



Deposited via The University of Sheffield.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/74754/>

Article:

Lenton, P., Roberts, J. and Brazier, J. (2012) Examining the potential for microeconometric analysis of health data sets: an exploratory study using the psychiatric morbidity surveys. HEDS Discussion Paper 12/16. (Unpublished)

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



HEDS Discussion Paper

No.12.16

**EXAMINING THE POTENTIAL FOR MICROECONOMETRIC ANALYSIS OF HEALTH DATA SETS:
AN EXPLORATORY STUDY USING THE PSYCHIATRIC MORBIDITY SURVEYS**

Pamela Lenton¹, Jennifer Roberts¹ and John Brazier²

¹ Department of Economics, University of Sheffield, P.Lenton@sheffield.ac.uk

² School of Health and Related Research, University of Sheffield

Disclaimer:

This series is intended to promote discussion and to provide information about work in progress. The views expressed in this series are those of the authors, and should not be quoted without their permission. Comments are welcome, and should be sent to the corresponding author.

White Rose Repository URL for this paper: <http://eprints.whiterose.ac.uk/74754>

White Rose Research Online

eprints@whiterose.ac.uk

EXAMINING THE POTENTIAL FOR MICROECONOMETRIC ANALYSIS OF HEALTH DATA SETS: AN EXPLORATORY STUDY USING THE PSYCHIATRIC MORBIDITY SURVEYS

Pamela Lenton¹, Jennifer Roberts¹ and John Brazier²

¹ Department of Economics, University of Sheffield, P.Lenton@sheffield.ac.uk

² School of Health and Related Research, University of Sheffield

This work was funded by the NIHR Methods Opportunity Funding Scheme Grant and the project report was submitted in February 2011.

INTRODUCTION

NIHR is concerned to build capacity in research methods relevant to their work. At the same time academic health economists are concerned that a separation is emerging between economists and health economists which may be detrimental to the quality of health economics research. An important factor limiting the involvement of economists in areas relevant to the NIHR is a lack of awareness of data sets which might include variables of interest to economics researchers alongside health variables. Our study focuses on ways in which large health-related data sets can be used by economists to tackle questions that are relevant to both economists and to NIHR, and which offer the opportunity to develop and test econometric methods. In this way economists may be attracted to health-related work, thus increasing the knowledge base on which NIHR can draw. We explore these issues using the Office of National Statistics (ONS) Psychiatric Morbidity Surveys (PMS), which are described in more detail in the sections that follow.

The stated objectives of our project were to apply microeconomic methods to the Psychiatric Morbidity Surveys in order to:

- (i) generate accurate estimates of different mental health conditions on health related quality of life, after controlling for background variables and physical health problems;
- (ii) examine how stable the marginal impact of these conditions is over time;
- (iii) provide important data to populate economic models of interventions for preventing and treating mental health conditions used by NICE in developing guidance for the NHS;
- (iv) explore the interrelationships between debt and mental health;
- (v) explore more generally the potential for large health-related data sets to be used by economists to increase the knowledge base on which NIHR can draw.

Objectives (i) to (iii) are discussed in Sections I and II. Objective (iv) is discussed in Section III. Objective (v) is discussed in the Section (IV) along with directions for further work.

SECTION I: OBJECTIVES (i) to (iii)

MODELLING THE IMPACT OF MENTAL HEALTH DISORDERS ON HEALTH STATE VALUES

Introduction

There has been increasing use of economic evaluation to inform resource allocation in health care around the world. The most widely used technique of economic evaluation in health care has been cost effectiveness analysis and an increasingly applied version uses the Quality Adjusted Life Year (QALY) to assess effectiveness in units that are comparable across health care programmes. The number of QALYs is calculated by multiplying a person's expected years of life by the value of their health status in each period on a scale where full health is one and states equivalent to being dead are given a value of zero (with states worse than dead being given negative values).

The most commonly used measures for putting the 'Q' into the QALY are the generic preference-based measures of health, such as the EQ-5D (Dolan 1997) and SF-6D (Brazier et al, 2002). These generic measures have been adopted by agencies such as NICE as part of their reference case (NICE, 2008). These instruments have been widely used to assess the impact of physical health problems and for populating cost effectiveness models. However, there is little data on the impact of mental health problems on the health utility scale, and information is particularly scarce for more complex problems like psychosis and personality disorder (Brazier, 2008). This project seeks to fill that gap by utilising the data available in the Psychiatric Morbidity Survey (PMS).

Our aim is to examine the impact of mental health disorders on health state utility values. Specifically we estimate the decrement associated with various mental health disorders on the SF-12 (SF-6D) health utility index, using data from a representative sample of the UK general population and controlling for a wide range of background variables. We also compare these decrements with those associated with common physical disorders.

Data and Methods

The Psychiatric Morbidity Survey (PMS) has been carried out in 1993, 2000 and 2007 (Singleton et al 2000; McManus et al 2007). It is a general population survey of adult mental health and aims to provide information on the prevalence of psychiatric problems among people living in Great

Britain, as well as their associated social disabilities and use of services. PMS is a survey of private households covering about 8,000 adults of working age in each survey. PMS is unique in the UK for having data on a broad range of conditions including common mental health disorders like depression, anxiety and obsessive compulsive disorder, psychotic problems, personality disorders and alcohol and drug dependence. The PMS also contains general health measures including the SF-12 health index, a measure for which a preference based utility index is available (Brazier and Roberts, 2004). As well as these health indicators there is also information on socio-demographic data, education and employment, income and debt, accommodation and stressful life events. Our analysis uses only the 2000 and 2007 surveys because there is a lack of continuity between these more recent surveys and many of the questions asked in the first survey in 1993. While the 2000 survey covered England, Wales and Scotland, PMS 2007 only interviewed people in England so our analysis uses data for England only. Data from the PMS is available from the UK Data Archive.

In both years the interviews are conducted in 2 stages. Firstly, a computer assisted personal interview in the respondents own home covering neurotic symptoms and disorders using the Clinical Interview Schedule Revised (CIS-R) and screening items on personality disorder and psychosis. A second stage sample was chosen comprising respondents who satisfied screening criteria for psychotic and personality disorder. The second stage interviews were conducted by trained psychologists using *Schedules for Clinical Assessment in Neuropsychiatry* (SCAN) and Structured Clinical Interview (SCID-II). In 2000 (2007) there were 8580 (7461) initial interviews, a response rate of 54 (57)%. At the second stage there were 638 (630) interviews and a response rate of 73 (74)%. Our analysis sample comprises 5688 individuals in 2000 and 5388 individuals in 2007. Our main exclusions are due to age, because we have included in our analysis only individuals of working age (between 18 and 64 years), and those individuals with complete information of employment status and education.

The basic model to be estimated is:

$$U_i = f(M_i, P_i, X_i, \varepsilon_i) \quad (1)$$

Where U_i is health utility for respondent i ; M is mental health, P is physical health and X is a set of background characteristics. ε_i is a random error term.

The dependent variable (U) is the SF-6D health utility index derived from individual responses to the SF-12. The SF-12 is a generic health measure based on items taken from the SF-36 health survey, a standardised questionnaire used to assess patient health (Ware et al, 1993). The SF-12 contains 12 items selected from the SF-36 on the basis of their psychometric performance across eight dimensions of health: physical functioning, role limitations- physical, role limitations- emotional, bodily pain, general health, vitality, social functioning and mental health. Brazier and Roberts (2004) developed a preference based index for the SF-12; this utility index is calculated using a preference-based algorithm estimated from standard gamble valuations of a sample of SF-6D states obtained from members of the UK general population (Brazier et al, 2002). The index takes values from zero (equivalent to dead) to one (full health), with negative values denoting health states deemed to be worse than dead.

Mental health (M) is measured in two ways. Firstly, using a set of dichotomous variables to represent the presence of specific disorders. Diagnosis of specific disorders were assigned by ONS using answers to various sections of the CIS-R and applying algorithms based on the ICD-10 diagnostic criteria; these disorders are: generalised anxiety disorder (GAD), mixed anxiety depressive disorder (MADD), panic disorder, obsessive compulsive disorder, phobia, and depression. In addition to this, psychosis and personality disorder are assigned via the Stage 1 screening questions, alcohol dependence is defined according to the Severity of Alcohol Dependence questionnaire (SAD-Q) and drug dependence defined according to questions used in the US Epidemiologic Catchment Area (ECA) survey. The second method uses a set of dichotomous variables to represent the overall CIS-R score¹. The overall CIS-R score is obtained by summing the symptom scores, and it reflects the severity of neurotic symptoms. The score can range from 0 to 49 and our analysis classifies the data into seven groups: 0 – 5; 6 – 11; 12 – 17; 18 – 23; 24 – 29; 30 – 35; and 36 plus. A score of 12 and over indicates significant levels of neurotic symptoms and a score of 18 and over suggests a level of symptoms likely to require treatment. More detail on definitions for each disorder can be found in the PMS Technical Reports (Singleton et al 2000; APMS 2007).

Physical health (P) is measured by a set of dichotomous variables denoting the presence of self-reported long-standing health problems: muscular-skeletal, respiratory, digestive, heart and circulatory, urinary, skin, ear, eye, neoplasm, blood disorder, and infection. The set of

¹ CISR scores can also be used to measure the severity of each condition (see below).

background variables (X) include age, marital status, presence of children aged 16 in the household, employment status, ethnicity, education and income. Dummy variables for regions and year are also included.

See Appendix 1 for a full list of variables and definitions

The distribution of the SF6D health utility index for men and women is shown in Figures 1a and 1b. The distribution is skewed for both sexes, with the majority of values clustered at the higher end of the scale indicating high levels of health utility; this is expected for a general population sample. The scale of the dependent variable is constrained to a maximum at one, which represents full health on the SF-6D scale. However there is no obvious ceiling effect and only a small proportion of observations take the value of one (5% for males and 3% for females).

In these circumstances OLS estimation of the parameters of model (1) leads to biased and inconsistent estimates (Greene 2000: Ch 20). We have tried two alternative approaches, both designed to deal with the skewed and truncated nature of the SF12 index. The first is a tobit model (Tobin, 1958), estimated using maximum likelihood via the `dtobit2` procedure in Stata v11. The second is a generalised linear model (GLM) estimated using the `PGLM` procedure in Stata v11 (Basu 2005). While the utility index is not truncated, a tobit model may help to deal with the skew. GLM has been the dominant approach in modelling health care costs data (Jones 2010). Cost data poses similar problems for econometric modelling to the outcome data in question. GLM combine a *link* function that relates the conditional mean of the dependent variable to the covariates (commonly this is the identity link or log link), and a *distribution* function that specifies the relationship between the variance and the mean (common distributional families re Gaussian, Poisson, Gamma and inverse Gaussian). These distributions allow considerable flexibility in modelling data, but it is often difficult to choose an optimum combination of link and distribution function; the most common combination for health care cost data has been the log-link with a gamma error. Basu and Rathouz (2005) suggest a methods to estimate the parameters in the link function and variance structure simultaneously with regression coefficients; this is implemented in Stata via `PGLM` (Basu 2005).

Having tried both tobit models and `PGLM` on our data, diagnostic tests show that these models fit no better than a linear model estimated by OLS, and that the marginal effects of physical and mental health conditions on the SF12 index are not much affected by the estimation procedure

and functional form. This finding is similar to that of Jones (2010) who compared a number of different models for modelling health care cost data. Therefore, for ease of exposition we report OLS results here and we continue to explore the functional form issues of the SF12 index in further work. Breusch-Pagan/ Cook- Weisberg tests results suggest heteroskedastic errors therefore the OLS models are estimated with robust error variance.

Models are estimated separately for men and women and were initially estimated separately for each year 2000 and 2007; however results for both years were very similar so the models reported here are for the pooled 2000 and 2007 data with a dummy variable representing observations from 2007. In relation to Objective (ii) we can therefore confirm that the marginal impact of mental health conditions is stable over the 2000 to 2007 time period.

Table 1 reports descriptive statistics by year and Table 2 shows the distribution of physical and mental health problems by year. Table 1 confirms that, in terms of background characteristics, the samples in 2000 and 2007 are very similar. The question on physical health problems was different in 2000 and 2007, which explains why prevalence appears to be much greater in the latter year; in 2000 65% of people reported no physical health problems whereas in 2007 this was only 40%. We believe this is due to the general health question changing in 2007. In 2000 respondents were asked “Do you have any long-standing illness disability or infirmity?” whereas in 2007 respondents were asked “Have you ever had any of the following conditions since the age of 16?” The prevalence of mental health problems is very similar in both years. Around 74% of people have no mental health disorder. The most common problem is MADD found in around 10% of respondents, and this is followed by alcohol dependency, which is here defined as any level of dependency detected by the SADQ, ranging from mild to severe. The prevalence of mental health problems in our data set is very similar to that reported in the PMS reports (Singleton et al 2000, McManus et al 2007).

The results are shown in Table 3. The data for males and females is pooled with a dummy variable, which equals one if the respondent is male, after separate estimation of the models by sex produced very similar results for men and women. There are four specifications; Specification (1) is a baseline model including only background variables; (2) also includes physical health problems; (3) includes dummy variables for specific mental health disorders; and (4) is an alternative to (3) which includes dummy variables for overall CIS-R score to represent mental health state.

The results show that after conditioning on the full set of background variables, both mental and physical health problems are associated with lower health utility. Looking first at specification (3), which includes specific mental health problems, all of the physical health problems, except eye complaints, are statistically significant at $p=0.005$. The three mental health problems that do not have a statistically significant affect on health utility are psychosis, personality disorder and alcohol dependence. In the alternative specification (4), all CISR scores are significant and they have the expected gradient with higher scores associated with lower health utility. The effects of mental health problem are large, and generally larger than for physical health problems. The largest decrement to health utility is for depression, the presence of which reduces the SF-6D index by around 0.14. CIS-R scores of 6 – 11, the lowest category above baseline, are associated with around a 0.09 reduction in the SF-6D, and this increases to a reduction 0.27 for a score of 30 or more.

Looking across the four specifications, the effects of the background variables are reduced when mental health problems are included alongside physical health problems, and are similar regardless of how mental health is measured. Being male is associated with higher health utility, and being widowed or separated is associated with lower health utility. There is a u-shaped relationship with age, which suggests that lowest health utility occurs at around age 40. The presence of children in the household has a positive effect. Education also seems to have a positive effect and individuals who are working have higher health utility. Being in the lowest income category is associated with lower health utility and the higher income categories have a positive effect.

Looking at the Adjusted R^2 figures across the four models, adding physical and then mental health problems successively increases the explanatory power of the models, such that for specifications including mental health conditions, the Adjusted R^2 is over 0.40. However the Ramsey (1969) RESET test suggests that the models do suffer from misspecification problems. The Pregibon (1980) link test statistics, calculated in OLS models without robust standard errors, also suggest misspecification problems². These tests also revealed misspecification problems with tobit and GLM models (not reported here).

² The RESET test is based on re-running the regression with squares and other powers of the fitted values included as auxiliary variables. The Pregibon link test is an alternative which adds the level of the fitted values rather than the individual regressors.

Comorbidities

The models reported in Table 3 assume an additive relationship between mental health and health utility, such that for example in specification (3) of Table 3, someone with depression would have a utility score 0.137 lower than someone without depression, *ceteris paribus*. However, comorbidities are an important issue for health utility and health care modelling, and they may not necessarily have an additive effect. We have explored all first order interactions between mental health problems by estimating model (2) below:

$$U_i = f(M_p, P_p, X_i, IM_p, \varepsilon_i) \quad (2)$$

Where IM is a set of dichotomous variables representing first order interactions between the ten mental health conditions described above; the variable takes the value one when an individual has both mental health problems in question and zero otherwise. All other variables are as defined for model (1). Table 4a reports the results for these models; only the coefficients on the main mental health problems and the significant (at $p = 0.01$) interactions are reported. The coefficients on the mental health problems are reduced in size compared to Table 3 but remain statistically significant. The first point to note is that the coefficients on all of the interaction terms are positive; this means that having both problems results in a health utility decrement that is less than the sum of the individual coefficients. For example having GAD and depression, the decrement to the utility index is $-0.107 - 0.182 + 0.122 = -0.167$; this is of course smaller than that suggested by the additive model.

We also explore first order interactions between mental health and physical health problems by estimating model (3) below:

$$U_i = f(M_p, P_p, X_i, IP_p, \varepsilon_i) \quad (3)$$

Where IP is a set of dichotomous variables representing first order interactions between the ten mental health conditions and the eleven physical health problems described above; the variable takes the value one when an individual has both health problems in question and zero otherwise. All other variables are as defined for model (1). Table 4b reports the results for these models; only the coefficients on the main health problems and the significant (at $p = 0.01$) interactions are reported. Again the coefficients on the mental and physical health problems are reduced in size

compared to Table 3 but remain statistically significant. Of the 38 interactions reported in Table 4a, the majority (28) are positive, meaning that the presence of both disorders reduces health utility by a smaller amount than that suggested by the additive model. However in 10 cases the interaction term has a negative coefficient suggesting that the presence of both problems reduces health utility by a larger amount than that suggested by the additive model. Despite the insignificant main effects for alcohol dependence, there are significant positive interactions with GAD, MADD and depression.

Severity of mental health condition

The models in Table 3 indicate the presence of each condition with a simple dichotomous variable. For cost effectiveness modeling it is often useful to know the severity of the condition, as quality of life decrements and health care costs are usually much higher for greater levels of disability. Each condition is diagnosed via a set of four questions from the CIS-R. For example for Anxiety these are: (i) felt generally anxious/nervous/tense for 4 days or more in the past seven days 1; (ii) in past seven days anxiety/nervousness/tension has been very unpleasant; (iii) in the past seven days have felt any of the following symptoms when anxious/nervous/tense (Racing heart, sweating or shaking hands, feeling dizzy, difficulty getting one's breath, dry mouth, butterflies in stomach, nausea or wanting to vomit); (iv) felt anxious/nervous tense for more than three hours in total on any one of the past seven days. Each question scores one if that symptom was present, giving a total Anxiety score ranging from zero for no symptoms to four. This score can be used as a measure of severity of the condition.

We have explored the severity of two conditions, anxiety and depression. We estimate model (1) and in the vector M , the dichotomous variable for the presence of anxiety (depression) is replaced with a set of four dummy variables indicating the score, compared to a baseline of zero. The results are shown in Table 5; the effect on other coefficients is negligible so only the estimated coefficients on the new set of dummy variables are reported. The results for depression are as expected, the utility decrement increases with the severity of the condition. However, for anxiety, while there is a gradient overall from level 1 to 4, the estimated coefficient for levels 3 and 4 have very similar decrements. In cost effectiveness modelling the common solution for this problem is to aggregate levels until a consistent gradient is achieved. Despite the insignificant main effects for psychosis and personality disorder, the former has a significant positive interaction with blood disorder and the latter with GU problems. Similarly, alcohol dependency despite being insignificant on its own, has a significant negative interaction with

blood disorder and positive interactions with muscular skeletal problems, digestive problems, GU problems and skin complaints.

Discussion

There is little existing data on the impact of mental health problems on the health utility scale, especially for more complex problems like psychosis and personality disorder. (Brazier, 2008). Our estimates from over 10,000 responses to the PMS 2000 and 2007 show that all but three of the mental health problems considered here have a statistically significant and relatively large adverse effect on health utility; these effects are larger than for self reported physical health problems. The effects are also stable across 2000 and 2007. The three problems that are not statistically significant are alcohol dependency, personality disorder and psychosis; the latter two could be due to relatively small numbers, as less than 1% of the sample has these problems. For alcohol dependency we explored whether this was due to our relatively broad definition of *any* dependency, by testing the effects of moderate and severe dependence on alcohol (as defined by the SADQ) alone, but these were not statistically significant either.

We explored the effects of comorbidities by exploring the first order interactions between all mental health problems and also mental and physical health problems; this relaxes the restrictive additive specification of the model. For mental health problems the significant interactions are all positive, meaning that having both problems results in a health utility decrement that is less than the sum of the individual coefficients. This would suggest that an additive model would overestimate the effect of mental health problems in the presence of comorbidities within mental health. When considering interactions between mental and physical health problems, the majority are positive, however in ten cases the interaction is negative suggesting that the presence of both problems reduces health utility by a larger amount than the additive model would suggest.

Brief exploration of the effects of the severity of anxiety and depression on the health utility index, suggest that for depression the results are as expected, the utility decrement increasing with the severity of the condition. However, for anxiety the gradient is not smooth and in practice this would tend to result in aggregation of levels of severity in cost effectiveness modelling.

Overall the models we have estimated have good explanatory power but the RESET test does suggest misspecification problems. The SF12 index is highly skewed and our initial exploration of Tobit and GLM models to deal with these issues was not successful but we will explore this in further work.

It is worth stressing here that the data we have used to estimate these models is not based on clinical diagnosis of mental health problems, but instead on well established instruments administered by trained interviewers. There may also be a concern as to a generic measure of health like the SF-12 adequately assesses the impact of all mental disorders – particularly personality disorders and psychosis. In addition the models do not include the quality of life impact on carers, only the individuals themselves, and the data is limited to those living in private households.

SECTION II: CHILDHOOD STRESSFUL LIFE EVENTS AND HEALTH UTILITY

In this section we examine the additional impact of stressful life events experienced before the age of 16 on SF-12 health state utility values. We condition on background characteristics, physical health conditions, mental health disorders and also in some models, recently experienced traumatic life events. Our focus is on whether stressful life events experienced in childhood are associated with additional health utility decrements even after background mental health and physical health are taken into account.

That data comes from the 2007 PMS survey, which includes questions on stressful life events experienced by respondents and the time at which these events occur. First the respondent is asked whether they have ever experienced any of the specific problems or events shown on a list. If they answer yes to any of these, they are then asked when the event happened: within the last 6 months; more than 6 months ago but after age 16; more than 6 months ago and before age 16. The list of events is shown in Table 6.

The basic model to be estimated is:

$$U_i = f(M_i, P_i, E_i, X_i, \epsilon_i) \quad (2)$$

Where U_i is health utility for respondent i ; M is mental health, P is physical health, E is a set of stressful life events, and we distinguish between those experienced before age 16 and those experienced within the last 6 months. X is a set of background characteristics. ϵ_i is a random error term. As in Section I the dependent variable (U) is the SF-6D health utility index derived from individual responses to the SF-12. The distribution is highly skewed but for ease of exposition we continue to use OLS estimation with robust standard errors and leave exploration of alternative functional forms for future work.

As in Section I mental health (M) is measured using a set of dichotomous variables to represent the presence of specific disorders. Physical health (P) is measured by a set of dichotomous variables denoting the presence of self-reported long-standing health problems: muscular-skeletal, respiratory, digestive, heart and circulatory, urinary, skin, ear, eye, neoplasm, blood disorder, and infection. The set of background variables (X) include age, marital status, presence

of children aged 16 in the household, employment status, ethnicity, education and income. See Appendix 1 for a full list of variables and definitions.

Table 6 shows the frequency of stressful life events experienced in our sample. Data for males and females are pooled due to the small number of some events reported and the sample is limited to those aged 25 and over to ensure that the childhood life event was not experienced recently. The most common stressful childhood life event reported is bullying, which was experienced by 17% of our sample. 14% of the sample reported death of a family member or friend, 5% of our sample report experiencing sexual abuse in childhood, and 5% report experiencing serious illness or injury in childhood. In terms of recent life events, 9% report death of close friend or family member, and 5% report problems with losing or not finding a job.

The results of OLS estimation of equation (2) are shown in Table 7. There are two models: the first includes background characteristics, physical health problems, mental health problems and dummy variables for each life event experienced before age 16; the second model also includes a set of dummy variables for life events experienced in the past six months. The inclusion of these recent life events makes little difference to the effects of childhood life events on health state utility. Two childhood events have a significant negative effect on health state utility event after background characteristics, physical health problems, mental health problems and recent life events are controlled for; these are a serious illness or injury before age 16 which reduces the SF12 index by 0.023, and sexual abuse in childhood which reduces the index by 0.028.

Stressful events in childhood, such as bullying and bereavement seem to be commonly experienced by the respondents to the PMS2007, and we have explored the additional impact of these events on SF-12 health state utility values. Only serious illness or injury, and sexual abuse in childhood seem to have a lasting impact once current physical and mental health problems are taken into account. These events are relatively rare, experienced by only 5% of the sample in both cases. This analysis assumes a simple additive model but exploration of the interaction of childhood life events with current mental health problems revealed no significant interaction effects.

SECTION III: DEBT AND MENTAL DISTRESS (Objective iv)

In this section we examine the relationship between mental health and debt. Our focus is on whether having a mental health condition increases the probability of being in debt after controlling for personal characteristics, demographics, income and physical health conditions. Jenkins et al (2008) investigate the relationship between debt, income and mental disorder using PMS 2000. They find that those with low incomes are more likely to have a mental health problem, but that this relationship is attenuated when debt is adjusted for and disappears completely when other sociodemographic variables are taken into account.

We are able to use both the 2000 and 2007 PMS as the debt questions are consistent across surveys. Specifically, the question is asked 'have there been times during the last year when you were seriously behind in paying within the time allowed for any of these items?' this is followed by a list of 15 possible payees, which includes different utilities, housing and credit providers. We calculate a binary dependent variable that takes the value of one if the respondent answers yes to any of these debts. In addition, to examine whether the type of debt matters for its influence on health, we create two further dependent variables, household debt and non-household debt, which as their names imply reflect mortgage, rent and utilities debts and such debt as credit cards and catalogues, respectively. The estimation method for this analysis is Probit models of debt, household debt and non household debt. Household debts are defined here as including: rent, mortgage, utility bills, council tax and TV licence. Non-household debts include: hire purchase, credit cards, catalogues, loans, road tax, social fund loan. This model predicts the probability of reporting being in debt after controlling for physical and mental health conditions, and other characteristics.

The model estimated is:

$$\text{Prob } D_i = f(M_i, P_i, X_i, \varepsilon_i) \quad (3)$$

Where D_i is whether debt is reported for respondent i ; M is mental health, P is physical health, X is a set of background characteristics and ε_i is a random error term. Models are estimated with the dichotomous variable for reported debt, household debt and non household debt as the dependent variable. We build the model by estimating three specifications; the first includes the personal characteristics (X) only as explanatory variables, specification 2 then incorporates physical health problems (P) and specification 3 adds the mental health conditions (M). In this way we can examine whether the influence of personal characteristics on debt changes when we

include physical health and whether or not the inclusion of mental health conditions changes the estimates of physical health. To enable an interpretation of the magnitude of the influence on debt of the independent variables, we calculate the marginal effects, which provide an estimate of the change in the probability of reporting debt for a change in an independent variable.

Tables 8 and 9 report debt by income level and debt by mental health disorder, respectively, for the full sample and for separate years, and for household and non-household debt. From table 8 we can see that reported debt was much higher in 2000 compared to 2007 for all income brackets. The debt questions in each of the surveys are identical and therefore this is taken to be a macroeconomic effect. Furthermore, reported household debt is always greater than non-household debt across both years. In Table 9 we can see that for all mental health disorders reported debt was higher in 2000 than in 2007. Respondents with a phobia or drug dependency are those most likely to report being in debt and individuals who have MADD have the lowest reported debt. However, approximately one third of respondents in each mental health category report debt and a larger proportion of respondents report household debt compared to non-household debt.

The estimates of the probit models of debt are reported in Tables 10 through 13 for males and Tables 14 through 17 for females. We report results separately by sex as there are some differences between the findings for men and women. The significant results in column 1 of Table 10 reveal that males who are widowed or divorced are more likely to be in debt than those who are single. Having a degree level of education reduces the probability of reporting debt compared to holding no qualifications as does being non white compared to being white. The gross income variables are well behaved, providing evidence that the likelihood of being in debt reduces as income increases. In column 2 the addition of physical health variables does not significantly change the personal characteristic estimates and show that having a skeletal or muscular problem, a urinary complaint or an infectious disorder increases the probability of being in debt. When we include the mental health dummies, column 3, only the infectious disease physical problem remains significant. Having MADD, panic disorder, alcohol dependency or drug dependency increases the probability of reporting debt. Tables 11 and 12 report the estimates for household and non-household debt, respectively for males. Holding a degree or A level qualification reduces the probability of being in household debt but is not significant in the non-household debt model where holding low level qualifications compared to no qualifications actually increases the probability of reporting this type of debt. Being non-white

has a positive influence on reporting debt but only household debt and being in work reduces the probability of household debt only.

We focus the rest of our discussion for males on the marginal effects of specification 3, which are reported in Table 13. The marginal effects for income reveal that compared to the base category (earning less than £5200 per annum), a respondent who earns between £5200 and 10399 reduces his probability of being in debt by 3 percentage points and a respondent who earns more than £33800 reduces his probability of being in debt by nearly 15 percentage points. The marginal effects on income are larger in magnitude for household debt than non-household i.e. a respondent earning more than £33800 compared to the base category reduces his probability of reporting household debt by 9 percentage points whereas for non-household debt the reduction is only 4 percentage points. The marginal effects on our mental health variables also reveal a stronger effect on household debt than non-household debt. Respondents with MADD increase the probability of being in debt by 8 percentage points, being in household debt by 7 percentage points and being in non-household debt by 4 percentage points. Alcohol dependency has a significant effect on overall debt (3 percentage points) and non-household debt (2 percentage points). Drug dependency has a greater influence on increasing the probability of household debt (8 percentage points) than non-household debt (3 percentage points).

The significant results in column 1 of Table 14 reveal that females who are married are less likely to be in debt than those who are single. This result is in contrast to males who were more likely to be in debt if they were widowed or divorced but had no significant effects from being married. For each higher level of education qualification, compared to holding no qualifications, we see an increasing reduction in the probability of reporting debt. The gross income variables are significant only for the highest and lowest band compared to the base category with the positive estimate on the lowest band suggesting that the likelihood of being in debt increases. These findings are in contrast to males where all levels of income is significant and education insignificant. The coefficients on ethnicity are not significant. In column 2 the addition of physical health variables does not significantly change the personal characteristic estimates and they show that only having a digestive complaint increases the probability of being in debt. When we include the mental health dummies, column 3, none of the physical health conditions are significant. Having GAD, MADD, panic disorder, depression, psychosis or drug dependency increases the probability of reporting debt. Tables 15 and 16 report the estimates for household

and non-household debt, respectively for females. Holding any level of education qualification is statistically significant and reduces the probability of household debt (column 1; Table 15) however, only holding a degree or A level qualification reduces the probability of being in non-household (column 1; Table 16). Gross income variables in the top two income categories are significant in the model of household debt but are largely insignificant in the model of non-household debt.

We continue our discussion for females on the marginal effects of specification 3, which are reported in Table 17. The marginal effects for the education dummies reveal that compared to the base category (no qualifications), a respondent who holds a degree reduces her probability of being in debt by 9 percentage points; if she holds A levels or GCSEs this is reduced to 8 and 5 percentage points, respectively. A similar pattern is seen for the marginal effects of holding a degree, A levels and GCSEs on household debt (6, 5 and 3 percentage points, respectively). However, only holding a degree reduces the probability of housing debt (11 percentage points). Only a personal income of between £5200 – 10399 has a statistically significant positive effect on overall debt compared to an income of less than £5200. This positive marginal effect (3 percentage points) at first appears contrary to expectations but could be explained if a female earning less than £5200 is likely to qualify for benefits which will assist her to pay her debts. The marginal effects on the mental health variables reveal the strongest effect on all our debt measures is where a female has a problem of drug dependency. These effects are stronger for household than non-household debt (11 and 8 percentage points, respectively). A respondent with MADD increases her probability of being in debt and in household debt by 5 percentage points and being in non-household debt by 3 percentage points. Having a phobia or a GAD also significantly increases the probability of reporting all types of debt.

Discussion

In contrast to Jenkins et al (2008) we find that even after controlling for sociodemographic factors and income, a number of mental health problems are still associated with a greater probability of being in debt. Our method is based on probit models using individual level data from PMS 2000 and 2007. Jenkins et al (2008) used cell means and only had access to PMS 2000 so this may account for the difference in our results. In addition in their sociodemographic factors Jenkins et al do not include physical health problems, this is a major shortcoming, since as our results show, these are also significantly associated with the probability of being in debt in a number of cases. The marginal effects reveal that these effects are quantitatively important

increasing the chances of being in debt by 9 percentage points in some cases. It is important to stress that this is cross section data so we cannot deduce the direction of causality between mental health problems and debt from these results. We can however state that mental health problems significantly increase the chances of having both household and non-household debts even after physical health problems and socio-demographic characteristics are taken into account.

SECTION IV: DIRECTIONS FOR FURTHER WORK

PCT IDENTIFIERS

The basic PMS data sets that are available freely from the data archive do not include any usable geographical identifiers. Regional variation may be an important factor in mental health prevalence. Geographical identifiers are available for an additional payment; we acquired PCT identifiers for the 2007 PMS survey. These were matched to Strategic Health Authority areas. Table 18 reports prevalence of mental health disorders by SHA and this reveals a fair amount of variation across SHA. The prevalence of depression for example varies from 2.3% in South East Coast to 5.2% in East Midlands, and drug dependency varies from 2.1% in East of England to 5.1% in London. This regional variation is worthy of further study. We plan to work with Professor Glenys Parry (University of Sheffield) to compare the prevalence of mental health disorders found in the PMS data with prevalence found in the primary care Quality Assessment Framework (QAF) data. We will explore whether differences are associated with socio-economic characteristics of the regions or supply side factors.

PHD FELLOWSHIP: MODELLING HEALTH OUTCOMES DATA

The non-normality of the health outcome data is an important topic in health economics and econometrics. While there is a large literature on the non-normality of cost data in health care (see for example Jones 2010 for a comprehensive review), there is much less work on the non-normality of health outcome data, such as the SF-6D index, which is obtained from the SF-12 instrument included in the PMS survey. In this study we briefly explored alternative specifications for the index including tobit and GLM. However, this is a much larger topic of research and prompted by our exploratory work we have applied for an NIHR Doctoral Fellowship (application submitted 11 Jan 2011) for Chantelle Brown, a Research Officer at the Academic Unit of Health Economics, Leeds Institute of Health Sciences, University of Leeds.

The fellowship will be supervised by Richard Edlin and Jennifer Roberts (University of Leeds) and key experts have agreed to be part of the supervisory panel, including Andrew Jones (University of York) and John Brazier (University of Sheffield). In addition the fellowship proposal includes a study visit to the University of Chicago to work with Willard Manning, who leads the field in modelling health care costs data.

OTHER AREAS

A number of other areas are potentially of interest to economists beyond the remit of health economics. These include: social capital and mental health; work stress and mental health; caring responsibilities and mental health.

SHORTCOMINGS

One of the main shortcomings of the PMS data is that it is a repeated cross section study, and thus it is very difficult to establish causal relationships from the data. The models we have estimated do control for a wide set of background variables but we are only establishing a significant statistical association between say mental health problems and health state utility and mental health problems and the probability of being in debt, and not providing evidence for causality. The standard econometric approach to dealing with endogenous relationships with cross section data is to use instrumental variables to derive causal effects, however in the applications we consider here we were not able to identify suitable instruments in the PMS data.

During the course of this study we became aware that a longitudinal follow-up survey to the 2000 PMS was carried out in 2002; this covered 2406 people from the original survey (see Singleton and Lewis, 2003). This data has been used by Skapinakis et al (2006) to explore socio-economic position and common mental disorders, and by Haynes et al (2008) who look at on alcohol consumption as a risk factor in common mental disorders. The follow-up survey was carried out by ONS but was never archived and the ONS staff involved have since left. To date we have not been able to acquire this data and this is very disappointing as longitudinal data is particularly valuable for causal modelling.

References

- APMS (2007) Adult Psychiatric Morbidity Survey 2007: User Guide. Natcen.
- Basu A (2005) Extended generalized linear models: Simultaneous estimation of flexible link and variance functions. *The Stata Journal* 5(4): 501-16.
- Basu A, Rathouz PJ (2005) Estimating marginal and incremental effects on health outcomes using flexible link and variance function models. *Biostatistics* 6(1): 93-109.
- Brazier J. Measuring and valuing mental health for economic evaluation. *Journal of Health Services Research and Policy* 2008, 13 (S3) :70-75.
- Brazier JE, Roberts J, Deverill M (2002) The estimation a preference-based single index measure for health from the SF-36. *Journal of Health Economics*; 21(2):271-292
- Brazier JE, Roberts J. Estimating a preference-based index from the SF-12. *Medical care* 2004;42:851-859.
- Dolan P (1997) Modelling valuation for Euroqol health states. *Medical Care*; 35:351-363
- Greene, W (2000) *Econometric Analysis* 4th Edition.
- Haynes JC, Farrell M, Singleton N, Meltzer H, Araya R, Lewis G, Wiles NJ (2007) Alcohol consumption as a risk factor for non-recovery from common mental disorder; results from the longitudinal follow-up of the National Psychiatric Morbidity Survey *Psychological Medicine* 38(3): 451-5.
- Jenkins R, Bhugra P, Bebbington P, Brugha T, Farrell M, Coid J, Fryers T, Weich S, Singleton N, Meltzer H (2008) Debt, income and mental disorder in the general population. *Psychological Medicine* 38, 1485-93.
- Jones AM (2010) Models for health care. HEDG Working Paper 10/01 University of York.
- McManus S, Meltzer H, Brugha T, Bebbington P, Jenkins R. (2007) Adult Psychiatric Morbidity in England, 2007: Results of a household survey. National Centre for Social Research and the Department of Health Sciences, University of Leicester.
- National Institute for Health and Clinical Excellence (NICE) 2008. Guide to the methods of technology appraisal. London, NICE.
- Pregibon D (1980) Goodness of link tests for generalized linear models. *Applied Statistics* 29:15-24
- Ramsey JB (1969) Tests for specification errors in classical linear least squares regression analysis. *Journal of the Royal Statistical Society B* 31:350-70.
- Singleton N, Lee A, Meltzer H.(2000) Psychiatric Morbidity among Adults living in Private Households. Office for National Statistics Technical Report, London.

Singleton N, Lewis G (2003) Better or worse: a longitudinal study of the mental health of adults living in private households in Great Britain. Office for National Statistics, London

Skapinidis P, Weich S, Lewis G, Singleton N, Araya R. (2006) Socio-economic position and common mental disorders: Longitudinal study in the general population in the UK. *British Journal of Psychiatry* 189:109-117.

Sullivan PW, Lawrence WF, Ghushchyan V. 2005. A national catalogue of preference-based scores for chronic conditions in the United States. *Medical Care* 43:736-40

Tobin J (1958) Estimation of relationships for limited dependent variables. *Econometrica* 26:24-36.

Ware JE, Snow KK, Kolinski M, Gandek B (1993) *SF-36 Health Survey manual and interpretation guide*. Boston: The Health Institute, New England Medical Centre, Boston.

Table 1: Descriptive statistics by year.

	2000 (n = 5688)		2007 (n = 5388)	
	mean	Std dev	mean	Std dev
Male	0.45	0.50	0.44	0.50
Single	0.21	0.41	0.22	0.41
married	0.61	0.49	0.62	0.49
widow/divorced/separated	0.18	0.38	0.16	0.37
age	42.08	12.80	43.44	12.85
Children under 16	0.36	0.48	0.33	0.47
Education- Degree	0.16	0.37	0.23	0.42
Education- HND/Teach/Nursing	0.74	0.26	0.80	0.27
Education - A level	0.15	0.35	0.16	0.36
Education - GCSE/O level	0.26	0.44	0.29	0.45
Education - lower level	0.11	0.31	0.03	0.16
Education - none	0.24	0.43	0.20	0.40
Gross personal income < £5200 p.a.	0.25	0.43	0.17	0.38
Gross personal income 5200-10399 p.a.	0.22	0.41	0.19	0.39
Gross personal income 10400 -15559 p.a.	0.18	0.38	0.17	0.37
Gross personal income 15560m-20799 p.a.	0.12	0.33	0.12	0.33
Gross personal income 20800 -33799 p.a.	0.16	0.37	0.21	0.41
Gross personal income >33800 p.a.	0.07	0.26	0.14	0.35
Non white	0.07	0.26	0.12	0.33
Working	0.70	0.46	0.71	0.46
Reported in debt	0.10	0.29	0.10	0.31
Household debt	0.11	0.32	0.09	0.29
Non-household debt	0.06	0.23	0.04	0.20

Table 2. Physical and mental health problems by year.

	2000		2007	
	<i>n</i>	%	<i>n</i>	%
<i>Physical health</i>				
No physical health problems	3697	65.0	2182	40.5
Muscular/skeletal complaint	1012	17.8	1459	27.1
Respiratory complaint	420	7.4	549	10.2
Digestive complaint	265	4.7	341	6.3
Heart/circulatory complaint	444	7.8	788	14.6
Urinary related complaint	129	2.3	459	8.5
Skin complaint	86	1.5	640	11.9
Ear complaint	90	1.6	344	6.4
Eye complaint	61	1.1	758	14.1
Neoplasm	66	1.2	51	0.9
Blood disorder	27	0.5	187	3.5
Infectious disorder	17	0.3	35	0.6
<i>Mental health</i>				
No mental health problems *	4225	74.2	4038	74.9
Generalised anxiety disorder	311	5.5	302	5.6
Mixed anxiety depressive disorder	553	9.7	545	10.1
Panic disorder	51	0.9	70	1.3
Obsessive compulsive disorder	86	1.5	76	1.4
Phobia	131	2.3	136	2.5
Depression	188	3.3	179	3.3
Psychosis	44	0.8	37	0.7
Personality disorder	16	0.3	15	0.3
Alcohol dependency (any)	440	7.7	341	6.3
Drug dependency	199	3.5	180	3.3
<i>Neurotic symptoms score</i>				
cisr score_1 (0 - 5)	3668	68.1	3478	64.6
cisr score_2 (6 - 11)	1020	18.9	934	17.3
cisr score_3 (12 -17)	500	9.3	457	8.5
cisr score_4 (18 -23)	252	4.7	237	4.4
cisr score_5 (24 –29)	135	2.5	147	2.7
cisr score_6 (30 –35)	75	1.4	86	1.6
cisr score_7 (36+)	42	0.8	49	0.9

* No mental health problem category includes a score of 11 or below on the cis-r scale.

Table 3: Determinants of SF12 health index - OLS regression**Dependent variable Sf12 index**

N = 10310	(1)		(2)		(3)		(4)	
	coef	p value	coef	p value	coef	p value	coef	p value
male	0.012	0.000	0.012	0.000	0.011	0.000	0.004	0.059
married	0.013	0.000	0.016	0.000	0.008	0.014	0.007	0.017
widow/divorced/separated	-0.027	0.000	-0.022	0.000	-0.015	0.000	-0.012	0.001
age	-0.009	0.000	-0.008	0.000	-0.005	0.000	-0.004	0.000
age squared	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Children under 16	0.016	0.000	0.011	0.000	0.007	0.011	0.010	0.000
Education- Degree	0.014	0.003	0.011	0.007	0.001	0.770	0.003	0.476
Education- HND/Teach/Nursing	0.013	0.017	0.014	0.007	0.006	0.175	0.005	0.281
Education - A level	0.017	0.000	0.017	0.000	0.009	0.017	0.008	0.025
Education - GCSE/O level	0.016	0.000	0.015	0.000	0.007	0.023	0.006	0.064
Education - lower level	0.013	0.020	0.012	0.019	0.007	0.142	0.007	0.116
North	-0.001	0.843	0.001	0.898	0.001	0.789	0.003	0.604
North West	-0.005	0.326	-0.003	0.578	-0.002	0.559	0.000	0.947
Yorkshire and Humber	0.008	0.135	0.010	0.048	0.007	0.111	0.009	0.027
East Midlands	0.006	0.335	0.007	0.194	0.004	0.415	0.005	0.250
West Midlands	0.000	0.996	0.001	0.803	-0.001	0.737	0.001	0.843
East of England	0.014	0.008	0.012	0.017	0.012	0.008	0.012	0.004
South West	0.014	0.005	0.013	0.004	0.010	0.011	0.012	0.001
South East	0.024	0.000	0.025	0.000	0.019	0.000	0.017	0.000
Gr personal inc 5200-10399	-0.012	0.004	-0.008	0.037	-0.007	0.039	-0.007	0.031
Gr personal inc 10400 -15559	0.004	0.405	0.006	0.196	0.001	0.732	0.000	0.991
Gr personal inc 15560m-20799	0.013	0.010	0.013	0.008	0.007	0.107	0.005	0.187
Gr personal inc 20800 -33799	0.021	0.000	0.017	0.000	0.008	0.055	0.006	0.092
Gr personal inc >33800	0.030	0.000	0.026	0.000	0.017	0.001	0.013	0.004
Non white	0.003	0.507	-0.004	0.340	-0.003	0.459	-0.001	0.723
Working	0.072	0.000	0.057	0.000	0.039	0.000	0.037	0.000
Year 2007	-0.005	0.051	0.018	0.000	0.016	0.000	0.013	0.000
Muscular/skeletal complaint			-0.086	0.000	-0.071	0.000	-0.060	0.000
Respiratory complaint			-0.041	0.000	-0.029	0.000	-0.024	0.000
Digestive complaint			-0.046	0.000	-0.030	0.000	-0.022	0.000
Heart/circulatory complaint			-0.035	0.000	-0.028	0.000	-0.023	0.000
Urinary related complaint			-0.065	0.000	-0.040	0.000	-0.032	0.000
Skin complaint			-0.026	0.000	-0.016	0.000	-0.009	0.029
Ear complaint			-0.033	0.000	-0.028	0.000	-0.024	0.000
Eye complaint			-0.014	0.004	-0.006	0.154	-0.005	0.225
Neoplasm			-0.079	0.000	-0.054	0.000	-0.042	0.000
Blood disorder			-0.030	0.001	-0.034	0.000	-0.024	0.001
Infectious disorder			-0.063	0.000	-0.050	0.002	-0.041	0.006
Generalised anxiety disorder					-0.086	0.000		
Mixed anxiety depressive disorder					-0.136	0.000		

Panic disorder					-0.077	0.000		
Obsessive compulsive disorder					-0.057	0.000		
phobia					-0.083	0.000		
Depression					-0.137	0.000		
Psychosis					-0.001	0.913		
Personality disorder					-0.010	0.609		
Alcohol dependency					-0.002	0.568		
Drug dependency					-0.027	0.000		
cisr score_2							-0.088	0.000
cisr score_3							-0.145	0.000
cisr score_4							-0.193	0.000
cisr score_5							-0.229	0.000
cisr score_6							-0.250	0.000
cisr score_7							-0.270	0.000
constant	0.875	0.000	0.880	0.000	0.881	0.000	0.897	0.000
Adjusted R2	0.123		0.245		0.411		0.482	
Reset test	52.7	0.000	59.04	0.000	79.07	0.000	38.51	0.000
Pregibon test	-5.445	0.000	-1.59	0.000	0.348	0.000	-0.426	0.000
Breusch-Pagan/ Cook -Weisberg	626.79	0.000	447.85	0.000	254.85	0.000	225.27	0.000

Table 4a: Determinants of SF12 health index - OLS specification (3) with mental health interaction terms

	Coef.	p.Value	Coef.	p.Value	Coef.	p.Value	Coef.	p.Value	Coef.	p.Value
Generalised anxiety disorder (GAD)	-0.094	0.000	-0.101	0.000	-0.107	0.000	-0.094	0.000	-0.090	0.000
Mixed anxiety depressive disorder (MADD)	-0.137	0.000	-0.137	0.000	-0.137	0.000	-0.136	0.000	-0.136	0.000
Panic disorder	-0.075	0.000	-0.074	0.000	-0.073	0.000	-0.079	0.000	-0.079	0.000
Obsessive compulsive disorder (OCD)	-0.099	0.000	-0.056	0.000	-0.057	0.000	-0.058	0.000	-0.057	0.000
Phobia	-0.083	0.000	-0.133	0.000	-0.086	0.000	-0.085	0.000	-0.086	0.000
Depression	-0.137	0.000	-0.138	0.000	-0.182	0.000	-0.138	0.000	-0.136	0.000
Psychosis	-0.005	0.642	-0.013	0.233	-0.003	0.770	-0.004	0.687	-0.002	0.820
Personality disorder	-0.014	0.543	-0.004	0.849	-0.009	0.707	-0.014	0.560	-0.012	0.608
Alcohol dependency	-0.002	0.565	-0.002	0.574	-0.002	0.548	-0.008	0.051	-0.002	0.598
Drug dependency	-0.027	0.000	-0.028	0.000	-0.025	0.000	-0.026	0.000	-0.033	0.000
GAD X OCD	0.103	0.000								
GAD X Phobia			0.121	0.000						
GAD X Depression					0.122	0.000				
GAD X Alcohol dependency							0.057	0.000		
GAD X Drug dependency									0.057	0.006
constant	0.882	0.000	0.881	0.000	0.882	0.000	0.882	0.000	0.881	0.000

	Coef.	p.Value	Coef.	p.Value	Coef.	p.Value	Coef.	p.Value	Coef.	p.Value
Generalised anxiety disorder (GAD)	-0.086	0.000	-0.085	0.000	-0.085	0.000	-0.085	0.000	-0.086	0.000
Mixed anxiety depressive disorder (MADD)	-0.138	0.000	-0.136	0.000	-0.137	0.000	-0.137	0.000	-0.136	0.000
Panic disorder	-0.077	0.000	-0.074	0.000	-0.076	0.000	-0.074	0.000	-0.078	0.000
Obsessive compulsive disorder (OCD)	-0.056	0.000	-0.096	0.000	-0.110	0.000	-0.056	0.000	-0.059	0.000
phobia	-0.083	0.000	-0.105	0.000	-0.083	0.000	-0.127	0.000	-0.085	0.000
Depression	-0.137	0.000	-0.136	0.000	-0.155	0.000	-0.165	0.000	-0.144	0.000
Psychosis	-0.001	0.920	-0.003	0.770	0.004	0.696	-0.006	0.548	-0.002	0.825
Personality disorder	-0.010	0.660	-0.016	0.480	-0.018	0.428	-0.013	0.576	-0.014	0.552
Alcohol dependency	-0.006	0.192	-0.002	0.689	-0.003	0.497	-0.003	0.448	-0.005	0.200
Drug dependency	-0.027	0.000	-0.025	0.000	-0.025	0.000	-0.025	0.000	-0.026	0.000
MADD X Alcohol dependency	0.024	0.051								
OCD X Phobia			0.133	0.000						
OCD X Depression					0.127	0.000				
Phobia X Depression							0.126	0.000		
Depression X Alcohol dependency									0.040	0.019
constant	0.881	0.000	0.882	0.000	0.882	0.000	0.882	0.000	0.881	0.000

Table 4b: Determinants of SF12 health index – OLS specification (3) with mental health and physical health interaction terms

	coefficient	p value		coefficient	p value
generalised anxiety disorder	-0.095	0.000	Panic	-0.070	0.000
muscular/skeletal complaint	-0.073	0.000	skin complaint	-0.014	0.001
GAD X muscular/skeletal	0.025	0.028	Panic X skin complaint	-0.048	0.046
generalised anxiety disorder	-0.090	0.000	Panic	-0.085	0.000
digestive complaint	-0.034	0.000	ear complaint	-0.030	0.000
GAD X digestive complaint	0.034	0.052	Panic X ear complaint	0.108	0.005
generalised anxiety disorder	-0.091	0.000	Panic	-0.091	0.000
gu complaint	-0.044	0.000	eye complaint	-0.008	0.069
GAD X gu complaint	0.039	0.032	Panic X eye complaint	0.153	0.000
generalised anxiety disorder	-0.091	0.000	OCD	-0.063	0.000
eye complaint	-0.009	0.041	digestive complaint	-0.032	0.000
GAD X eye complaint	0.039	0.025	OCD X digestive complaint	0.092	0.006
generalised anxiety disorder	-0.088	0.000	OCD	-0.063	0.000
infectious disease	-0.069	0.000	gu complaint	-0.041	0.000
GAD X infectious disease	0.179	0.004	OCD X gu complaint	0.055	0.059
MADD	-0.133	0.000	OCD	-0.059	0.000
respiratory complaint	-0.025	0.000	ear complaint	-0.029	0.000
MADD X respiratory complaint	-0.025	0.014	OCD X ear complaint	0.120	0.019
MADD	-0.139	0.000	OCD	-0.055	0.000
gu complaint	-0.045	0.000	blood disorder	-0.033	0.000
MADD X gu complaint	0.028	0.026	OCD X blood disorder	-0.091	0.014
MADD	-0.139	0.000	Phobia	-0.097	0.000
skin complaint	-0.020	0.000	muscular/skeletal complaint	-0.072	0.000
MADD X skin complaint	0.031	0.016	Phobia X muscular/skeletal	0.038	0.023
MADD	-0.135	0.000	Phobia	-0.089	0.000
blood disorder	-0.030	0.002	digestive complaint	-0.033	0.000
MADD X blood disorder	-0.039	0.062	Phobia X digestive complaint	0.055	0.026
Panic	-0.094	0.000	Phobia	-0.090	0.000
muscular/skeletal complaint	-0.072	0.000	gu complaint	-0.043	0.000
Panic X muscular/skeletal	0.048	0.069	Phobia X gu complaint	0.050	0.043
Phobia	-0.086	0.000	Personality disorder	-0.001	0.956
ear complaint	-0.030	0.000	gu complaint	-0.039	0.000
Phob X ear complaint	0.069	0.062	Personality disorder X gu complaint	-0.132	0.005
Phobia	-0.082	0.000	Personality disorder	-0.028	0.247
blood disorder	-0.032	0.000	skin complaint	-0.016	0.000
Phobia X blood disorder	-0.119	0.090	Personality disorder X skin complaint	0.129	0.037
Phobia	-0.086	0.000	Alcohol dependency	-0.007	0.122
infectious disease	-0.066	0.000	muscular/skeletal complaint	-0.072	0.000
Phobia X infectious disease	0.253	0.000	Alcohol dependency X		
			muscular/skeletal	0.019	0.084
Depression	-0.154	0.000	Alcohol dependency	-0.005	0.243
muscular/skeletal complaint	-0.073	0.000	digestive complaint	-0.034	0.000
Depression X muscular/ skeletal	0.053	0.000	Alcohol dependency X digestive		
			complaint	0.048	0.036

Depression	-0.147	0.000	Alcohol dependency	-0.005	0.250
respiratory complaint	-0.032	0.000	gu complaint	-0.043	0.000
Depression X respiratory complaint	0.060	0.000	Alcohol dependency X gu complaint	0.043	0.042
Depression	-0.143	0.000	Alcohol dependency	-0.005	0.295
gu complaint	-0.043	0.000	skin complaint	-0.018	0.000
Depression X gu complaint	0.039	0.063	Alcohol dependency X skin complaint	0.030	0.046
Depression	-0.136	0.000	Alcohol dependency	-0.002	0.714
blood disorder	-0.032	0.000	blood disorder	-0.031	0.001
Depression X blood disorder	-0.060	0.023	Alcohol dependency X blood disorder	-0.098	0.000
Depression	-0.139	0.000	Drug dependency	-0.026	0.000
infectious disease	-0.066	0.000	neoplasm	-0.051	0.000
Depression X infectious disease	0.193	0.011	Drug dependency X neoplasm	-0.061	0.045
Psychosis	0.001	0.904	Drug dependency	-0.027	0.000
blood disorder	-0.033	0.000	infectious disease	-0.053	0.004
Psychosis X blood disorder	-0.097	0.000	Drug dependency X infectious disease	0.154	0.000

Table 5: Severity of Anxiety and Depression

	(1) Depression		(2) Anxiety	
Score	Coef	P value	Coef	P value
1	-0.062	0.000	-0.035	0.000
2	-0.084	0.000	-0.070	0.000
3	-0.127	0.000	-0.065	0.000
4	-0.149	0.000	-0.086	0.000

Notes: Estimates from models as in Table 3, with dichotomous variable for each condition replaced with CIS-R score for that condition.

Table 6: Frequency of Life events

Event	n	%
Serious illness or injury to self before age 16	273	5
Serious illness or injury to relative before age 16	152	2
Death of close family member before age 16	322	6
Death of other family member/friend before age 16	402	8
Family separation before age 16	145	3
Bullied before age 16	892	17
Violence in the home before age 16	188	4
Sexual abuse before age 16	241	5
Expelled from school before age 16	89	2
Ran away from home before age 16	229	4
Serious illness or injury to self in past 6 months	70	1
Serious illness or injury to relative in past 6 months	115	2
Death of close family member in past 6 months	180	3
Death of other family member/friend in past 6 months	329	6
Separation due to marital difficulties in past 6 months	91	2
Problem with close friend in past 6 months	154	3
Made redundant or sacked in past 6 months	83	2
Looked unsuccessfully for work 1 month in past 6 months	165	3
Major financial crisis in the past 6 months	68	1
In trouble with police in past 6 months	31	1
Something lost or stolen in past 6 months	100	2
Bullied in past 6 months	36	1
Violence in work in past 6 months	26	0.5
Violence in the home in past 6 months	19	0.4
Sexual abuse in past 6 months	2	0.04

Table 7: Life Event models, OLS regression Dependent variable = sf12index

	Specification 1		Specification 2	
	Coef.	p. Value	Coef.	p. Value
married	0.011	0.015	0.011	0.019
widow/divorced/separated	-0.015	0.012	-0.015	0.011
age	-0.005	0.000	-0.005	0.000
age squared	0.000	0.000	0.000	0.000
Children under 16	0.001	0.720	0.002	0.644
Education- Degree	-0.003	0.618	-0.002	0.698
Education- HND/Teach/Nursing	0.008	0.212	0.010	0.125
Education - A level	0.010	0.082	0.011	0.051
Education - GCSE/O level	0.010	0.056	0.010	0.049
Education - lower level	0.001	0.943	0.000	0.977
North	0.010	0.270	0.009	0.295
North West	-0.005	0.437	-0.005	0.427
Yorkshire and Humber	0.005	0.486	0.005	0.483
East Midlands	0.003	0.658	0.004	0.617
West Midlands	-0.013	0.068	-0.011	0.102
East of England	0.009	0.190	0.010	0.156
South West	0.006	0.341	0.006	0.326
South East	0.016	0.025	0.016	0.025
Gr personal inc 5200-10399	-0.002	0.740	-0.002	0.745
Gr personal inc 10400 -15559	0.005	0.415	0.004	0.476
Gr personal inc 15560m-20799	0.011	0.081	0.011	0.099
Gr personal inc 20800 -33799	0.015	0.010	0.016	0.007
Gr personal inc >33800	0.027	0.000	0.027	0.000
Non white	-0.005	0.382	-0.004	0.459
Working	0.036	0.000	0.037	0.000
Muscular/skeletal complaint	-0.059	0.000	-0.058	0.000
Respiratory complaint	-0.035	0.000	-0.035	0.000
Digestive complaint	-0.030	0.000	-0.028	0.000
Heart/circulatory complaint	-0.022	0.000	-0.021	0.000
Urinary related complaint	-0.037	0.000	-0.036	0.000
Skin complaint	-0.021	0.000	-0.021	0.000
Ear complaint	-0.033	0.000	-0.032	0.000
Eye complaint	-0.005	0.317	-0.005	0.286
Neoplasm	-0.073	0.000	-0.069	0.001
Blood disorder	-0.033	0.000	-0.031	0.001
Infectious disorder	-0.035	0.097	-0.034	0.090
Generalised anxiety disorder	-0.072	0.000	-0.074	0.000
Mixed anxiety depressive disorder	-0.131	0.000	-0.128	0.000

Panic disorder	-0.082	0.000	-0.080	0.000
Obsessive compulsive disorder	-0.035	0.016	-0.033	0.023
phobia	-0.078	0.000	-0.074	0.000
Depression	-0.136	0.000	-0.126	0.000
Psychosis	-0.005	0.771	0.003	0.848
Personality disorder	-0.005	0.889	0.010	0.774
Alcohol dependency	0.005	0.418	0.005	0.469
Drug dependency	-0.015	0.083	-0.013	0.143
Serious illness or injury to self before age 16	-0.023	0.002	-0.023	0.002
Serious illness or injury to relative before age 16	0.005	0.594	0.003	0.719
Death of close family member before age 16	0.006	0.348	0.004	0.545
Death of other family member/friend before age 16	0.002	0.742	0.000	0.973
Family separation before age 16	0.004	0.712	0.005	0.632
Bullied before age 16	-0.007	0.103	-0.007	0.089
Violence in the home before age 16	-0.003	0.771	-0.002	0.817
Sexual abuse before age 16	-0.027	0.001	-0.028	0.001
Expelled from school before age 16	-0.002	0.863	0.000	0.979
Ran away from home before age 16	0.003	0.740	0.004	0.613
Serious illness or injury to self in past 6 months			-0.077	0.000
Serious illness or injury to relative in past 6 months			-0.013	0.266
Death of close family member in past 6 months			-0.043	0.000
Death of other family member/friend in past 6 months			-0.004	0.552
Separation due to marital difficulties in past 6 months			-0.010	0.346
Problem with close friend in past 6 months			-0.012	0.200
Made redundant or sacked in past 6 months			-0.004	0.736
Looked unsuccessfully for work 1 month in past 6 months			0.023	0.017
Major financial crisis in the past 6 months			-0.027	0.068
In trouble with police in past 6 months			-0.017	0.390
Something lost or stolen in past 6 months			-0.019	0.081
Bullied in past 6 months			-0.056	0.008
Violence in work in past 6 months			0.003	0.888
Violence in the home in past 6 months			-0.005	0.837
Sexual abuse in past 6 months			0.098	0.001
constant	0.905	0.000	0.903	0.000

Table 8: Debt by income level

	Under £5200	£5200- £10399	£10400- £15559	£15560- £20799	£20800- £33799	33800 or more
Survey years 2000 and 2007						
N	2214	2117	1780	1277	1885	1074
Any serious debts in past year	22.3	23.4	17.3	13.8	11.1	6.7
Household debts^a	16.0	16.5	10.9	7.0	5.0	2.2
Non-household debts^b	6.7	7.4	5.3	4.4	3.0	1.6
Survey year 2000						
N	1388	1207	974	677	879	406
Any serious debts in past year	26.2	27.5	20.5	18.5	17.1	13.3
Household debts	17.2	16.2	9.9	7.4	5.4	2.5
Non-household debts	7.1	8.3	5.5	4.7	3.2	2.0
Survey year 2007						
N	826	910	806	600	1006	668
Any serious debts in past year	15.7	17.9	13.4	8.5	5.9	2.7
Household debts	14.0	16.8	12.1	6.7	4.7	2.1
Non-household debts	6.0	6.3	5.0	4.0	2.9	1.4

a. Household debts include: rent, mortgage, utility bills, council tax and TV licence.

b. Non-household debts include: hire purchase, credit cards, catalogues, loans, road tax, social fund loan.

Table 9: Debt by mental health disorder

	Generalised Anxiety Disorder	Mixed Anxiety Depressive Disorder	Panic Disorder	Obsessive Compulsive Disorder	Phobia
Survey years 2000 and 2007					
N	607	1091	121	161	264
Any serious debts in past year	31.5	23.5	32.2	37.9	40.5
Household debts	24.8	18.1	26.5	32.7	34.1
Non-household debts	14.5	8.9	14.9	17.3	18.0
	Depression	Psychosis	Personality Disorder	Alcohol Dependency	Drug Dependency
N	363	79	31	778	378
Any serious debts in past year	36.4	32.9	38.7	26.6	41.3
Household debts	29.7	28.4	32.3	19.2	34.3
Non-household debts	15.3	13.6	22.6	11.0	18.7
Survey year 2000					
	Generalised Anxiety Disorder	Mixed Anxiety Depressive Disorder	Panic Disorder	Obsessive Compulsive Disorder	Phobia
N	311	553	51	86	131
Any serious debts in past year	36.3	26.0	37.3	40.7	42.8
Household debts	26.4	17.2	33.3	32.6	34.4
Non-household debts	14.5	10.5	17.7	20.9	16.0
	Depression	Psychosis	Personality Disorder	Alcohol Dependency	Drug Dependency
N	188	44	16	440	199
Any serious debts in past year	43.7	34.1	43.8	33.2	48.2
Household debts	33.0	27.3	31.3	22.1	36.2
Non-household debts	17.0	9.1	25.0	13.2	24.1
Survey year 2007					
	Generalised Anxiety Disorder	Mixed Anxiety Depressive Disorder	Panic Disorder	Obsessive Compulsive Disorder	Phobia
N	296	538	70	75	133
Any serious debts in past year	26.4	20.8	28.6	34.7	38.4
Household debts	23.2	19.1	21.4	32.9	33.8
Non-household debts	14.6	7.3	12.9	13.2	19.9
	Depression	Psychosis	Personality Disorder	Alcohol Dependency	Drug Dependency
N	175	35	15	338	179
Any serious debts in past year	28.6	31.4	33.3	18.1	33.5
Household debts	26.3	29.7	33.3	15.5	32.2
Non-household debts	13.4	18.9	20.0	8.2	12.8

Table 10 Probit model of debt: Males**Dependent variable: Reported in debt**

N = 4563	Specification 1		Specification 2		Specification 3	
	Coef	p value	Coef	p value	Coef	p value
married	0.017	0.803	0.010	0.886	0.035	0.618
widow/divorced/separated	0.196	0.023	0.194	0.025	0.180	0.040
age	0.035	0.010	0.031	0.022	0.025	0.077
age squared	-0.001	0.000	-0.001	0.001	0.000	0.009
Children under 16	0.041	0.491	0.045	0.456	0.067	0.270
Education- Degree	-0.157	0.056	-0.160	0.053	-0.113	0.178
Education- HND/Teach/Nursing	-0.072	0.487	-0.074	0.480	-0.028	0.790
Education - A level	-0.126	0.111	-0.132	0.096	-0.099	0.215
Education - GCSE/O level	0.012	0.858	0.009	0.900	0.040	0.563
Education - lower level	-0.093	0.343	-0.103	0.298	-0.079	0.423
North	-0.418	0.001	-0.433	0.001	-0.463	0.000
North West	-0.301	0.001	-0.312	0.001	-0.321	0.000
Yorkshire and Humber	-0.205	0.033	-0.211	0.028	-0.206	0.034
East Midlands	-0.337	0.001	-0.338	0.001	-0.321	0.003
West Midlands	-0.162	0.084	-0.166	0.078	-0.151	0.112
East of England	-0.131	0.165	-0.136	0.149	-0.127	0.183
South West	0.078	0.362	0.071	0.409	0.074	0.396
South East	-0.203	0.093	-0.207	0.089	-0.197	0.109
Gr personal inc 5200-10399	-0.174	0.037	-0.176	0.034	-0.143	0.090
Gr personal inc 10400 -15559	-0.435	0.000	-0.436	0.000	-0.406	0.000
Gr personal inc 15560m-20799	-0.599	0.000	-0.597	0.000	-0.553	0.000
Gr personal inc 20800 -33799	-0.769	0.000	-0.760	0.000	-0.717	0.000
Gr personal inc >33800	-0.965	0.000	-0.964	0.000	-0.925	0.000
Non white	0.141	0.066	0.156	0.043	0.195	0.011
Working	-0.133	0.073	-0.114	0.128	-0.038	0.620
Year 2007	-0.508	0.000	-0.535	0.000	-0.536	0.000
Muscular/skeletal complaint			0.133	0.024	0.096	0.109
Respiratory complaint			0.001	0.994	-0.015	0.857
Digestive complaint			-0.081	0.474	-0.147	0.203
Heart/circulatory complaint			-0.075	0.379	-0.101	0.238
Urinary related complaint			0.258	0.033	0.195	0.114
Skin complaint			0.022	0.837	-0.016	0.885
Ear complaint			-0.068	0.603	-0.072	0.586
Eye complaint			0.019	0.865	0.009	0.932
Neoplasm			-0.301	0.365	-0.435	0.197
Blood disorder			0.066	0.730	0.098	0.609
Infectious disorder			0.753	0.021	0.700	0.029
Generalised anxiety disorder					0.145	0.190
Mixed anxiety depressive disorder					0.325	0.000

Panic disorder					0.429	0.042
Obsessive compulsive disorder					0.100	0.603
phobia					0.264	0.122
Depression					0.222	0.113
Psychosis					-0.081	0.741
Personality disorder					-0.193	0.480
Alcohol dependency					0.138	0.052
Drug dependency					0.411	0.000
constant	-0.323	0.233	-0.277	0.309	-0.461	0.099
Pseudo R2	0.115		0.118		0.132	

Table 11 Probit model of household debt: Males**Dependent variable: Reported household debt.**

N = 4563	Specification 1		Specification 2		Specification 3	
	Coef	p value	Coef	p value	Coef	p value
married	-0.077	0.337	-0.092	0.258	-0.069	0.401
widow/divorced/separated	0.407	0.000	0.408	0.000	0.392	0.000
age	0.061	0.000	0.059	0.000	0.050	0.002
age squared	-0.001	0.000	-0.001	0.000	-0.001	0.000
Children under 16	0.052	0.458	0.057	0.415	0.088	0.220
Education- Degree	-0.370	0.000	-0.368	0.000	-0.320	0.002
Education- HND/Teach/Nursing	-0.162	0.168	-0.153	0.196	-0.099	0.403
Education - A level	-0.320	0.001	-0.323	0.001	-0.294	0.002
Education - GCSE/O level	-0.037	0.629	-0.036	0.638	-0.003	0.966
Education - lower level	-0.109	0.334	-0.118	0.301	-0.099	0.380
North	-0.397	0.005	-0.418	0.003	-0.465	0.002
North West	-0.341	0.001	-0.353	0.001	-0.361	0.001
Yorkshire and Humber	-0.295	0.006	-0.301	0.006	-0.298	0.006
East Midlands	-0.394	0.001	-0.397	0.001	-0.380	0.002
West Midlands	-0.339	0.002	-0.346	0.002	-0.328	0.003
East of England	-0.194	0.074	-0.198	0.069	-0.178	0.105
South West	-0.190	0.059	-0.206	0.042	-0.199	0.052
South East	-0.357	0.011	-0.374	0.008	-0.356	0.013
Gr personal inc 5200-10399	-0.153	0.086	-0.162	0.070	-0.128	0.161
Gr personal inc 10400 -15559	-0.470	0.000	-0.470	0.000	-0.447	0.000
Gr personal inc 15560m-20799	-0.670	0.000	-0.665	0.000	-0.616	0.000
Gr personal inc 20800 -33799	-0.896	0.000	-0.883	0.000	-0.840	0.000
Gr personal inc >33800	-1.154	0.000	-1.150	0.000	-1.111	0.000
Non white	0.274	0.001	0.299	0.000	0.349	0.000
Working	-0.165	0.048	-0.137	0.104	-0.041	0.635
Year 2007	-0.052	0.369	-0.083	0.172	-0.077	0.217
Muscular/skeletal complaint			0.162	0.016	0.115	0.098
Respiratory complaint			0.015	0.874	-0.010	0.922
Digestive complaint			0.018	0.880	-0.066	0.601
Heart/circulatory complaint			0.018	0.854	-0.016	0.872
Urinary related complaint			0.245	0.072	0.157	0.273
Skin complaint			0.004	0.973	-0.045	0.719
Ear complaint			-0.064	0.674	-0.065	0.678
Eye complaint			0.050	0.689	0.036	0.776
Neoplasm			0.206	0.547	0.035	0.922
Blood disorder			-0.112	0.605	-0.066	0.761
Infectious disorder			0.899	0.006	0.831	0.008
Generalised anxiety disorder					0.149	0.222
Mixed anxiety depressive disorder					0.417	0.000
Panic disorder					0.451	0.045

Obsessive compulsive disorder					0.007	0.974
phobia					0.241	0.172
Depression					0.350	0.017
Psychosis					-0.043	0.871
Personality disorder					-0.324	0.265
Alcohol dependency					0.136	0.090
Drug dependency					0.463	0.000
constant	-0.928	0.003	-0.915	0.003	-1.123	0.000
	0.157		0.163		0.184	

Table 12 Probit model of non- household debt: Males**Dependent variable: Reported non- household debt.**

N = 4567	Specification 1		Specification 2		Specification 3	
	Coef	p value	Coef	p value	Coef	p value
married	0.113	0.254	0.109	0.275	0.135	0.185
widow/divorced/separated	0.418	0.000	0.411	0.001	0.395	0.001
age	0.040	0.037	0.038	0.047	0.031	0.130
age squared	-0.001	0.001	-0.001	0.001	-0.001	0.009
Children under 16	0.069	0.378	0.075	0.338	0.103	0.200
Education- Degree	-0.049	0.678	-0.039	0.743	0.004	0.977
Education- HND/Teach/Nursing	-0.006	0.970	-0.013	0.932	0.044	0.772
Education - A level	-0.090	0.434	-0.097	0.402	-0.061	0.604
Education - GCSE/O level	0.131	0.178	0.131	0.183	0.164	0.104
Education - lower level	0.225	0.097	0.230	0.096	0.239	0.084
North	-0.120	0.451	-0.118	0.457	-0.140	0.391
North West	-0.392	0.003	-0.405	0.002	-0.426	0.001
Yorkshire and Humber	-0.352	0.011	-0.339	0.015	-0.341	0.016
East Midlands	-0.211	0.136	-0.199	0.159	-0.181	0.205
West Midlands	-0.305	0.026	-0.306	0.026	-0.298	0.032
East of England	-0.118	0.344	-0.110	0.382	-0.092	0.467
South West	-0.029	0.805	-0.024	0.840	-0.031	0.796
South East	-0.352	0.050	-0.366	0.040	-0.370	0.040
Gr personal inc 5200-10399	-0.161	0.163	-0.172	0.133	-0.140	0.236
Gr personal inc 10400 -15559	-0.331	0.009	-0.331	0.010	-0.303	0.020
Gr personal inc 15560m-20799	-0.486	0.000	-0.485	0.000	-0.455	0.001
Gr personal inc 20800 -33799	-0.642	0.000	-0.632	0.000	-0.589	0.000
Gr personal inc >33800	-0.872	0.000	-0.876	0.000	-0.836	0.000
Non white	0.047	0.643	0.059	0.566	0.107	0.298
Working	-0.063	0.557	-0.026	0.807	0.057	0.615
Year 2007	-0.113	0.100	-0.160	0.034	-0.145	0.059
Muscular/skeletal complaint			0.128	0.125	0.071	0.405
Respiratory complaint			-0.104	0.414	-0.113	0.396
Digestive complaint			-0.122	0.507	-0.212	0.255
Heart/circulatory complaint			0.257	0.030	0.213	0.080
Urinary related complaint			0.196	0.276	0.136	0.468
Skin complaint			0.268	0.051	0.216	0.119
Ear complaint			-0.418	0.090	-0.427	0.093
Eye complaint			0.023	0.882	0.012	0.940
Neoplasm			-	-	-	-
Blood disorder			0.131	0.655	0.176	0.551
Infectious disorder			0.500	0.228	0.412	0.288
Generalised anxiety disorder					0.262	0.067
Mixed anxiety depressive disorder					0.394	0.000
Panic disorder					0.469	0.064

Obsessive compulsive disorder					0.303	0.185
phobia					0.114	0.573
Depression					0.093	0.612
Psychosis					-0.344	0.289
Personality disorder					-0.010	0.975
Alcohol dependency					0.227	0.014
Drug dependency					0.296	0.013
constant	-1.359	0.000	-1.347	0.000	-1.539	0.000
	0.107		0.116		0.138	

Table 13. Marginal effects from the probit models, specification 3: Males

N = 4563	Debt		Household debt		Non-household debt	
	ME	p value	ME	p value	ME	p value
married	0.008	0.616	-0.009	0.407	0.010	0.174
widow/divorced/separated	0.043	0.054	0.064	0.001	0.038	0.010
age	0.006	0.076	0.007	0.002	0.002	0.124
age squared	0.000	0.009	0.000	0.000	0.000	0.007
Children under 16	0.015	0.277	0.012	0.232	0.008	0.218
Education- Degree	-0.025	0.162	-0.037	0.000	0.000	0.977
Education- HND/Teach/Nursing	-0.006	0.787	-0.012	0.374	0.003	0.779
Education - A level	-0.022	0.199	-0.034	0.000	-0.004	0.591
Education - GCSE/O level	0.009	0.567	0.000	0.966	0.013	0.131
Education - lower level	-0.017	0.405	-0.012	0.349	0.021	0.147
North	-0.082	0.000	-0.045	0.000	-0.009	0.332
North West	-0.064	0.000	-0.040	0.000	-0.024	0.000
Yorkshire and Humber	-0.042	0.020	-0.033	0.001	-0.019	0.002
East Midlands	-0.062	0.000	-0.040	0.000	-0.011	0.146
West Midlands	-0.032	0.090	-0.036	0.000	-0.018	0.008
East of England	-0.027	0.160	-0.021	0.072	-0.006	0.438
South West	0.017	0.407	-0.024	0.031	-0.002	0.792
South East	-0.040	0.076	-0.037	0.001	-0.020	0.005
Gr personal inc 5200-10399	-0.030	0.072	-0.016	0.133	-0.009	0.193
Gr personal inc 10400 -15559	-0.079	0.000	-0.048	0.000	-0.018	0.005
Gr personal inc 15560m-20799	-0.100	0.000	-0.060	0.000	-0.025	0.000
Gr personal inc 20800 -33799	-0.133	0.000	-0.085	0.000	-0.034	0.000
Gr personal inc >33800	-0.147	0.000	-0.089	0.000	-0.039	0.000
Non white	0.048	0.019	0.057	0.001	0.008	0.334
Working	-0.009	0.624	-0.006	0.641	0.004	0.604
Year 2007	-0.118	0.000	-0.010	0.214	-0.010	0.053
Muscular/skeletal complaint	0.022	0.120	0.016	0.115	0.005	0.422
Respiratory complaint	-0.003	0.856	-0.001	0.921	-0.008	0.350
Digestive complaint	-0.031	0.169	-0.008	0.584	-0.013	0.167
Heart/circulatory complaint	-0.022	0.218	-0.002	0.870	0.018	0.124
Urinary related complaint	0.048	0.146	0.023	0.321	0.011	0.516
Skin complaint	-0.004	0.885	-0.006	0.711	0.019	0.180
Ear complaint	-0.016	0.572	-0.008	0.664	-0.022	0.011
Eye complaint	0.002	0.932	0.005	0.781	0.001	0.941
Neoplasm	-0.076	0.080	0.005	0.924	-	-
Blood disorder	0.023	0.625	-0.008	0.749	0.015	0.606
Infectious disorder	0.213	0.075	0.187	0.063	0.043	0.432
Generalised anxiety disorder	0.035	0.219	0.022	0.266	0.024	0.132
Mixed anxiety depressive disorder	0.084	0.001	0.071	0.000	0.039	0.006
Panic disorder	0.118	0.083	0.081	0.118	0.052	0.185
Obsessive compulsive disorder	0.024	0.620	0.001	0.974	0.029	0.296
phobia	0.068	0.167	0.038	0.241	0.009	0.608
Depression	0.056	0.150	0.059	0.052	0.007	0.638
Psychosis	-0.017	0.730	-0.006	0.866	-0.018	0.126
Personality disorder	-0.039	0.427	-0.034	0.140	-0.001	0.974
Alcohol dependency	0.033	0.066	0.019	0.115	0.019	0.036
Drug dependency	0.111	0.000	0.082	0.000	0.027	0.046

Table 14 Probit model of debt: Females**Dependent variable: Reported in debt**

N =5778	Specification 1		Specification 2		Specification 3	
	Coef	p value	Coef	p value	Coef	p value
married	-0.353	0.000	-0.346	0.000	-0.301	0.000
widow/divorced/separated	0.032	0.648	0.026	0.714	0.024	0.735
age	0.010	0.419	0.009	0.480	0.003	0.835
age squared	0.000	0.012	0.000	0.015	0.000	0.086
Children under 16	0.232	0.000	0.242	0.000	0.270	0.000
Education- Degree	-0.545	0.000	-0.551	0.000	-0.511	0.000
Education- HND/Teach/Nursing	-0.344	0.000	-0.349	0.000	-0.334	0.000
Education - A level	-0.447	0.000	-0.451	0.000	-0.435	0.000
Education - GCSE/O level	-0.280	0.000	-0.282	0.000	-0.254	0.000
Education - lower level	-0.171	0.051	-0.168	0.054	-0.136	0.124
North	-0.110	0.264	-0.117	0.237	-0.085	0.398
North West	-0.145	0.067	-0.151	0.058	-0.145	0.071
Yorkshire and Humber	-0.102	0.242	-0.106	0.227	-0.069	0.433
East Midlands	-0.239	0.013	-0.242	0.012	-0.211	0.030
West Midlands	-0.050	0.562	-0.051	0.555	-0.013	0.878
East of England	-0.169	0.050	-0.166	0.055	-0.145	0.098
South West	-0.051	0.507	-0.052	0.501	-0.022	0.782
South East	-0.118	0.259	-0.119	0.256	-0.074	0.488
Gr personal inc 5200-10399	0.177	0.002	0.181	0.002	0.154	0.008
Gr personal inc 10400 -15559	0.102	0.145	0.111	0.116	0.102	0.151
Gr personal inc 15560m-20799	-0.008	0.932	0.002	0.983	0.003	0.973
Gr personal inc 20800 -33799	0.023	0.793	0.038	0.671	0.057	0.524
Gr personal inc >33800	-0.280	0.047	-0.261	0.064	-0.247	0.083
Non white	0.100	0.171	0.115	0.119	0.126	0.089
Working	-0.249	0.000	-0.236	0.000	-0.185	0.000
Year 2007	-0.381	0.000	-0.431	0.000	-0.440	0.000
Muscular/skeletal complaint			0.050	0.347	-0.003	0.956
Respiratory complaint			0.102	0.136	0.059	0.395
Digestive complaint			0.166	0.070	0.122	0.188
Heart/circulatory complaint			-0.015	0.857	-0.036	0.658
Urinary related complaint			0.076	0.392	-0.015	0.875
Skin complaint			0.118	0.171	0.067	0.453
Ear complaint			0.085	0.486	0.056	0.652
Eye complaint			0.085	0.344	0.048	0.602
Neoplasm			0.204	0.258	0.113	0.539
Blood disorder			0.165	0.328	0.200	0.238
Infectious disorder			0.087	0.770	0.027	0.933
Generalised anxiety disorder					0.367	0.000
Mixed anxiety depressive disorder					0.228	0.000
Panic disorder					0.295	0.097

Obsessive compulsive disorder					0.148	0.328
phobia					0.417	0.000
Depression					0.205	0.064
Psychosis					-0.046	0.846
Personality disorder					0.471	0.360
Alcohol dependency					0.129	0.202
Drug dependency					0.569	0.000
constant	-0.003	0.991	-0.015	0.949	-0.135	0.587
Pseudo R2	0.115		0.118		0.138	

Table 15 Probit model of household debt: Females**Dependent variable: Reported household debt.**

N = 5778	Specification 1		Specification 2		Specification 3	
	Coef	p value	Coef	p value	Coef	p value
married	-0.433	0.000	-0.423	0.000	-0.370	0.000
widow/divorced/separated	0.176	0.027	0.165	0.040	0.166	0.043
age	0.014	0.333	0.012	0.405	0.004	0.812
age squared	-0.001	0.002	-0.001	0.003	0.000	0.030
Children under 16	0.276	0.000	0.295	0.000	0.335	0.000
Education- Degree	-0.688	0.000	-0.703	0.000	-0.655	0.000
Education- HND/Teach/Nursing	-0.397	0.000	-0.409	0.000	-0.396	0.001
Education - A level	-0.555	0.000	-0.565	0.000	-0.551	0.000
Education - GCSE/O level	-0.326	0.000	-0.331	0.000	-0.305	0.000
Education - lower level	-0.229	0.028	-0.229	0.029	-0.194	0.068
North	-0.133	0.224	-0.138	0.208	-0.108	0.340
North West	-0.178	0.046	-0.186	0.039	-0.180	0.049
Yorkshire and Humber	-0.323	0.002	-0.332	0.001	-0.294	0.005
East Midlands	-0.475	0.000	-0.471	0.000	-0.447	0.000
West Midlands	-0.323	0.002	-0.328	0.001	-0.285	0.006
East of England	-0.357	0.000	-0.352	0.000	-0.332	0.001
South West	-0.369	0.000	-0.374	0.000	-0.362	0.000
South East	-0.389	0.002	-0.387	0.002	-0.334	0.009
Gr personal inc 5200-10399	0.129	0.047	0.132	0.042	0.097	0.143
Gr personal inc 10400 -15559	0.061	0.450	0.069	0.396	0.050	0.544
Gr personal inc 15560m-20799	-0.169	0.120	-0.157	0.149	-0.157	0.153
Gr personal inc 20800 -33799	-0.190	0.082	-0.171	0.121	-0.147	0.184
Gr personal inc >33800	-0.596	0.004	-0.579	0.004	-0.560	0.006
Non white	0.132	0.111	0.154	0.064	0.168	0.046
Working	-0.306	0.000	-0.282	0.000	-0.211	0.001
Year 2007	0.053	0.308	-0.010	0.861	-0.008	0.884
Muscular/skeletal complaint			0.117	0.057	0.050	0.438
Respiratory complaint			0.125	0.108	0.067	0.403
Digestive complaint			0.135	0.218	0.097	0.390
Heart/circulatory complaint			0.033	0.732	0.019	0.847
Urinary related complaint			0.137	0.161	0.018	0.863
Skin complaint			0.148	0.118	0.102	0.303
Ear complaint			0.068	0.631	0.040	0.785
Eye complaint			0.071	0.490	0.029	0.788
Neoplasm			0.400	0.043	0.291	0.161
Blood disorder			0.165	0.401	0.204	0.295
Infectious disorder			0.169	0.638	0.090	0.819
Generalised anxiety disorder					0.419	0.000
Mixed anxiety depressive disorder					0.342	0.000
Panic disorder					0.255	0.190

Obsessive compulsive disorder					0.300	0.063
phobia					0.453	0.001
Depression					0.112	0.387
Psychosis					0.115	0.661
Personality disorder					0.798	0.075
Alcohol dependency					0.113	0.309
Drug dependency					0.576	0.000
constant	-0.093	0.735	-0.108	0.698	-0.238	0.405
Pseudo R2	0.182		0.188		0.216	

Table 16 Probit model of non-household debt: Females**Dependent variable: Reported non- household debt.**

N = 5780	Specification 1		Specification 2		Specification 3	
	Coef	p value	Coef	p value	Coef	p value
married	-0.278	0.001	-0.271	0.001	-0.198	0.020
widow/divorced/separated	0.179	0.062	0.170	0.078	0.174	0.083
age	0.033	0.079	0.032	0.089	0.018	0.359
age squared	-0.001	0.002	-0.001	0.002	-0.001	0.032
Children under 16	0.196	0.005	0.214	0.002	0.267	0.000
Education- Degree	-0.280	0.015	-0.304	0.009	-0.205	0.094
Education- HND/Teach/Nursing	-0.095	0.489	-0.103	0.461	-0.067	0.646
Education - A level	-0.197	0.063	-0.206	0.057	-0.152	0.180
Education - GCSE/O level	-0.090	0.300	-0.101	0.250	-0.036	0.696
Education - lower level	-0.013	0.916	-0.013	0.920	0.061	0.646
North	-0.139	0.309	-0.146	0.286	-0.125	0.378
North West	-0.094	0.384	-0.099	0.364	-0.076	0.496
Yorkshire and Humber	-0.118	0.331	-0.119	0.330	-0.059	0.635
East Midlands	-0.198	0.130	-0.199	0.129	-0.143	0.294
West Midlands	-0.178	0.148	-0.176	0.152	-0.105	0.401
East of England	-0.146	0.233	-0.122	0.323	-0.083	0.512
South West	-0.120	0.259	-0.112	0.292	-0.069	0.528
South East	-0.307	0.055	-0.311	0.048	-0.236	0.142
Gr personal inc 5200-10399	0.128	0.107	0.134	0.094	0.086	0.295
Gr personal inc 10400 -15559	-0.014	0.886	-0.007	0.946	-0.020	0.839
Gr personal inc 15560m-20799	-0.029	0.817	-0.014	0.915	-0.014	0.912
Gr personal inc 20800 -33799	-0.192	0.149	-0.173	0.198	-0.131	0.335
Gr personal inc >33800	-0.421	0.064	-0.396	0.082	-0.420	0.072
Non white	-0.017	0.863	0.014	0.890	0.037	0.719
Working	-0.155	0.028	-0.130	0.071	-0.034	0.651
Year 2007	0.041	0.511	-0.042	0.542	-0.043	0.544
Muscular/skeletal complaint			0.189	0.011	0.113	0.150
Respiratory complaint			0.152	0.104	0.104	0.294
Digestive complaint			0.174	0.176	0.105	0.424
Heart/circulatory complaint			0.030	0.813	-0.046	0.721
Urinary related complaint			0.088	0.458	-0.046	0.723
Skin complaint			0.084	0.455	-0.020	0.867
Ear complaint			-0.024	0.903	-0.122	0.553
Eye complaint			0.294	0.010	0.245	0.043
Neoplasm			0.390	0.083	0.241	0.361
Blood disorder			0.049	0.847	0.086	0.731
Infectious disorder			-0.415	0.346	-0.669	0.160
Generalised anxiety disorder					0.598	0.000
Mixed anxiety depressive disorder					0.378	0.000
Panic disorder					0.545	0.011

Obsessive compulsive disorder					0.090	0.631
phobia					0.431	0.003
Depression					0.221	0.108
Psychosis					0.173	0.544
Personality disorder					0.207	0.727
Alcohol dependency					0.173	0.184
Drug dependency					0.667	0.000
constant	-1.381	0.000	-1.429	0.000	-1.601	0.000
Pseudo R2	0.112		0.123		0.176	

Table 17. Marginal effects from the probit models, specification 3: Females

N =5778	Debt		Household debt		Non-household debt	
	ME	p value	ME	p value	ME	p value
married	-0.067	0.000	-0.049	0.000	-0.013	0.027
widow/divorced/separated	0.005	0.737	0.022	0.059	0.012	0.116
age	0.001	0.835	0.000	0.812	0.001	0.349
age squared	0.000	0.086	0.000	0.029	0.000	0.024
Children under 16	0.060	0.000	0.044	0.000	0.018	0.001
Education- Degree	-0.091	0.000	-0.059	0.000	-0.011	0.059
Education- HND/Teach/Nursing	-0.061	0.000	-0.038	0.000	-0.004	0.627
Education - A level	-0.078	0.000	-0.050	0.000	-0.009	0.136
Education - GCSE/O level	-0.051	0.000	-0.034	0.000	-0.002	0.692
Education - lower level	-0.027	0.099	-0.021	0.036	0.004	0.663
North	-0.017	0.377	-0.012	0.305	-0.007	0.327
North West	-0.029	0.055	-0.020	0.030	-0.005	0.473
Yorkshire and Humber	-0.014	0.419	-0.030	0.001	-0.004	0.620
East Midlands	-0.041	0.015	-0.041	0.000	-0.008	0.237
West Midlands	-0.003	0.877	-0.030	0.001	-0.006	0.362
East of England	-0.029	0.077	-0.034	0.000	-0.005	0.483
South West	-0.005	0.780	-0.037	0.000	-0.004	0.510
South East	-0.015	0.471	-0.033	0.001	-0.012	0.071
Gr personal inc 5200-10399	0.034	0.011	0.012	0.157	0.006	0.313
Gr personal inc 10400 -15559	0.023	0.165	0.006	0.554	-0.001	0.837
Gr personal inc 15560m-20799	0.001	0.973	-0.017	0.114	-0.001	0.911
Gr personal inc 20800 -33799	0.013	0.533	-0.017	0.148	-0.008	0.289
Gr personal inc >33800	-0.047	0.045	-0.047	0.000	-0.019	0.006
Non white	0.029	0.108	0.023	0.070	0.002	0.726
Working	-0.041	0.001	-0.027	0.001	-0.002	0.654
Year 2007	-0.093	0.000	-0.001	0.884	-0.003	0.542
Muscular/skeletal complaint	-0.001	0.956	0.006	0.447	0.008	0.176
Respiratory complaint	0.013	0.407	0.009	0.422	0.007	0.334
Digestive complaint	0.028	0.213	0.013	0.420	0.007	0.462
Heart/circulatory complaint	-0.008	0.653	0.002	0.848	-0.003	0.711
Urinary related complaint	-0.003	0.874	0.002	0.865	-0.003	0.713
Skin complaint	0.015	0.467	0.013	0.334	-0.001	0.865
Ear complaint	0.012	0.661	0.005	0.791	-0.007	0.506
Eye complaint	0.011	0.610	0.004	0.791	0.019	0.090
Neoplasm	0.026	0.562	0.044	0.244	0.019	0.456
Blood disorder	0.048	0.283	0.029	0.360	0.006	0.750
Infectious disorder	0.006	0.934	0.012	0.830	-0.023	0.001
Generalised anxiety disorder	0.093	0.000	0.068	0.001	0.062	0.000
Mixed anxiety depressive disorder	0.054	0.001	0.051	0.000	0.032	0.000
Panic disorder	0.074	0.145	0.038	0.266	0.056	0.085
Obsessive compulsive disorder	0.034	0.363	0.046	0.124	0.006	0.657
phobia	0.109	0.003	0.076	0.008	0.040	0.033
Depression	0.049	0.091	0.015	0.423	0.017	0.180
Psychosis	-0.010	0.842	0.015	0.686	0.013	0.602
Personality disorder	0.127	0.445	0.168	0.217	0.016	0.771
Alcohol dependency	0.029	0.230	0.015	0.345	0.013	0.251
Drug dependency	0.158	0.000	0.105	0.001	0.076	0.001

Table 18: Prevalence of mental health problem by SHA (%)

	n	GAD	MADD	Panic	OCD	Phob	Dep	Psych	PD	Alc	Drug
London	610	5.6	10.7	1.3	1.1	2.6	2.5	0.8	0.1	4.2	5.1
East of England	584	4.6	9.9	1.9	1.4	2.2	3.6	1.0	0.7	5.4	2.1
South Central	424	4.9	7.8	0.4	1.7	2.1	3.1	1.1	0	4.9	3.3
SE Coast	432	5.3	7.8	1.6	1.8	3.5	2.3	0.9	0.7	4.8	3.2
East Midlands	503	7.3	8.9	0.9	1.3	3.6	5.2	0.6	0.6	7.0	2.6
West Midlands	571	6.1	10.1	1.2	1.2	4.2	3.5	0.5	0.2	5.4	3.5
Yorks & Humber	550	6.2	11.2	0.7	1.2	1.1	2.5	0.4	0	8.0	3.5
North East	304	5.2	14.1	0.3	2.6	3.3	4.9	0.9	0.7	9.2	2.6
North West	780	5.1	12.0	2.3	1.3	1.5	3.7	0.7	0.1	8.9	4.6
South West	517	6.2	8.9	1.1	1.2	2.1	2.5	0	0	5.6	2.5

Figure 1a: Distribution of SF-6D index for men (2000 and 2007)

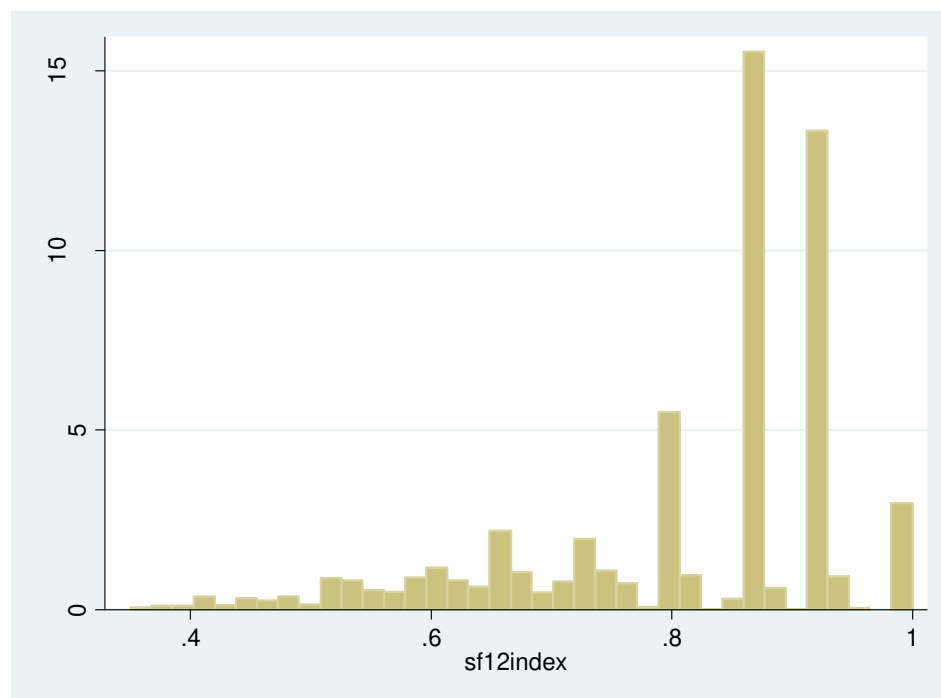
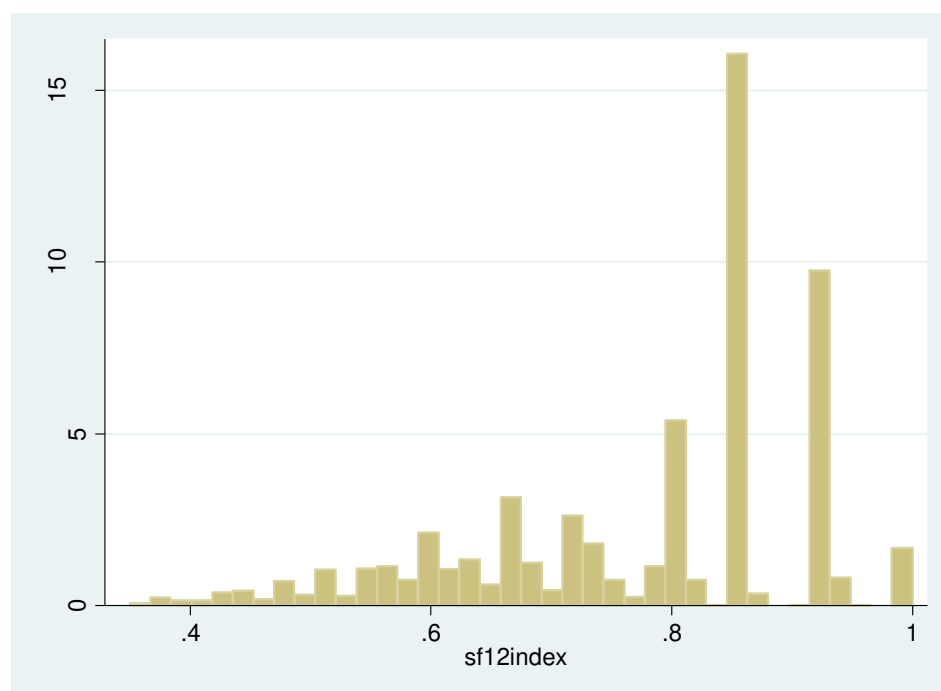


Figure 1b: Distribution of SF-6D index for women (2000 and 2007)



Appendix 1: Variables and Definitions

Variable Name	Definition
Marital status	A set of dummy variables that take the value of 1 if the respondent is married or widowed/separated/divorced else 0 if the respondent is single.
Age	Age in years and age squared.
Children	A dummy variable taking the value of 1 if the respondent has a child under age 16.
Education	A set of dummy variables that take the value of 1 if the respondent holds any educational qualifications else 0. The categories are: degree, HND/high level vocational qualification, A level, GCSE/O level, lower qualifications.
Income	A set of dummy variables that take the value of 1 for various income brackets. These are: £5200 - £10399pa, £10400 - £15559pa, £15600 - £20799pa, £20800 - £33799pa and £33800 or more. The base category is under £5200pa.
Ethnicity	A dummy variable takes the value of 1 where the respondent is not white.
Employment status	A dummy variable takes the value of 1 if the respondent states he/she is working, else zero.
Region	A set of dummy variables that each take the value of 1 if the respondent lives in the region else zero. The regions include, the North, North West, Yorkshire and Humber, East Midlands, West Midlands, East, South West, South East. Greater London is the base category.
Year	In models where the data from 2000 and 2007 is pooled, a dummy variable takes the value 1 if the data is from 2007 and 0 for 2000.
Physical health	A set of dummy variables that each take the value 1 if the respondent has the health problem, and zero otherwise. The problems are: muscular/skeletal, respiratory, digestive, heart/circulatory, urinary, skin, ear, eye, neoplasm, blood, infection. The omitted category is no physical health problem.
Mental health	(a) A set of dummy variables that each take the value 1 if the respondent has the health problem, and zero otherwise. The problems are generalised anxiety disorder, mixed anxiety depressive disorder, panic disorder, obsessive compulsive disorder, phobia, psychosis, personality disorder, depression, alcohol dependence and drug dependence. The omitted category is no mental health problem. (b) A set of 7 dummy variables to represent levels of overall CIS-R score. The CIS-R score is an instrument designed to measure neurotic symptoms. The range is from zero to 36+. CISR=2=a score of 6-11; CISR=3 = a score of 12-17; CISR=4 = a score of 18-23; CISR=5 = a score of 24-29; CISR=6 = a score of 30-35; CISR=7 = a score of 36+. The omitted category is CISR=1 which indicates a score of 0-5.