.33)	0.013 (0.69)	-0.261** (-4.93)	-0.223** (-4.19)	-0.172** (-2.97)
Log (Alcohol consumption)	-0.033** (-7.25)	-0.035** (-7.96)	-0.037** (-8.57)	-0.022 (-1.67)	-0.028* (-2.34)	-0.026 (-1.93)	0.444** (9.10)	0.466** (10.44)	0.465** (10.64)
Constant	0.274 (0.68)	0.051 (0.12)	0.161 (0.39)	-13.7** (-10.80)	-14.3** (-11.42)	-14.2** (-10.12)	35.079** (9.31)	37.341** (9.72)	37.005** (9.41)
Observations	276	276	276	276	276	276	256	256	256
Adjusted R-squared	0.83	0.83	0.83	0.76	0.77	0.72	0.83	0.83	0.80
Wald test	179.77	168.86	153.06	192.39	197.74	163.91	285.10	279.73	137.92
[p-value]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Endogeneity	2.30	2.29	3.43	3.63	3.97	10.00	2.23	3.94	14.81
[p-value]	0.51	0.51	0.33	0.30	0.26	0.02	0.53	0.27	0.00
Hansen-Sargan	14.03	13.62	11.62	12.52	14.25	8.10	12.58	13.47	8.19
[p-value]	0.60	0.63	0.77	0.71	0.65	0.96	0.70	0.70	0.96
Regional fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table shows two-stage IV- GMM regressions. Z-statistics are reported in parenthesis. The Wald statistic tests the relevance of the variables in the model. Rejection of the null hypothesis implies explanatory variables matter. Endogeneity tests of the endogenous regressors are implemented under the null hypothesis that the specified regressors can be treated as exogenous. Endogenous regressors (household debt indicators, public health expenditure, alcohol consumption) are instrumented using one-year lags as instrument. We also include as external instruments credit to non-financial corporations as a percentage of GDP along with the exogenous variables. The Hansen-Sargan's statistic tests the validity of the instruments used, and rejection implies that the instruments are not valid. All variables have been winsorized at 1% from the top and bottom tails. ** p<0.01, * p<0.05.

Appendix I. Variable definitions

Variable	Scale	Definition	Sources
Health Outcomes			
Years of life expectancy at birth	Years	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.	World Development Indicators
Life expectancy at age 65	Years	Life expectancy at age 65 measures the number of additional years of life a person at age 65 will live, on average (given current patterns of mortality)	OECD Indicators
Premature mortality	Rate for 100 000 population (aged 0-69 years old)	Potential years of life lost (PYLL) is a summary measure of premature mortality (all causes of death) which provides an explicit way of weighting deaths occurring at younger ages, which are, a priori, preventable.	OECD Indicators
Household debt indicators			
Debt to gross disposable income	% of gross disposable income	Consumer credit as a percentage of the gross disposable income of households.	ECRI database
Growth rate of debt to disposable income	% growth rate	Growth rates of consumer credit as a percentage of disposable income of households (year by year).	
Real growth rate of debt per capita	% growth rate	Real growth rates of consumer credit per capita (year by year).	
Short-term debt	% of total consumer credit	Consumer credit with a maturity of ≤ 1 year.	
Medium-term debt	% of total consumer credit	Consumer credit with a maturity of 1 - 5 years.	
Long-term debt	% of total consumer credit	Consumer credit with a maturity of > 5 years.	
Over-indebtedness	Dummy	Takes value one if leverage to disposable income ratio of country i in year t is above 75^{th}, 85^{th} and 95^{th} percentile of the sample distribution in year t, and 0 otherwise.	
Control variables			
GDP per capita	Per capita	Real GDP per capita (deflated using GDP deflator: 1995=100).	ECRI database and World Bank
Rural Population	% of total population	It is the difference between the total population and the urban population.	World Development Indicators
Government expenditure on health	% of GDP	Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds.	
Alcohol consumption	Litres per head of population aged >15	Consumption of alcoholic beverages.	OECD Indicators

Appendix II. Household's health and debt indicators in OECD countries

Average values and standard errors in parenthesis for the period 1995-2012

	Years of life expectancy at birth	Years of life expectancy at age 65	Potential years of life lost (per 100 000 population)	Debt to disposable income (%)	Growth rate of debt to disposable income (%)	Real growth rate of debt per capita (%)	Short-term debt (%)	Medium-term debt (%)	Long-term debt (%)
Asia Pacific	81.54 (0.99)	10.19 (0.4)	2999.94 (260.42)	0.04 (0.01)	-0.04 (0.04)	-0.03 (0.14)			
Australasia	80.07 (1.34)	9.6 (0.49)	3373.28 (457.07)	0.17 (0.03)	0.04 (0.04)	0.06 (0.13)			
Eastern Europe	74.09 (2.37)	7.95 (0.54)	6362.5 (1687.25)	0.08 (0.06)	0.17 (0.24)	0.2 (0.28)	0.12 (0.08)	0.4 (0.22)	0.48 (0.22)
North America	78.43 (1.58)	9.22 (0.38)	4469.31 (873.95)	0.23 (0.01)	0.01 (0.03)	0.05 (0.13)			
Western Europe	78.62 (2.34)	9.12 (0.72)	3671.14 (667.63)	0.11 (0.05)	0.03 (0.12)	0.05 (0.14)	0.3 (0.22)	0.3 (0.16)	0.35 (0.18)