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The Impact of Household Overindebtedness on Physical and Mental Health

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Abstract

We analyse data collected from a survey of Northern Irish households experiencing varying degrees of financial hardship and examine whether debt affects physical health, mental health and health-related behaviours. Our results indicate that neither the size of the debt, the type of debt nor the number of different lenders used affect health. Instead, we find that the subjective experience of feeling financially stressed has a robust relationship with most aspects of health including ability to self-care, problems performing usual activities, pain problems and psychological health. Additionally, we find that the adverse effect of financial stress on health is mediated through worse diets, lower levels of physical activity and increased consumption of cigarettes and drugs. This research is timely as cuts to social care spending in the UK government are already exacerbating indebtedness in low-income households and putting strain on the healthcare system.

Keywords: Over-indebtedness Health.

1. Introduction

Levels of household debt in industrialized countries have sharply increased in recent years. In the UK, for example, household debt was 117% of GDP in 2000 and, by 2009, had risen to 180% (Guiso and Sodini, 2013). The current UK government's austerity program has thus far caused social care spending to fall by 14% in the most deprived communities with cuts at least as big as those that have already happened promised in the next parliament (Hastings et al., 2015). High levels of household debt lead to poor mental health but the implications of household over-indebtedness for physical health have been less studied and are less well understood. In this paper, we analyse data collected from a survey of Northern Irish households experiencing varying degrees of financial hardship and discuss whether debt affects physical health, mental health and health-related behaviours.

The focus of the literature connecting debt and health primarily focuses on mental health. Although anecdotal evidence indicates a link between physical health and debt there has been very little research in this area especially at household level. The idea that macroeconomic conditions could influence health was first introduced by Ruhm (1996). A number of more recent studies have shown that, at country-level, the recent financial crisis has caused a decline in health status (e.g., Clayton et al., 2015). There have been fewer studies on the effect of household debt on health. In an important early study, Drentea and Lavrakas (2000) show the influence of credit card debt on physical impairment and self-reported health in a telephone survey of Ohio residents. Using a simple health measure, Lenton and Mosley (2008) estimate a model which accounts for reverse causation between debt and health using the UK Families and Children survey. More recently, Sweet et al. (2013) show that reporting high financial debt is related to worse self-reported general health and higher diastolic blood pressure in a study of US young adults. Keese and Schmitz (2014) find an association between household indebtedness and health satisfaction but not with obesity after controlling for unobserved heterogeneity using data from the German Socio-Economic Panel. A common shortcoming in this literature is a lack of consideration of the potential

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endogeneity of debt. Also, the range of debt information and health information is limited because studies have not been designed with both these research areas in mind. Researchers are therefore unable to consider variation of the impact of debt on health by type of debt or to consider the various channels by which debt can affect health.

In our study, we contribute to this sparse literature by using a more sophisticated measure of health - the EQ-5D health questionnaire. This instrument has been recommended for use in the economic evaluation of health care interventions by reimbursement authorities and academic bodies worldwide due to its simplicity and reliability. In addition, we analyse the relationship between debt and health behaviours in order to understand the channels by which indebtedness affects health. We account for endogeneity by developing a model of the links between debt and health based on a review of the recent literature. We use both objective and subjective measures of debt as well as a number of measures of the type of debt. Our sample focuses on a financially vulnerable section of the population for whom overindebtedness is likely to have a negative impact on their mental and physical health whereas national studies may contain only a small proportion in poor financial, physical and mental health. While this study focuses only on members of NI credit unions in debt arrears, these institutions work with over 100 million members in financially vulnerable communities in 79 countries worldwide.

Our results indicate that neither the size of the debt, the type of debt nor the number of different lenders used affect health whereas the subjective experience of feeling financially stressed has a robust relationship with most aspects of health. In particular, financial stress negatively affects self-care problems, problems with performing usual activities, experiencing pain and feeling anxious or depressed. The adverse effect of financial stress on health is mediated through worse diets and lower levels of physical activity. Those experiencing financial hardship are also seen to reduce consumption of alcohol and fast-food but increase consumption of more addictive goods (cigarettes and drugs). We also find that the financially-stressed are more likely to visit a GP or healthcare professional confirming findings from surveys of

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GPs who say that debt is increasing their workload (Iacobucci, 2014). The implication is therefore that household debt has a wider social cost hitherto unrecognised by policy-makers.

The paper is structured as follows : Section 2 outlines the conceptual model and modelling strategy ; Section 3 describes the data and provides some descriptive statistics; Section 4 reports analyses of the links between debt and health, further broken by dimensions of health with an additional investigation of the pathways by which these links could occur ; the last section concludes.

2. The Model

In this section, we develop the conceptual model based on a review of recent literature and use this model as a basis for developing relationships between debt and health that we can estimate.

2.1. Conceptual model

Following Lenton and Mosley (2008), figure 1 outlines the relationships between debt and health in a cycle of causation from debt to health and from health to debt. We start our explanation on the right-hand side of the figure where *health* impacts on *labour market status* by reducing an unhealthy individual's ability to perform the tasks and responsibilities of particular jobs and/or reducing the number of hours that they can supply in employment thus adversely impacting on household income.

A reduction in household income has consequences for the ability to service existing *debt* and may also cause further indebtedness by borrowing to make ends meet. There are a range of other factors unrelated to health which also cause household debt. *Lifecycle planning* allows households to plan consumption based on how much they expect to earn over their lifetimes and households will therefore enter debt during their early years knowing that they will have the resources to repay these loans later when incomes are higher (Ando and

Modigliani, 1963). However, unexpected negative household *financial shocks* such as marital breakdown or withdrawal of welfare benefits can force households into over-indebtedness. Individual *personality traits* may also lead to financial hardship. A lack of confidence dealing with financial matters or a lack of financial literacy is associated with higher debt burdens, incurring greater fees, and defaults and delinquency (Disney and Gathergood, 2013). Materialistic individuals are more prone to compulsive spending (Garðarsdóttir and Dittmar, 2012) and poor money management skills lead to inattentiveness and poor financial decision-making (French and McKillop, 2014).

We do not have a direct link from *debt* to *health* as we find no evidence for such a link in this study in agreement with a number of other authors (e.g. Bridges and Disney, 2010; Arber et al., 2014). Indeed, it is not clear as to what the hypothesised channels of causation are in those studies where such a link has been identified. In a systematic review of the available literature, Turunen and Hiilamo (2014) conclude that the causal link between indebtedness and health runs through a emotional response to financial difficulties of shame, failure, worry and concern. On the left-hand side of the figure, *debt* causes *financial stress* and this effect is mitigated by an individual's *constitutional factors* (e.g. optimism, resilience) and the degree to which they can draw on the *social capital* of family and friends. All individuals in our study will have access to the same sources of debt advice through the credit control function of the credit union and through community advice centres and hence the availability of debt advice does not represent a source of variation for the degree to which individuals are stressed by their financial situation.

At the bottom of the figure, the last link in our chain of causation is from *financial stress* to *health*. We control for income in our analysis so this connection is independent of the effect of reduced income on the reduced consumption of health-enhancing goods (e.g. medication) and services (e.g. healthcare). The link between financial health and psychological health is well-documented. Theory explaining why financial stress should also affect physical health has recently been forthcoming. The literature describes how financial worries con-

sume mental resources preventing rational decision-making and depleting limited resources of self-control (Mani et al., 2013; Vohs, 2013; Haushofer and Fehr, 2014). In an experiment, artificially elevating cortisol levels in participants caused an increase in temporal discounting (Cornelisse et al., 2013). Nelson et al. (2008) find that the financially-stressed more readily indulge in impulsive behaviours such as overeating unhealthy foods, excessive consumption of drugs and alcohol, sedentary behaviour and physical fighting.

The epidemiological literature suggests there may be additional biological pathways whereby debt influences health. Economic difficulties have been associated with a higher incidence of coronary events in the famous Whitehall study of health inequalities (Ferrie et al., 2005) and, in particular, financial strain has been observed to elevate triglyceride levels, a risk factor for heart disease, independently of changes in health behaviours or poor mental health (Georgiades et al., 2009). Havlik et al. (1992) found that melanoma patients were more likely to have experienced a major financial crisis in the five years before clinical presentation than a control group perhaps reflecting greater susceptibility to this illness due to stress. Ochsmann et al. (2009) report a higher incidence of back pain among those who approached debt counselling agencies although the authors do not make it clear why this should be the case.

[Insert Figure 1 near here]

2.2. Modelling strategy

To estimate the degree of association between debt and health, we begin with a simple model assuming that debt exogenously influences health :

$$h_j = \beta' X_j + \gamma d_j + \epsilon_j \qquad (1)$$

where h_j is a continuous measure of health for individual j, X_j is a vector of exogenous control variables and d_j is a measure of debt and ϵ_j is a random error term. Our exogenous

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control variables are household demographic variables (age, gender, female, respondent has partner, homeowner, household income and the number of children under five), educational qualifications and employment status.

However, debt may be endogenous in this relationship i.e. d_j is correlated with ϵ_j. This may occur for two reasons. Firstly, in addition to debt causing health problems, poor health may also cause debt problems. Balmer et al. (2006) report that long-term illness or disability was the strongest predictor of debt problems in their analysis. Healthcare costs due to serious medical conditions may drive patients into bankruptcy (Himmelstein et al., 2009). Houle and Keene (2014) find that illness increases the risk of mortgage default and foreclosure. Another form of reverse causation which arises for subjective reports of financial distress is discussed by Bridges and Disney (2010). They focused on mental health and argue that those suffering from poor mental health will be more inclined to see a given set of financial circumstances in an adverse light. The same argument could also apply to reports of physical health where, for example, a mentally draining illness such as back pain might lead the sufferer to negatively view their financial situation.

Allowing for the potential endogeneity of debt results in the following model :

$$h_j = \beta' X_j + \gamma d_j + \epsilon_j \tag{2}$$
$$d_j^* = \delta' W_j + u_j$$

and the binary variable d_j is generated by the unobservable latent variable d_j^* according to

$$d_j = \begin{cases} 1, & \text{if } d_j^* > 0 \\ 0, & \text{otherwise} \end{cases}$$

where the error terms ϵ_j and u_j are bivariate normal with mean zero and covariance

matrix

$$\begin{pmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{pmatrix}$$

Consistent estimation of parameters in this model can be achieved by two-stage least squares (2SLS) under conventional instrumental variables assumptions. In our estimation, limited information maximum likelihood (LIML) is preferred as it is more robust to weak instruments (Hahn et al., 2004). If we additionally make some general assumptions including that the functional form of the second equation in (2) is known (e.g. probit) and the first equation has homoscedastic errors then a more efficient IV estimator is available (Wooldridge, 2002). An alternative approach based on maximum likelihood estimation is provided by Maddala (1986) which while more efficient may potentially be less robust to misspecification (Wooldridge, 2007).

If the health variable h_j is also binary, 2SLS is inappropriate but consistent estimates can be achieved by a LIML approach (Roodman, 2011). The model becomes :

$$h_j^* = \beta' X_j + \gamma d_j + \epsilon_j \tag{3}$$
$$d_j^* = \delta' W_j + u_j$$

and the error terms ϵ_j and u_j are bivariate normal with mean zero as before but with σ normalized to 1 in the covariance matrix for identification :

$$\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$$

3. Data

3.1. Survey and Data collection

Five Northern Irish credit unions located in Greater Belfast and Newry, Co. Down participated in our study. The common bonds for these credit unions cover the Antrim Road, Shankill Road and Markets areas of Belfast which were deeply affected by the recent period of civil war known locally as 'the Troubles' and are now among the most economically and health deprived areas of NI (NISRA, 2010). Credit unions in Northern Ireland have historically been very successful and play a very significant role in the financial sector here. In 2011, there were 181 credit unions in Northern Ireland and 26% of the Northern Irish population were members of a credit union (McKillop and Wilson, 2011).

Management in these five credit unions identified 1,091 of their members with either loans in arrears for greater than 9 weeks or loans that had been rescheduled. They wrote to these members explaining the study and highlighting that they had been chosen for interview on the basis of their arrears position. The rationale for this approach was to make respondents aware that the interviewers would know they were in debt and hence they would be less inclined to underreport the level and extent of their debts as in other studies (Zinman, 2009; Karlan and Zinman, 2008). They were also offered the opportunity at this stage to contact the credit union to opt out (25 declined to participate). Only one participant per household was interviewed. The survey was carried out from January to April 2014 by a local market research company until the sampling frame was exhausted resulting in 499 completed surveys giving a response rate of 47%. The survey was carried out face-to-face and lasted approximately one hour. The questionnaire consisted of modules on household demographics, employment, income and benefits, debt, expenditure, savings and assets, financial literacy and financial characteristics as well as a number of health-related questions.

Our first debt measure was formed by summing responses to 'How much do you currently owe...' on loans from bank/building society, credit union, internet money lender, high street

loan shop, home collection loan agency, unauthorised money lender, friend/relative, employer and other (e.g. social fund, student loan). Bank overdrafts, credit card commitments as well as arrears on household bills (rent, electricity, fuel, rates and other utilities) were added to this total. The respondent was also instructed to consider partner's debt if not already included. The log of the ratio of this measure to household income is our unsecured debt variable (UNSECURED DEBT). To construct our measure of secured debt, we first calculate mortgage debt from questions on total household expenditure and the percentage of this budget spent on mortgages. This figure is then annualised and multiplied by the number of years left on the mortgage. Any outstanding car loans are also added to this total and the log of the ratio of this total to household income is our secured debt variable (SECURED DEBT).

We also collected information on subjective financial well-being. Respondents are asked 'Thinking back over the past 12 months, how often would you say you have had trouble with debts that you found hard to repay...'. There are four possible answers to this question and we classify those who report trouble 'Almost all the time' or 'Quite often' as having persistent debt troubles (DEBT TROUBLE). The next question asks 'How often would you say you have money over at the end of the week, or end of the month if you budget by month? Would you say it was...'. There were six possible answers and we classify households with money over 'Hardly ever' or 'Never' as having budget difficulties (NO MONEY OVER). Our last question on financial stress is 'Taking everything together, which of these phrases best describes how you are managing financially these days?'. Households with 'some financial difficulties' or 'in deep financial trouble' were deemed to be not managing financially (NOT MANAGING). We regard individuals as being in financial stress if they have persistent debt troubles or budget difficulties or are not managing financially (FINANCIAL STRESS).

Our main measures of health are responses to questions on five dimensions of health from the EQ-5D questionnaire (The EuroQol Group, 1990). Respondents state if they have (1) no problems, (2) some problems, or (3) severe problems with their mobility, self-care, ability

to perform usual activities, pain/discomfort, and anxiety/depression. Each respondent then has one of 243 possible health states e.g. 11111, 32132. These were then transformed to a quality-of-life scale using time-trade-off data from a nationally representative UK health valuation study (Dolan et al., 1996; Dolan, 1997). Respondents were asked how many years x of perfect health were equivalent to 10 years in the poorer health state. For example, $x = 1$ indicated a very poor health state as only one year in perfect health equals 10 years in this state. The tariff is expressed as a fraction $x/10$ with death and full health assigned scores of 0 and 1 respectively. States worse than death are assigned negative scores bounded by -1.

A number of additional variables provide us with suitable instruments in our instrumental variables (IV) regressions. RESILIENCE is measured according to the Brief Resilience Scale (Smith et al., 2008) which is a series of six statements on the ability of respondents to recover from negative life events e.g. 'I tend to bounce back quickly after hard times'. Agreement with the statement is measured on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). OPTIMISM is measured using three items from the Scheier et al. (1994) Life Orientation Test-Revised (e.g. 'In uncertain times, I usually expect the worst') measured on a 5-point Likert scale. FINANCIAL CONFIDENCE is measured from responses to the question 'When you are shown information about a financial product such as a loan, credit card or store card, on a scale of 1 to 5, how confident are you that you understand the total amount you would need to repay?'. FINANCIAL LITERACY is measured from four simple mathematical problems on simple interest, percentage, division and compound interest. The first question was linked with borrowing behaviour in (Disney and Gathergood, 2013) while the remainder have been asked in two waves of the English Longitudinal Study of Ageing and have been shown to affect income and wealth life outcomes (Banks et al., 2010). Garðarsdóttir and Dittmar (2012) provide the survey questions to measure MONEY MANAGEMENT SKILLS and MATERIALISM. The money management skills variable is based on responses to a nine item scale on self-reported skills in managing money (e.g. 'I monitor my financial statements') and the materialism variable is based on a nine-item

scale based on attitudes to material success and happiness (e.g. 'I admire people who own expensive homes, cars and clothes').

3.2. Descriptive statistics

Selected descriptive statistics for our sample are reported in Table 1 along with statistics for the Northern Irish population where available. Our sample has a disproportionate number of females and less than one-third are aged over 50. Incomes are substantially lower than the general population and participants in our sample are experiencing considerable financial stress. On each of the three indicators - debt trouble, no money over and not managing - about one-half of the sample report difficulties. These figures are substantially higher than elsewhere in the population.

In contrast, the only dimension of the EQ-5D higher in the sample than in the NI population is the indicator of whether respondents have some or severe problems with anxiety/depression. The poorer mental health of our sample is also borne out by the 12-item General Health Questionnaire (GHQ-12) where a score of 4 or more indicates the presence of psychiatric morbidity and 28% of our sample compared to 19% of the population have a high score. The other dimensions of the EQ-5D index are very similar to national levels and reports of some or severe pain/discomfort problems are actually lower but we will see later than these aggregate statistics mask large variation by debt levels.

In order to additionally understand the channels by which debt affects health, our survey contained a module on health-related behaviours including smoking, drinking, physical activity, diet and consumption of illegal drugs. The diet of our over-indebted sample appears to be poor with 14% not having enough to eat compared to 2% nationally and a much smaller proportion (19%) than nationally (33%) eating the recommended five portions of fruit and vegetables per day. The sample contains a much higher proportion of current smokers than the general population but the percentage drinking alcohol is much lower. Only 7% of our sample have taken non-prescription substances (e.g. cannabis, cocaine) in the last 4 weeks

which is very similar to the Northern Irish figure. Our sample, as a whole, appears to have a higher percentage meeting the NI Chief Medical Officer's recommended levels of physical activity. As the UK National Health Service is publicly-funded, financial difficulties do not restrict access to healthcare services and, in fact, our sample are more likely to have visited a GP or healthcare professional in the last two weeks than the general population.

[Insert Table 1 near here]

4.   Results

4.1.   Debt and health

Our first set of estimates are given in Table 2 for the simple model (1) explaining health where all debt variables are regarded as being exogenous. The dependent variable is the EQ-5D index score and our control variables are household demographic variables (age, gender, female, respondent has partner, homeowner, household income and the number of children under five), educational qualifications and employment status. We progressively add measures of debt across the four columns to assess the robustness of results. In the first regression, we see that health monotonically worsens with age. Being over 50 reduces the ED-5D index score by around 0.17 compared to the 18-24 reference age category. Educational qualifications make little difference to health except for work-related qualifications which increase the ED-5D index score by 0.14 when compared to the reference category who have no educational qualifications. Being employed also makes a large statistically significant difference to the Eq5D index. Of most interest to this study, we also see that debt lowers our index of health but find that the effect is confined to secured debt. However, when we move to our second regression where we add subjective questions on financial well-being, this variable is no longer significant whereas NOT MANAGING significantly lowers health. The effect is large (-0.087) considering the range of the index and is of the order of the

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effect of moving from the 18-24 reference age category to being aged 35-49 (-0.093). In the third regression, we also consider the number of different lenders used in the last three years as having multiple loans means multiple repayment schedules, more paperwork, greater chance of missing repayments and potentially higher interest rates (Meltzer et al., 2012). In the fourth regression, high-interest financing is also considered as debts of this form rapidly spiral and these lenders use more aggressive methods to compel repayment (Lusardi and Scheresberg, 2013). The coefficient on NOT MANAGING is unchanged throughout whereas these additional variables do not add any extra explanatory power to the regression. The other two measures of subjective financial stress, DEBT TROUBLE and NO MONEY OVER, are statistically insignificant in all of the different model specifications.

[Insert Table 2 near here]

A number of tests of the robustness of these results to the potential endogeneity of our subjective measures of financial well-being are conducted in Table 3. The three separate measures are combined into the FINANCIAL STRESS variable described above. The preferred models are (4) and (5) which account for the binary nature of our endogenous variable. This is ignored in models (1)-(3) where a two-stage least squares (2SLS) approach is used. However, 2SLS will produce consistent but inefficient estimates and does not require us to get the functional form for the first-stage regression correct. These estimates therefore provide checks for the robustness of results and we will discuss them first.

Valid instruments must be correlated with financial stress but uncorrelated with the error term and we use figure 1 to guide us in which instruments should theoretically satisfy these criteria. In the first model, the instruments are the constitutional factors that mediate the effect of debt on financial stress (resilience and optimism); in the second model, the instruments are the exogenous variables that affect debt but are not affected in turn by health (financial confidence, financial literacy, money management skills, materialism) and in the third model, the two sets are combined. Coefficient estimates indicate a large effect of

financial stress on health but these estimates have large standard errors. As before, unsecured and secured debt provide no additional explanatory power in all three models.

The Wooldridge estimator in column (4) provides efficient estimates under the assumption of homoscedasticity. The estimate of the effect of financial stress on health is smaller than before (-0.353) but still within the confidence intervals of estimates from models (2) and (3). The treatment-effects model in (5) gives the most conservative estimate but the effect is still very large (-0.301) and is greater than the positive effect of being employed or not (0.208 - not shown in table). This estimate is most precise but as noted earlier this model may potentially be less robust to misspecification.

All models are correctly specified with acceptance of the null hypothesis that the instruments are valid (*Hansen-J test*) and rejection of the null hypothesis that the instruments are irrelevant i.e. uncorrelated with the endogenous regressor (*Underidentification test*). Tests are also included for weak identification as weakly correlated instruments can lead to bias and misleading inference. In particular, these test statistics allow us to check that the size of tests conducted on the β of FINANCIAL STRESS is close to the correct 5% level. The *Cragg-Donald* test assumes homoscedastic errors while the *Kleibergen-Paap* weak identification test assumes heteroscedastic errors. As these test statistics are generally above the 10% maximal size critical value, weak identification appears not to be a problem although as a precaution we have used the LIML estimation approach which is more robust to weak identification. Importantly, in every case, the difference-in-Hansen endogeneity test rejects the hypothesis that financial stress can be treated as exogenous thus necessitating instrumental variable approaches. In the treatment effects model in column (5), violation of the assumption that the error terms in model (2) are correlated can lead to estimation bias. Rejection of equation independence suggests that applying the treatment effects model is appropriate.

A clear picture emerges then from this set of regressions. Financial stress is endogenous and we therefore must use instrumental variables approaches. The issue of endogeneity of

debt-related variables was neglected in two important studies in this area thus compromising estimates (Drentea and Lavrakas, 2000; Sweet et al., 2013). All regressions point towards a large negative effect of financial stress on the EQ-5D index of health with a range of estimates varying between -0.301 and -0.686 if we discount the first very imprecise estimate.

We conducted two further checks on the robustness of these results which are not reported here (though available on request). We repeated the regressions reported in Table 3 with NOT MANAGING as the only endogenous measure of subjective financial well-being. Results are very similar to those reported here. A second check instrumented SECURED DEBT and UNSECURED DEBT using the exogenous variables that affect debt (financial confidence, financial literacy, money management skills, materialism) as well as instrumenting FINANCIAL STRESS by the constitutional factors that mediate the effect of debt on financial stress (resilience and optimism). This model was then estimated using a limited information maximum likelihood approach (Roodman, 2011). Results are unchanged. The debt measures are statistically insignificant and FINANCIAL STRESS is statistically significant and of the same size as in Table 3.

[Insert Table 3 near here]

4.2. Debt and dimensions of health

As mental health constitutes one of the five dimensions of the EQ-5D index, the relationship between financial stress and health could be driven by the already well-established connection between mental health and debt. In the next step, we estimate the relationship between debt and each of the EQ-5D dimensions separately using the recursive bivariate probit model outlined in model (3). The dependent variable in each case is coded 1 if the respondent has some or severe problems with the particular dimension of health and 0 otherwise. Controls are as before and the full instrument set described above is used for financial stress. Results are presented in Table 4 where marginal effects are reported. We see that

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financial stress does not just impact on mental health but on almost all dimensions of health captured by this index. The marginal effect is greatest for mental health where financial stress increases the probability of having problems with anxiety or depression by 58%. But financial stress also increases the probability of reporting self-care problems by 18.3%, the probability of having problems with performing usual activities by 28.1% and the probability of having problems with pain by 37.6%. Our subjective measure of financial well-being has no significant effect on problems with mobility. Secured and unsecured debt have no statistically significant effect for any of the dimensions although this result is very marginal for the anxiety-depression dimension where the p-value for the parameter estimate of unsecured debt is very close to the 5% significance level (p=0.054).

[Insert Table 4 near here]

4.3. The chain of causation from debt to health

Having established the positive association of financial stress with dimensions of health we explore the causal mechanisms by which this association could occur in our final set of estimates (Table 5). We concentrate here on how health-related behaviours change with levels of financial stress. As discussed in subsection 2.1, stress may also cause cardiovascular disease and some cancers through biological pathways which are independent of changes in behaviours. However, collecting information on appropriate biomarkers to identify these effects was outside the scope of this study.

Being in debt and having little disposable income could potentially have a positive effect on health. The consumption of unhealthy goods (e.g.alcohol, cigarettes, fast-food) requires disposable income and therefore the financially-stressed should consume less of these goods. On the other hand, theory suggests that financial worries cause stress which, in turn, induces short-sighted decision-making (Haushofer and Fehr, 2014). Decision-making while financially-stressed exhausts limited resources of self-control and therefore, in our sample,

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we would expect a lower tendency to engage in goal-directed health behaviours (e.g. physical activity, diet) in those who are most in debt.

Our estimates tend to agree with these arguments. As the dependent variables are a mix of binary, ordinal and continuous variables, the figures presented are parameter estimates not marginal effects and we will focus on the sign and magnitude of the coefficients. Controls and instruments are as before. Financial stress reduces the probability that an individual will achieve the recommended levels of physical activity and lowers the number of portions of fruit and vegetables consumed daily. On the consumption side, those who are financially stressed do not consume alcoholic drinks more frequently nor do they visit fast-food outlets more frequently. However, they smoke many more cigarettes per week and they have a higher probability of taking non-prescription substances. These conflicting results can perhaps be explained by how the influences of the force of present-biases increasing demand and the force of a lack of disposable income reducing demand vary for each unhealthy consumption good. For the more addictive goods (cigarettes and drugs), the present-bias wins out while for the less addictive goods (alcohol and fast-food) the opposing forces balance. This type of reasoning could be accommodated within the rational theory of addiction proposed by Becker and Murphy (1988) which models the consumption of an addictive good in terms of its degrees of addictiveness, individual time preference as well as income and other economic parameters.

As the UK National Health Service is publicly-funded, financial difficulties should not restrict access to healthcare services. In fact, the financially stressed are more likely to have visited a GP or healthcare professional in the past two weeks and there is therefore no indication of a reduction in healthcare utilisation due to financial difficulties.

Unlike Nelson et al. (2008), we find that debt measures have little association with any of these behaviours. The only estimates that are significant are for the effect of unsecured debt on physical activity and fruit and vegetable consumption where debt appears to act in an unexpected way improving these healthy behaviours and contradicting our *a priori*

reasoning.

[Insert Table 5 near here]

Conclusion

Levels of household debt in industrialized countries have sharply increased in recent years and a recent literature has explored the implications of debt for health especially mental health. There have been few studies relating debt levels to physical health and even fewer at household level. The issue of endogeneity is often neglected in this literature and any results and conclusions made will therefore be compromised.

Our study has a greater breadth of information than in the literature reviewed as we used a survey purposely designed to capture many aspects of debt, physical health, mental health and health behaviours. This has allowed us to go beyond simple summary measures of health and consider the impact of both objective and subjective measures of debt on a range of dimensions of health. In addition, we consider potential mediating variables in order to understand how such effects might occur. Also, our empirical analysis considers the issue of endogeneity in greater detail than elsewhere.

Our conclusions are that the level of financial stress matters for physical health, mental health and health-related behaviours. Our results indicate that neither the size of the debt, the type of debt nor the number of different lenders used affect health whereas the subjective experience of feeling financially stressed has a robust relationship with most aspects of health. The adverse effect of financial difficulties on health is mediated through worse diets, lower levels of physical activity and increased consumption of cigarettes and drugs. We also find that the financially-stressed are more likely to visit a GP or healthcare professional. The implication is therefore that household debt has a wider social cost hitherto unrecognised by policy-makers.

This research is timely as the current UK government's austerity program has thus far caused social care spending to fall by 14% in the most deprived communities with cuts at least as big as those that have already happened promised in the next parliament. Due to Welfare Reform, many doctors report an increase in patients presenting to them with problems connected to unemployment and debt and nearly all GPs say that debt is increasing their workload. Households are seeing debts escalate and our study indicates over-indebtedness has consequences for health. Rising levels of indebtedness will lead to resource issues for the healthcare system.

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Table 1 : Descriptive statistics

Variable	Sample	NI
Demographics		
Female	0.58	
Age over 50	0.31	
No educational qualifications	0.32	
Homeowner	0.45	
Employed	0.56	
Has partner	0.38	
Partner employed	0.66	
Children under-5 in household	2.2	
Income and debts		
Unsecured debt	£4,021	
Secured debt	£17,438	
Household weekly income	£290	£454
Debt trouble	0.42	0.07
No money over	0.58	0.22
Not managing	0.52	0.05
Health		
EQ-5D index score	0.81	
Mobility problems	0.17	0.15
Self-care problems	0.08	0.08
Usual activities problems	0.18	0.17
Pain/discomfort problems	0.26	0.31
Anxiety/depression problems	0.33	0.26
High GHQ12 score	0.28	0.19
Not enough to eat	0.14	0.02
Fruit & veg (5+ a day)	0.19	0.33
Eat fast food	0.57	
Currently Smoke	0.41	0.24
Drink alcohol	0.58	0.81
Illegal drugs (aged <60)	0.07	0.05
Physically active	0.72	0.60
Seen GP last 2 weeks	0.35	0.23
N	499	

Notes : Unsecured and secured debt are given as the figures reported by participants before the transformation described in the text.

Physically active implies meeting the NI Chief Medical Officer's guidelines. Over a week, activity should add up to at least 150 minutes of moderate intensity activity or alternatively 75 minutes of vigorous intensity activity or a combination of moderate and vigorous intensity activity. Source for NI data is Health Survey Northern Ireland 2013/14. These figures are standardised to the age and sex distribution of our sample. Exceptions are *Illegal drugs* 2010/11 Northern Ireland Drug Prevalence Survey *Debt trouble, No money over, Not managing* 2009/10 Continuous Household Survey *Household weekly income* 2013/14 Continuous Household Survey. These figures are unstandardised.

Table 2 : OLS estimates of the impact of debt on the EQ-5D health index score

	(1) coef./s.e.	(2) coef./s.e.	(3) coef./s.e.	(4) coef./s.e.
Female	0.000	-0.012	-0.011	-0.010
	(0.024)	(0.024)	(0.025)	(0.025)
Aged 25-34	-0.014	-0.008	-0.006	-0.001
	(0.037)	(0.035)	(0.036)	(0.036)
Aged 35-49	-0.096*	-0.093*	-0.092*	-0.082
	(0.045)	(0.044)	(0.044)	(0.044)
Over 50	-0.174***	-0.178***	-0.173***	-0.163***
	(0.049)	(0.048)	(0.049)	(0.048)
Has GCSEs	0.059	0.062	0.063	0.061
	(0.037)	(0.038)	(0.037)	(0.038)
Work-related qualifications	0.138***	0.137***	0.136***	0.134***
	(0.038)	(0.037)	(0.037)	(0.037)
Has A Levels	0.050	0.047	0.050	0.044
	(0.042)	(0.042)	(0.043)	(0.042)
Has degree	0.064	0.059	0.053	0.063
	(0.051)	(0.051)	(0.053)	(0.053)
Homeowner	0.025	0.021	0.022	0.014
	(0.031)	(0.031)	(0.032)	(0.032)
Employed	0.229***	0.220***	0.222***	0.221***
	(0.031)	(0.031)	(0.031)	(0.031)
Has partner	0.029	0.027	0.028	0.017
	(0.031)	(0.031)	(0.031)	(0.031)
No. of children under-5	-0.007	-0.005	-0.005	-0.001
	(0.012)	(0.012)	(0.012)	(0.011)
Household income	0.007	0.009	0.006	0.008
	(0.018)	(0.019)	(0.020)	(0.020)
Unsecured debt	-0.017	-0.011	-0.015	-0.016
	(0.011)	(0.011)	(0.012)	(0.013)
Secured debt	-0.015*	-0.014	-0.014	-0.013
	(0.007)	(0.007)	(0.007)	(0.007)
Debt trouble		-0.015	-0.017	-0.012
		(0.032)	(0.032)	(0.032)
No money over		0.050	0.050	0.046
		(0.030)	(0.031)	(0.030)
Not managing		-0.087**	-0.087**	-0.092**
		(0.029)	(0.029)	(0.030)
No. of lenders			0.013	0.011
			(0.020)	(0.022)
High-interest loan last year				-0.021
				(0.059)
Constant	0.727***	0.732***	0.738***	0.733***
	(0.104)	(0.110)	(0.112)	(0.113)
R^2	0.278	0.294	0.295	0.296
N	476	476	476	470

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 : Instrumental variables estimates of the impact of debt on the EQ-5D health index score

	(1) LIML coef./s.e.	(2) LIML coef./s.e.	(3) LIML coef./s.e.	(4) Wooldridge coef./s.e.	(5) ML coef./s.e.
Unsecured debt	0.018	-0.001	0.007	-0.007	-0.011
	(0.022)	(0.015)	(0.018)	(0.013)	(0.012)
Secured debt	0.016	0.002	0.008	-0.003	-0.009
	(0.015)	(0.010)	(0.012)	(0.008)	(0.007)
Financial stress	-0.937***	-0.487**	-0.686***	-0.353***	-0.301***
	(0.262)	(0.161)	(0.198)	(0.075)	(0.050)
Underidentification test	39.2***	50.4***	72.3***	60.6***	
Weak identification tests					
Cragg-Donald	4.11	3.04	3.14	82.67	
Kleibergen-Paap	5.81	4.02	4.20	81.99	
10% maximal size	3.81	3.31	3.75	16.38	
Hansen J test	10.2	12.6	24.4		
Endogeneity test	23.1***	11.6***	16.6***	22.0***	
Test of indep. eqns.					26.7***
N	470	470	470	470	470

Notes : All models include controls used in final regression of Table 2. Model 1 - LIML with instruments {Optimism, Resilience}. Model 2 - LIML with instruments {Financial confidence, Financial literacy, Money management skills, Materialism}. Model 3 - LIML with all instruments from models (1) and (2). Model 4 - Wooldridge procedure using fitted probabilities of financial stress. Model 5 - ML estimation of treatment effects model. Standard errors are robust to heteroscedasticity and autocorrelation. The underidentification test is the Kleibergen-Paap rk underidentification test. The critical values provided for the weak identification tests require the assumption of i.i.d. errors (Stock and Yogo, 2005). Critical values have not been developed for the case of heteroscedasticity and following Baum et al. (2007), the Stock-Yogo critical values are applied to the Kleibergen-Paap test statistic with caution. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 : Maximum likelihood estimates of the impact of debt on dimensions of the EQ-5D health questionnaire (marginal effects)

|	Mobility problems	Self-care problems	Usual activities problems	Pain problems	Anxiety/ depression problems
Unsecured debt	-0.001	-0.001	-0.004	0.028	0.032
	(0.013)	(0.006)	(0.012)	(0.017)	(0.017)
Secured debt	-0.001	0.006	0.000	0.006	-0.003
	(0.010)	(0.005)	(0.009)	(0.011)	(0.011)
Financial stress	0.158	0.183***	0.281*	0.376***	0.578***
	(0.127)	(0.040)	(0.110)	(0.109)	(0.057)
Log-likelihood	-373.6	-322.3	-376.5	-437.3	-451.7
N	471	471	471	471	471

Notes : Recursive bivariate probit models estimated by limited-information maximum likelihood. All models include the full set of instruments and full set of controls. Standard errors are robust to heteroscedasticity and autocorrelation. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 : Maximum likelihood estimates of the impact of debt on health behaviours

	GP	Cigs.	Drink	Active	Fast food	Fruit & veg	Drugs
	coef./s.e.	coef./s.e.	coef./s.e.	coef./s.e.	coef./s.e.	coef./s.e.	coef./s.e.
Unsecured debt	0.087	-2.507	-0.041	0.121*	-0.011	0.063*	-0.057
	(0.049)	(2.497)	(0.043)	(0.052)	(0.053)	(0.031)	(0.050)
Secured debt	0.023	-1.165	-0.029	-0.054	-0.036	-0.022	-0.027
	(0.032)	(1.770)	(0.030)	(0.037)	(0.036)	(0.021)	(0.040)
Financial stress	0.965**	42.608*	0.518	-1.072***	0.550	-1.421***	1.447***
	(0.299)	(17.893)	(0.387)	(0.322)	(0.436)	(0.150)	(0.200)
2nd stage model	Probit	Continuous	Ordered Probit	Probit	Probit	Ordered Probit	Probit
N	499	471	499	499	499	499	499

Notes : *GP* - Have you consulted your GP or other health professional in the past two weeks? *Cigs.* - Cigarettes smoked per week. *Drink* - How often have you had an alcoholic drink of any kind during the last 12 months? Response on scale 1-8. *Active* - Achieving NI Chief Medical Officer's recommended levels of physical activity. *Fast food* - Can you tell me how often do you visit fast-food outlets? *Fruit & veg* - How many portions of fruit and vegetables do you eat each day? *Drugs* - During the last 4 weeks have you taken any non-prescription substances ? (i.e. illegal drugs)

Fig. 1. Links between debt and health
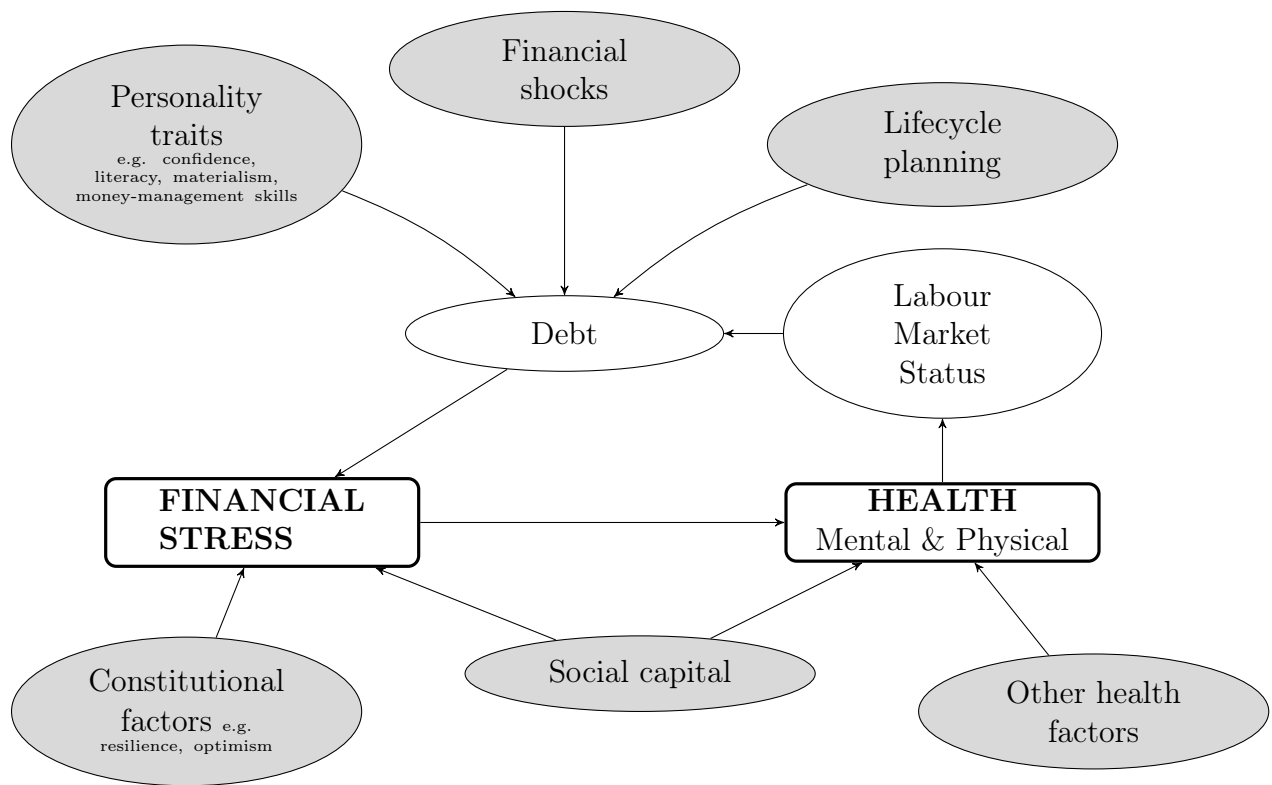
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