TESTING FOR UTILITY INTERDEPENDENCE IN MARRIAGE: EVIDENCE FROM PANEL DATA

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Testing for Utility Interdependence in Marriage: Evidence from Panel Data

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This paper is the first of its kind to study utility interdependence in marriage using information on subjective well-being of a large sample of people living in the UK over the period 1991-2001. Using "residual" self-rated health to provide instrument for spouse's well-being and allowing controls on individual fixed effects, we find strong evidence of altruism represented by interdependent relationships in the reported well-being found only among spouses, and not by partners in cohabiting union. Panel data also show that the well-being impact resulting from "caring" can be used to predict future income, unemployment, and marital status for the individuals. (100 words)

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1 Introduction

People get married for a variety of reasons. Most, however, do so for the beneficial reasons that go beyond acquiring a marriage certificate. In terms of economic benefits, marriage reduces the cost of frequent contact and of resource transfer between two people by sharing the same household (Becker, 1973). It can lead to specialization within the family, which allows one of the spouses to possess higher human capital accumulation in task demanded in the labor market compared to single people (Becker, 1981). This is reflected in a number of studies that married men earn more than their single counterparts, *ceteris paribus* (Dolton and Makepeace, 1987; Korenman *et al*, 1991; Loh, 1996; Chun and Lee, 2001)[1]. Individuals may also be entitled to financial gains in the form of various legal benefits resulting from marriage. This is summarized by the evidence that marriage often comes with legal rights for the couples to joint insurance policies for home, auto, and health, as well as rights to benefits such as annuities, pension plans, social security, and medical care.

One other aspect of marital benefits is achieved through intra-household sharing of "nonmarketable household commodities" that includes partner's expressed love and caring, as well as other emotional attachments, such as sexual activity or frequent contact with a particular person (Becker, 1974). It is these implications of "loving" and "caring" in marriage that are thought to have a direct contribution to individual's health and welfare, holding other things constant. For instance, greater social contact resulting from marriage can reduce the risks for the individuals from having to suffer stress-related and loneliness-related illness in their life time, leading to the evidence that married couples face a much lower risk of mortality compared to single people (Gove, 1973; Hu and Goldman, 1990; Ross *et al*, 1999; Wilson and Oswald, 2002). This impact of marriage on health is also found to be substantial; a single study has shown that the estimated effect of marriage on a reduced mortality risk is so large that it can almost exactly offset the consequent (negative) effect generated by smoking (Gardner and Oswald, 2002).

Other evidence on the benefits from sharing nonmarketable goods in marriage can be found in recent empirical work on happiness data. The standard result for different countries and time periods has been

that there exists a positive effect of marriage on psychological well-being, even after taking income and other relevant factors into consideration (Gerdtham and Johannesson, 1997; Frey and Stutzer, 2000; Graham and Pettinato, 2002; Di Tella and MacCulloch, 2004). The estimates of non-pecuniary effects of marriage have been found to be both substantial and significant. For instance, a lasting marriage in the US is estimated to be worth around $100,000 per annum compared to being widowed or separated (Blanchflower and Oswald, 2004).

However, even though it has been found that marriage often goes hand in hand with higher levels of psychological well-being for the individual, less attention has been paid on how it actually works. Economists have yet to test and quantify what Becker (1974) referred to as the implication of "loving" and "caring" in marriage. That is, since loving someone usually involves affectionate caring about what happens to him or her, if M cares about F, it then implies that M's utility levels depend on F's utility levels[2]. In economics, the term "caring" between spouses, which can also be defined broadly as altruism in marriage, plays an important role in the analysis of intra-household distribution of income and consumption. The principal idea is that, if a person is said to be altruistic towards his spouse then it implies that his welfare will also depend on his spouse's welfare. Hence, an exogenous decrease (increase) in the altruist's personal income will effectively lead to a fall (a rise) in money transfers to his beneficiary, which would imply a fall (a rise) in the welfare of both spouses as a result of the reduction (increase) in joint income (Ermisch, 2003). A similar idea of interdependent utility also appears in a series of psychology and sociology papers; there is a similar conjecture made by Argyle (1999) on how one spouse's happiness may encourage the happiness of the other in a marriage. This is perhaps because better psychological well-being facilitates social contacts, especially contacts with spouse and children (Veenhoven, 1998). On the other hand, as marriage is currently seen as a main source of happiness, there are possibilities that spouses may think something is wrong if one or both feel unhappy. In that case, even if nothing is wrong with their marriage, unhappiness within the household may still shatter confidence for the couple and work as a self-fulfilling prophecy towards future separation and divorce (Ross, 1955). Nevertheless, the concept of interdependent utility among married couples has never been properly tested on psychological well-being data, partly because of the econometric

problems involved into estimating them. It is not a straight forward task, for example, to come up with a valid exclusion restriction that identifies the true effect of M's utility on F's utility. This is partly because most of the household commodities are shared between M and F, and hence are perfectly transferrable, within the household. Therefore, unless we can figure out how household commodities are being shared between the married couple, instrumental variables (IV) approach on the effect of M's utility on F's utility, which has risen as a result from an overall increase in household commodities consumption, will yield biased results.

In this paper we propose a direct test for the utility interdependence in marriage by using the "residual" self-rated health of the respondent's spouse (or subjective health status that cannot be explained by one's actual physical condition and the standard socio-economic indicators) to provide instruments for spouse's well-being. This variable, which is the difference between self-reported and predicted subjective health status, is known to psychologists as the proxy ability to adjust to ill-health, which reflects one's personality as well as one's level of emotional adjustment. Hence, our IV approach relies on the assumption that the ability of the respondent's spouse to adapt to poor physical conditions is correlated with spouse's well-being, but uncorrelated with the respondent's well-being for reasons beyond its effect on the endogenous regressor. In addition to the IV approach, we also examine the trend of utility interdependence among cohabiting partners, the separated, and the divorced, as well as estimate the well-being impact of a change in the spouse's well-being from $t-1$ to t on future income, unemployment, and marital status for the respondents.

Section 2 describes the data and presents some initial results that, on average, married people report greater psychological well-being than individuals who have never been married or have been divorced, separated or widowed. Section 3 considers the utility model of marriage and discuss the estimation strategy. Section 4 shows, using a panel analysis of individuals, that there exists a strong and positive effect of spouse's well-being on the respondent's well-being in the data set. In addition to the evidence of utility interdependence among married couples, we also show that there is no clear evidence of utility interdependence between non-married couples, i.e. those cohabiting with a partner, and separated and divorced individuals. Our other results also suggest that the estimated effect of a change in the spouse's well-being on the respondent's

well-being can be used to predict future income, unemployment status, and the decision to stay married for the individuals. Section 5 concludes.

2 Data and the Well-being of Married Individuals in Britain

The data set used in this analysis is taken from eleven waves, Wave 1-11, of the British Household Panel Survey (BHPS) for the year 1991 to 2001. This general survey is a nationally-representative household panel covering a total sample of approximately 19,000 randomly selected individuals from 10,000 British households[3]. The data set contains information on a series of subjects about individual and household demographics, education, health, employment status, and income. There is both entry into and exit from the panel, leading to unbalanced data with an increased number of individual interviews over time. This is due to the inclusion of children in the original household sample who turn 16, and of the new members of household formed by original panel members.

Our analysis will refer to individuals of working age (16-65 years). This produces 98,972 observations in total, covering 22,342 different individuals. Of those, 10,487 people are married, and 1,918 of whom are present over all eleven waves. Of the married sample, 9,497 individuals has identified their current spouse to be living in the same household as they are, making a total sample of approximately 4,749 married couples in the data set.

The proxy utility measure used in this paper is the GHQ (General Health Questionnaire) measure of mental well-being (see Goldberg, 1972). This is constructed from the responses to 12 questions (administered via a self-completion questionnaire) covering the feelings of happiness, strain, depression, inability to cope, anxiety-based insomnia, and lack of confidence, among others (see Appendix A). Responses are based on a 4-point scale of the frequency of a feeling in relation to person's usual state: "not at all", "no more than usual", "rather more than usual", and "much more than usual". The GHQ well-being has been studied intensively by medical researchers, psychologists, and sociologists, and it is considered to be a robust indicator of the individual's psychological well-being[4].

[TABLE 1 HERE]

There are various ways to work with GHQ well-being responses. This paper calculates what is known as the "Likert GHQ score", which is simply the sum of the responses to the 12 questions, coded so that the response with the lowest well-being value scores 3 and the highest well-being value scores 0. In other words, the highest GHQ well-being score of 36 corresponds to the worst mental distress condition in the raw data. However, we have chosen to reverse the order of the data here for simplistic reasons, so that higher GHQ well-being scores indicate lower mental distress. As it stands, the measure now runs from the worst psychological health (score 0) to no responses indicating poor psychological health (score 36). The distribution of this well-being index in the BHPS sample is shown in table 1. The mean and mode of this distribution are 25 and 28, respectively. However, there is a long-tail: roughly half of the sample have scored less than 25, and around one-third have scored between 26 and 29.

Do married people in the U.K. report a higher psychological well-being score, on average, compared to their non-married counterparts? In order to answer this question, a multivariate approach is required. As there are 36 possible categorical responses to the Likert measure of psychological health, ordinary least squares (OLS) regressions are preferable to ordered limited dependent models in this paper[5].

[TABLE 2 HERE]

Table 2 reports the results from OLS regressions on the pooled BHPS data; we checked that ordered logit estimation, which treats GHQ well-being index as ordinal variable, produces the same substantive conclusions. The first column shows the estimates from regressing GHQ well-being scores on some exogenous variables, i.e. age and gender, and the respondent's marital status. The omitted marital status category here is "single". Being married is found to be associated positively and significantly with individual's well-being compared to single individuals, while those living with a partner have reported a well-being level somewhere around half way in between. The coefficients on divorced, separated, and widowed are negative and significant, thus in keeping with previous studies. Separated individuals seem to have the worst psychological well-being, followed by widowed and then divorced people[6]. Other results also reveal

that males have reported, on average, higher well-being levels than females and that there is a U-shaped pattern in age, minimizing around mid-30's (Oswald, 1997).

The second column adds in a number of other personal and household characteristics, including education, employment, subjective and objective health status, as well as household size, home ownership, and (natural) log of household income per annum. Household income variable is measured in the real term, having been adjusted by the yearly consumer price index. It also takes into consideration the number of people living in the household, making it real income per capita. Descriptive statistics of all variables are provided in Appendix B. Being married continues to produce a positive and significant coefficient, with a t-statistic of 2.23. Other categories of marital status remain qualitatively the same with additional controls, apart from those living with a partner category, where the positive coefficient becomes insignificant with a t-statistic of 0.89. These results are robust to standard errors adjusted to clustering in 19 regions.

Column 3 moves on to full specification, adding controls for wave and regional dummies, as well as the number of children in the household. With these controls, staying married continues to be strongly positively correlated with individual's well-being, whilst the coefficient on living with a partner has improved slightly in its significance from the second specification. Separation seems to bring the least happiness for the individuals, followed by widowhood and divorce.

The estimated coefficient on household income is positive and significant in the equation for an individual's well-being. Unemployed people have reported, on average, a significantly lower GHQ well-being level than employed individuals. This is consistent with the finding from previous studies on the non-pecuniary costs of unemployment on individual's happiness levels (see Darity and Goldsmith, 1996; Winkelmann and Winkelmann, 1998; Clark, 2003). With full controls, Column 3 produces the following ranking of worst recorded well-being among the BHPS' employment statuses: the first was unemployment, then disability, followed by family cared, student, and then self-employed. Self-reported well-being is higher for those owning their home outright, while an estimation on the household size yields a positive, though insignificant, coefficient. The levels of education obtained are negatively correlated, albeit insignificant, with individual's well-being. As expected, a proxy for poor objective health status (i.e., the number of days the respondent

stayed in hospital last year) is associated negatively and significantly with the GHQ well-being scores. There are, however, stronger correlations between subjective health status and the reported psychological well-being within the data set.

3 The Utility Model of Married Couples

It now seems to have been established beyond reasonable doubt that married people have better psychological health, on average, compared to their non-married counterparts, and by far more than their pooling of physical resources can predict. One question of interest is how such psychological, which is also non-pecuniary, gain from marriage come about. Psychologists have been explaining this in terms of intimacy and social support in a marriage (Diener *et al*, 1999). However, to the best of our knowledge, no empirical work to date has been able to demonstrate, systematically, this positive effect stemmed from intimacy, i.e. the "caring" for the well-being of one another, in a marriage on any large-scale data set. Therefore, we aim to go further in this paper by proposing a situation where individuals are able to gain additional utility *directly* from an increase in his or her spouse's utility level, and attempt to test this using the BHPS data set.

For simplicity, let us first define the function of a married individual's utility at any given time period as

$$U = U(X, Y, U_{SPOUSE}(X, Y)), \tag{1}$$

where X is a vector of commodities consumption within the household, Y is the total real money in-take by the couple, and U_{SPOUSE} is the spouse's utility. The individual's utility is assumed to be increasing with each level of X and Y, both of which are divisible and can be shared between the couple. An increase in X therefore raises individual's utility both through a direct effect upon $U(X)$ and an indirect effect, acting through a rise in spouse's utility, $U_{SPOUSE}(X)$. Note that we assume in equation (1) that the spouse's well-being is generally observable to the respondent. However, the individual's ability to assess the spouse's true welfare will depend partly on the spouse's ability to convey his or her true well-being, as well as the current level of "caring" within the marriage, i.e. an effective altruist is more likely than others to assess

perfectly and, hence, derive more satisfaction from an increase in the true welfare of his beneficiary, which is what we are trying to measure.

Hence, for a marriage between individual i and j, the empirical counterpart to equation (1) can be written as

$$U_{it} = \alpha_0 + \alpha_1 U_{jt} + \alpha_2 X_t + \alpha_3 Y_t + \varepsilon_{it}, \tag{2}$$

$$U_{jt} = \beta_0 + \beta_1 U_{it} + \beta_2 X_t + \beta_3 Y_t + \varepsilon_{jt}, \tag{3}$$

where $t = 1, 2, ..., T$, and $E(\varepsilon_{it}, \varepsilon_{jt}|X_t, Y_t) = 0$. Equation (2) and (3) imply that U_{it} and U_{jt} are endogenous variables, X_t and Y_t are exogenous variables, while ε_{it} and ε_{jt} are the stochastic disturbance terms. The error term, ε_t, is thought to subsume the inability of human beings to communicate accurately the true well-being levels, as well as unobserved personal traits such as optimism and intelligence. The parameters α_1 and β_1 can be defined such that the higher the value of α_1 (β_1) the more satisfaction individual i (j) can derive from the same increase in his or her spouse's utility. This is equivalent to saying that the larger the parameter α_1 (β_1) the more altruistic individual i (j) becomes, provided that altruists derive satisfaction from an increase in his beneficiary's welfare.

The reduced form of (2) and (3) are

$$U_{it} = \Pi_1 + \Pi_2 X_t + \Pi_3 Y_t + v_{1t}, \tag{4}$$

$$U_{jt} = \Pi_4 + \Pi_5 X_t + \Pi_6 Y_t + v_{2t}, \tag{5}$$

where the parameters are defined as

$$\begin{aligned} \Pi_1 &= \frac{\alpha_0\beta_1 + \alpha_0}{1 - \alpha_1\beta_1}, \quad \Pi_2 = \frac{\alpha_2\beta_1 + \beta_2}{1 - \alpha_1\beta_1}, \\ \Pi_3 &= \frac{\alpha_3\beta_1 + \beta_3}{1 - \alpha_1\beta_1}, \quad \Pi_4 = \frac{\alpha_1\beta_0 + \beta_0}{1 - \alpha_1\beta_1}, \\ \Pi_5 &= \frac{\alpha_1\beta_2 + \alpha_2}{1 - \alpha_1\beta_1}, \quad \Pi_6 = \frac{\alpha_1\beta_3 + \alpha_3}{1 - \alpha_1\beta_1}, \end{aligned} \tag{6}$$

with the error terms $v_{1t} = \frac{\alpha_1\varepsilon_{jt} + \varepsilon_{it}}{1 - \alpha_1\beta_1}$ and $v_{2t} = \frac{\beta_1\varepsilon_{it} + \varepsilon_{jt}}{1 - \alpha_1\beta_1}$. Therefore, unless it can be shown that $Cov(U_{jt}, \varepsilon_{it}) \neq 0$, OLS estimation on equation (2) will be inconsistent. The similar applies for OLS

estimation on equation (3). Nevertheless, the true (unbiased) effect of spouse's utility on own utility can still be obtained if there is a valid instrument, say Z_t, that affects spouse's utility but not own utility. Hence, with additional information on the instrument, equation (2) and (3) become

$$U_{it} = \alpha_0 + \alpha_1 U_{jt} + \alpha_2 X_t + \alpha_3 Y_t + \alpha_4 Z_{it} + \varepsilon_{it}, \tag{2'}$$

$$U_{jt} = \beta_0 + \beta_1 U_{it} + \beta_2 X_t + \beta_3 Y_t + \beta_4 Z_{jt} + \varepsilon_{jt}, \tag{3'}$$

where Z_{it} affects only U_{it} and not U_{jt}, while Z_{jt} affects only U_{jt} and not U_{it}. It then follows that the reduced forms of (2') and (3') are given by

$$U_{it} = \Pi_1 + \Pi_2 X_t + \Pi_3 Y_t + \Lambda_1 Z_{jt} + \Lambda_2 Z_{it} + v_{1t}, \tag{4'}$$

$$U_{jt} = \Pi_4 + \Pi_5 X_t + \Pi_6 Y_t + \Lambda_3 Z_{jt} + \Lambda_4 Z_{it} + v_{2t}, \tag{5'}$$

where

$$\begin{aligned} \Lambda_1 &= \frac{\alpha_1\beta_4}{1-\alpha_1\beta_1}, \quad \Lambda_2 = \frac{\alpha_4}{1-\alpha_1\beta_1}, \\ \Lambda_3 &= \frac{\beta_4}{1-\alpha_1\beta_1}, \quad \Lambda_4 = \frac{\alpha_4\beta_1}{1-\alpha_1\beta_1}, \end{aligned} \tag{8}$$

with other parameters have remained the same as defined in (4). We can now solve for parameter α_1 and β_1 from the structural equation that will give us the true effects of spouse's utility on the utility of individual i and j, respectively.

$$\frac{\Lambda_1}{\Lambda_3} = \frac{\alpha_1\beta_4}{1-\alpha_1\beta_1} \cdot \frac{1-\alpha_1\beta_1}{\beta_4} = \alpha_1, \tag{9}$$

$$\frac{\Lambda_4}{\Lambda_2} = \frac{\alpha_4\beta_1}{1-\alpha_1\beta_1} \cdot \frac{1-\alpha_1\beta_1}{\alpha_4} = \beta_1. \tag{10}$$

A key specification issue concerns the validity of Z. It is not a straight forward task to come up with a valid exclusion restriction that identifies the true effect of spouse's utility on individual's utility, provided that the composition of each household within the data set remains unidentified. That is, unless we can distinguish between private consumption from the consumption of public goods for each of the households in the BHPS, personal variables that can be shared within household, such as individual's income or ownership of some personal assets, are considered as poor instruments for each individual's utility. The same problem of

identification arises if we were to instrument individual's well-being by personal characteristics that can affect spouse's well-being by more than one way. For example, individual's unemployment can affect his or her spouse's well-being via these four routes: i) a drop in joint income, ii) a drop in own well-being independent of income effects, iii) heightening job insecurity for the spouse, and/or iv) a loss in family's reputation in the society, as in Akerlof (1980). In this paper we propose to use the spouse's unobservable characteristics, those that can neither be shared with the respondent nor have other known externalities on the respondent's well-being, as instrument. One of the instruments used in this article is the "residual" subjective health levels that are not correlated with the objective health status and the usual socio-demographic determinants of subjective health index.

There are several main arguments for the use of spouse's residual subjective health status as a valid instrument for spouse's utility levels. The first relies on the substantive evidence of strong correlations between individual's subjective health status and different measures of psychological well-being (for a general review on health and happiness, see Diener *et al*, 1999). In other words, for a marriage between individual i and j, $Cov(U_{it}, H_{it} \neq 0)$ and $Cov(U_{jt}, H_{jt} \neq 0)$, where H is individual's subjective health status at wave t. The second counts on the medical literature, which suggests that subjectively interpreted health are reflected not only by one's actual physical condition but also by one's level of emotional adjustment to the adverse life events of illness and disability (Watson and Pennebaker, 1989; Larsen, 1992). Those who have greater abilities to adapt are believed to suffer less psychologically from physical health problems[7]. Hence, the function of subjective health status for individual i at wave t is $H_{it} = H(P_{it}, A_{it})$, where P_{it} is the actual physical health status (as indexed, for example, by age and hospitalization), and A_{it} is the unobserved ability to adapt to ill health, which is more of an emotional component than anything else. We assume that P_{it} is correlated with individual j's utility, U_{jt}. This is because an individual's objective health condition is thought to have a direct effect on the spouse's utility through a number of physical externalities. For example, an individual's ill health may lead to a short-fall in the current household earnings, as well as interfere with the spouse's work or daily activities. On the other hand, it is unlikely that A_{it} will be correlated with U_{jt} for reasons beyond its effect on individual's i utility, U_{it}. Therefore, the idea is that we

can use the predicted A_{it}, or the so-called "residual" subjective health levels that are not correlated with the objective health status and the usual socio-demographic determinants of H_{it}, as a valid instrument for individual's i utility levels.

4 Empirical Evidence of Interdependent Utility in Marriage

4.1 Pooled Cross-sectional Regressions

Figures 1-2 present a first pass at the question of utility interdependence among married and cohabiting couples in the UK. In figure 1, the average GHQ well-being score of the respondent is plotted against the average GHQ well-being score of the respondent's spouse, both of which are calculated by region and year, in panel A, whilst panel B concentrates on the same relationship for couples in cohabiting union. It can then be seen in panel A that there is a clear positive correlation between the average GHQ well-being of the respondent and the average GHQ well-being of the respondent's spouse. On the other hand, the relationship between the average GHQ well-being of the respondent and the average GHQ well-being of the respondent's cohabiting partner, as shown in panel B, though positive, is less clear cut compared to the married sample in panel A.

[FIGURE 1 HERE]

Figure 2 extends this analysis further, and plot the average change in the GHQ well-being of the respondent from period $t-1$ against the average change in the GHQ well-being of the respondent's spouse or cohabiting partner from period $t-1$. Panel A of figure 2 reveals for the married sample a noticeable positive correlation in the well-being among spouses over time. Again, the same relationship seems to be relatively weaker for the cohabiting union sample. In an OLS regression, the estimated coefficients on the average change in the well-being of the respondent's spouse and cohabiting partner are 0.871 and 0.861, respectively. Nonetheless, the robust standard error appears to be nearly twice as large for the estimation carried out on the cohabiting union sample (0.040) compared to the married sample (0.027). The same results are obtained

when regional and year dummies are included into the regression. These aggregate numbers provide some first evidence that utility between married couples may be jointly determined and much more so compared to those couples who are not legally married, leading to smaller differences in the GHQ score being recorded for each set of husband and wife in the survey.

[FIGURE 2 HERE]

However, one of the limitations of the analysis using bivariate technique is that it does not allow controls for other characteristics that are likely to affect subjective well-being, such as income and health, for example. This calls for further multivariate approach. Table 3 presents some preliminary results from estimating empirical counterpart to equation (1) on the married sample in the BHPS data. The first column has the same broad specification as in column 3, table 2, and shows that, for most of the socio-economic variables, the use of the married sample has produced the same well-being structure as the use of the full sample would. The second column then introduces the GHQ well-being of spouse variable into the regression. On its own, the GHQ well-being of spouse enters the equation with a coefficient of 0.166 and a large t-statistic of 15.23, suggesting a positive and well-determined relationship between spouse's and individual's self-related psychological well-being.

[TABLE 3 HERE]

Nevertheless, it is quite likely that own and spouse's well-being are being determined simultaneously in the optimizing utility model, which implies that OLS estimates will be biased upward. In an attempt to correct for these biases, the last two columns adopt an IV approach and estimate the same well-being equation using Heckman's two-step least square (2SLS), with the GHQ well-being of spouse being instrumented by two experimental variables. In order to make the identification problem evident in our choices for instrumental variable, the first IV regression in column 3 uses a personal characteristic, known in the literature as a variable that can affect the respondent's well-being by more than one way, e.g. spouse's unemployment status, as instrument for spouse's well-being. The positive simultaneity bias on the spouse' well-being parameter is apparently clear; running the same well-being equation with spouse's unemployment status as

an instrumental variable produces an inflated coefficient on the GHQ well-being of spouse of 0.301 with a t-statistic of 2.58.

The last column of table 3 introduces spouse's "residual" subjective health index as a potential valid exclusion restriction. A three-step approach is chosen into calculating this variable. In the first step, we began with an ordered logit regression estimating, for the respondent's spouse, the relationship between the standard proxies of objective health status and the subjective health index (see Appendix C). In preparation for the second step, the predicted probability of falling into a particular health category for each respondent is obtained from the regression[8]. We then multiplied the probability of being in those categories by the value of each health category. The "expected" subjective health status variable, $\widehat{H}_t$, for each respondent's spouse at wave t is then calculated as followed:

$$\widehat{H}_t = \Pr(very\ poor) \times 1 + \Pr(poor) \times 2 + \Pr(fair) \times 3 + \Pr(good) \times 4 + \Pr(excellent) \times 5. \qquad (11)$$

In the third step, each spouse's "expected" subjective health status, $\widehat{H}_t$, is subtracted from his or her reported subjective health index, H_t, and based on this difference we created a variable for each spouse's residual subjective health index[9]. The mean and standard deviation of the residual subjective health index is approximately 0.01 and 0.89, suggesting that the expected value is very close to the actual value of self-reported health itself. Estimating the equation with spouse's residual subjective health status continues to produce a positive and significant coefficient on spouse's well-being. There is, nevertheless, a stark decrease of 11% and 51% in the impact of spouse's well-being on individual's well-being compared to the coefficients on GHQ well-being of spouse obtained in column 2 and 3, respectively (the GHQ well-being of spouse now enters the equation with a coefficient of 0.147 and a t-statistic of 6.69), as well as a substantial improvement in the overall R^2. Hence, by instrumenting spouse's well-being by residual health status we have removed the positive simultaneity bias affecting the GHQ well-being of spouse parameter in the utility model of marriage.

The size of the coefficient is also qualitatively important as well as the statistically significant. The mean of spouse's GHQ well-being score is 24.88 and its overall standard deviation is 5.16. A one standard deviation move from one below the mean of spouse's GHQ well-being score to one above therefore implies a

change from 19.72 to 30.04. Taking a conservative central estimate of spouse's GHQ well-being score to be 0.147, the implied change in the individual's well-being is approximately 1.5. This is greater than switching gender; it can completely offset the non-pecuniary cost of unemployment; it is equal of not having to spent around two and a half months in the hospital last year. All in all, the results thus suggest that there exists a degree of altruism *vis-á-vis* interdependency in the reported well-being among the married couples for Great Britain.

Of other particular interest is the role of household income among married couples after spouse's well-being has been taken into account in these equations. There is a significant drop in the coefficient size for the estimated coefficient on household income from 0.214 in column 1 to 0.105 in column 4, despite the fact that there is virtually no correlation between the instrumented GHQ well-being of spouse and the household income variable. One explanation for this is that money in-take at the household level contributes to individual's well-being in two ways: i) directly, and ii) indirectly through spouse's well-being. By controlling for the instrumented GHQ well-being of spouse we explicitly remove the indirect effect of income from the equation. As a result, the coefficient on household income reflects only the direct effect of income on individual's well-being, which in this case is roughly half of what was originally estimated in the first column of table 3.

[TABLE 4 HERE]

Given the possibilities that the degree of utility interdependence may be stronger for some groups of the married individuals than others, it seems useful to examine sub-samples in the population. Table 4 does this by spliting the data into categories of gender, age group, and income level. With the same controls as in column 4, table 3, the results reveal a larger estimated effect (and in its significance) of spouse's well-being on individual's well-being for females compared to males, and for the young compared to the older generations. For those with low household income (the poorest 25% of household), the GHQ well-being of spouse entered the equation with a coefficient of 0.159 and a t-statistic of 4.72. Running the same equation on those with high household income (the richest 10% of household) yields a slightly smaller coefficient of 0.125 and a

t-statistic of 2.29.

[TABLE 5 HERE]

Table 5 further examines sub-samples for Great Britain, this time by the number of own children and their age-group. The hypothesis is that the degree of utility interdependence is strongest when there are only two people in the marriage, i.e. no own children presence in the household. This is presumably because there may be greater intimacy presence among married couples with no children. The coefficient on spouse's well-being for those married with no children is positive and significant at 0.163 ($t = 5.29$). The estimated effect, as well as the significance of the coefficient, is roughly the same size for those with no children than the one obtained for those with either one to two children in the marriage. On the other hand, the same estimated coefficient for those married with three or more children, though positive, is insignificant ($t = 0.23$). For those married with children aged from 0 to 4 only, the GHQ well-being of spouse entered the equation with a relatively larger coefficient of 0.186 ($t = 2.72$) compared to those married with no children. The same coefficients estimated on those with older children sub-samples (aged 5-11 and 12-18) are positive, albeit slightly less significant compared to those married with young children.

Finally, separate regressions can be run on each of the GHQ-12 well-being components. This should give an idea of the principle conduits through which the interdependencies work. The results (not reported here) show spouse's well-being to be positive and significant at the 1% level for 10 out of 12 GHQ well-being components. For example, the individuals are better at overcoming difficulties when in a marriage where the spouse possesses high psychological well-being. The same qualitative results were also obtained when we unpacked the spouse's well-being into 12 components in our regressions. Hence, the positive effects from spouse's well-being on individual's well-being can work via a different route of mental components rather than at the overall level.

4.2 Fixed Effect Regressions

We turn now to the panel aspect of our data. Here, repeated observations on the same individual allows us to test for correlations between changes in own well-being and spouse's well-being over time. Controlling for unobserved individual heterogeneity in the normal way, table 6 presents the main results from OLS and 2SLS with fixed-effect regressions. In the first column, the use of full married sample produces panel-equation results that are generally consistent in structure with those from the first column of table 3's pool cross-section regression. Unemployment continues to have a profound negative effect on individual's well-being. Better health status, subjectively and objectively (i.e. less days spent in hospital last year), still have the same positive effects on self-rated well-being, while disability and family cared continue to enter the equation with strong negative coefficients. Lastly, the pattern of home ownership and the non-linear effect in age is similar under fixed-effect regression to that of table 3. Household income, on the other hand, has a negative, albeit insignificant, influence on the respondent's GHQ well-being score.

[TABLE 6 HERE]

Column 2 adds in control for spouse's well-being in the full married sample estimation. The choice for instrumental variable in these fixed-effect regressions, and for the remaining of this paper, will be spouse's residual subjective health status. The GHQ well-being of spouse variable continues to have a well-defined positive effect on the respondent's well-being; the proxy for spouse's utility enters with a well-defined coefficient of 0.085 and a t-statistic of 2.89. Again, the effect of spouse's well-being is also quantitatively important as well as statistically significant. Note that the estimated impact of spouse's well-being on individual's well-being is roughly one-half that of what was estimated in the cross-sectional analysis in column 4, table 3. Given that the mean of spouse's GHQ well-being score is 24.84 with a within group standard deviation of 3.53, if we were to take a conservative central estimate of spouse's well-being to be 0.085, a move from one standard deviation below to one standard deviation above implies a change in the respondent's well-being of approximately 0.6. This is more than enough to compensate a change from being employed the last period to family cared this period; it can roughly offset around one third of the negative effect unemployment have

on well-being; it is greater than the effect of owning home outright; it is equivalent of not having to spent around three weeks in the hospital last year.

Column 3 and 4 further explore the gender sub-samples overtime. The GHQ well-being of spouse variable continues to have a strong positive effect on individual's well-being for both males and females in these panel regressions. Similar to the figure from column 1 and 2 of table 4's pooled cross-sectional regressions, the size of the coefficient on spouse's well-being is significantly larger for females than males. The respective figures for the estimated coefficients on spouse's well-being for males and females are 0.074 and 0.104, suggesting that females gain more than males do from the same increase in the spouse's well-being. In other words, the results offer some first-hand evidence that females are, on average, more altruistic in their marriage compared to males.

4.3 The Well-being Trend Outside Marriage

One question of interest is whether these interdependencies are statistically significant only for the married sample. For instance, there is no *a priori* reason to assume that the utilities of those who live in a cohabiting union are not jointly determined. As the term cohabitation suggests, intra-household transfers between partners' utilities are still possible, provided that one or both cohabiting partners are altruistic individuals who care about the welfare of the current partner. This is represented by the positive, albeit relatively weaker, correlation in the well-being between cohabiting partners compared to married sample in figures 1-2.

Table 7 tests the hypothesis of utility interdependence among those identified themselves as living with a partner in the BHPS. The first panel presents the estimated coefficients from pooled cross-sectional regressions, while the second panel reports the fixed-effect regression results. We begin by presenting in the first column of table 7 the main regression results estimated on the living as couple sample ($N = 9,346$). With the same specification used to estimate the married sample in column 4 of table 3, the GHQ well-being of current partner enters the equation with a positive and significant coefficient of 0.176, with a t-statistic of 3.91. Thus, there seems to be some evidence of utility interdependence among cohabiting couples in the

cross-sectional analysis; happy people are likely to be found cohabiting with an equally happy partner. The results are also robust to the control of selection effects into marriage; we do so by including in the pooled regression a dummy representing those people who subsequently marry their partner sometimes in the future wave. Consistent with the idea that happier people stand a better chance of getting married than their less happy counterpart (see Mastekaasa, 1992; Frey and Stutzer, 2003), the estimated coefficient on this dummy variable is positive and significant for the U.K. sample, suggesting that people who subsequently marry their partner have, on average, a higher psychological well-being level compared to their contemporaries who did not marry in the data set.

We move on to estimate a fixed-effect regression on those cohabiting couples in the second panel of column 1, table 7. With full set of control variables, the fixed-effect results show that the GHQ well-being of spouse now enters the well-being equation with a positive, albeit insignificant, coefficient. Hence, unlike the married sample, there seems to be no evidence of utility interdependence among cohabiting couples over time.

[TABLE 7 HERE]

The second column examines the well-being trend among those couples who subsequently marry within the BHPS. As far as the theory of selection effects would predict, the hypothesis is that the degree of utility interdependence may be stronger for those cohabiting couples who will marry each other sometimes in the future than those who did not. However, we could not find any significant trend of utility interdependence between partners among those who subsequently marry in the data set, from either pooled or fixed-effect regressions. It is also worth noting here that, for the BHPS sample, the average number of years individuals spent cohabiting before marriage is approximately 4 years, with a standard deviation of around 2. This leaves 339 individuals (or 2,765 observations across the panel) who cohabited for at least 6 years, and still have not been married by the final wave. Assuming that these people may prefer cohabitation to marriage, the third column of table 8 checks whether there exists any degree of utility interdependence between these individuals and their cohabited partners. The pooled results show that there is a positive and significant relationship

between the respondent's well-being and the partner's well-being; the GHQ well-being of partner enters the equation with a sizeable coefficient of 0.212 and a t-statistic of 2.34. The interdependent relationship on cohabiting union is not long-lasting, however, as we cannot replicate the same qualitative results for the fixed-effect regression. One explanation of this is that, even though happy people are attracted to equally happy people, individuals who live in a cohabiting union tend not to be as committed as married couples. Consequently, they tend to care more about their own personal autonomy and less about the well-being of their partner over time. This is consistent with the recent sociological literature's findings of higher break-up rates, and eventual marital failures, by those cohabiting with a partner compared to spouses (see Popenoe and Whitehead, 2002, for a comprehensive review on separation and divorce in cohabiting union).

We also provide in table 7 some evidence regarding the trend of GHQ well-being after future separation and divorce: going into future waves, we can observe the correlation between individual's well-being and spouse's well-being after the marriage and living together is over. Looking at the last two columns of the table, it can be seen that the effects of former spouse's well-being on own well-being, though positive, are largely insignificant in all of our full sample and sub-sample analysis. Based on these findings, it thus seems reasonable to conclude that the same significant trend of utility interdependence among married couples does not exist between spouses after the marriage has ended.

4.4 Future Socio-economic Status and Behavior

We have shown, so far in this section, that changes in the well-being of the respondent's spouse has a strong positive influence on the respondent's own well-being, whilst the same effects do not seem to hold for either the cohabiting union, the separated, or the divorced. One question mainstream economists might ask is, "What difference does this make?" A pragmatic response to this is that well-being information has been shown to provide useful information about individual socio-economic status and behavior in the future. For example, Graham *et al* (2003) find for Russia that residual happiness (i.e. happiness that cannot explained by the usual demographic and socio-economic determinants of happiness) in the initial period is positively correlated with higher income and better health in future periods. Using the same panel data set as ours,

Clark (2003) also shows that those well-being fell the most on entering unemployment are more likely to search for job in $t+1$, and less likely to remain unemployed in $t+2$. In keeping with this spirit, we will be examining whether the GHQ well-being impact of spouse's well-being has any significant bearing on the respondent's future earnings, unemployment, and marital status.

Table 8 uses the panel aspect of the BHPS data to provide some first evidence that movements in the GHQ well-being has a significant explanatory power on individual income, employment, and marital status one period into the future. Controlling for individual fixed effects, we began with the standard 2SLS regression estimating the impact of changes in the spouse's well-being on the respondent's well-being. Based on the predicted GHQ well-being score we created a variable for each respondent's well-being at wave t that can only be explained by movement in spouse's GHQ well-being from the last period, $t-1$. We then checked for any casual relationships between this predicted well-being and a set of socio-economic status and labor market behavior at wave $t+1$.

[TABLE 8 HERE]

The first column of table 8 examines the correlation between the predicted well-being in t and log of personal income per annum in $t+1$. The OLS results show a positive and significant relationship between the GHQ well-being impact of spouse's well-being and future earnings for the individual. Those whose GHQ well-being has improved as a result from an increase in the spouse's well-being have experienced higher income on average in $t+1$ compared to t. This finding is consistent to the idea that happier people are more productive in the labor market than others, and hence are likely to earn more income in the future.

The next column considers the possible outcome of labor market behavior in $t+1$ by the unemployed at period t. The rough idea is that the decision to remain unemployed will be, *ceteris paribus*, an increasing function of the individual's utility, which does not necessarily have to be gained from employment (relative to unemployment). In this case, the hypothesis to be tested is whether the GHQ well-being impact of spouse's well-being increases the probability for the unemployed at wave t to remain jobless in $t+1$. The results show a positive and significant relationship between the predicted well-being and the probability of

joblessness for the unemployed. In addition, the estimates imply that, for an average unemployed individual at period t, a move of 1-point in the predicted GHQ well-being score is associated with a 22% chance that she will remain unemployed at wave $t+1$.

How about the impact of predicted GHQ well-being on the probability of staying married itself? One hypothesis is that, as marriage is currently seen as a main source of happiness, spouses may think something is wrong with their marriage if one or both feel unhappy. Thus possibilities may arise when extreme unhappiness within the household may work as a self-fulfilling prophecy towards future separation and divorce (Ross, 1955). The next two columns look at whether the GHQ well-being impact of spouse's well-being also predicts future marital status. Going one wave into the future, there were 576 observations of the married sample at wave t whose marital status changed to either separation or divorce at wave $t+1$. The logit results in the third column of table 7 show a negative and significant relationship between the predicted GHQ well-being at wave t and the probability of separation and divorce at wave $t+1$. In other words, the higher the individual's well-being at wave t, which can only be explained by movements in spouse's GHQ well-being from $t-1$ to t, the less likely that the marriage will end in either separation or divorce at wave $t+1$. This is consistent to Kiernan and Mueller (1998)'s finding for the U.K. of lower reported psychological well-being among married men and women who subsequently break up compared to their contemporaries who did not break up. The other estimated coefficients show that moves from marriage to either separation or divorce are more likely for the unemployed, the self-employed, and the highly educated, while the same movements are less likely for males, and those looking after home (i.e. family cared). Though not reported here, these results remain robust to control for the estimated individual fixed effects, which have been used as an independent variable in each of our future income, unemployment, and marital status equations.

Regarding the respondent's decision to stay in marriage one wave into the future, a further robustness check is carried out in the next column where a logit with fixed effect equation of either separation or divorce in $t+1$ is estimated. Controlling for within effects, the results show that increases in the predicted GHQ well-being significantly reduce the probabilities of either separation or divorce in the next period: a 1-point increase in the GHQ well-being impact of spouse's well-being from $t-1$ to t significantly reduces the

probabilities for an average married individual of future separation or divorce by over 43%.

In summary, the evidence presented in table 8 provide two additional information that may be useful to economists when analyzing how marriage works. The first, which is consistent with the previous findings in psychology and economics, is that measure of subjective well-being can be used successfully to predict labor market behavior and socio-economic outcomes. Secondly, the results offer an alternative psychological explanation - other than specialization, and resource pooling - as to why some people may be gaining more from marriage than others.

5 Conclusion

This empirical paper uses a form of proxy utility data to test theories of interdependent utility in marriage. Using a large UK panel sample from 11 waves of the BHPS data, we exploit the psychological nature of "residual" health status of each respondent's spouse to provide an instrument for their current well-being at different time periods. Consistent with the standard assumptions in the economic and psychology literature, the IV estimates reveal a strong and positive correlation between own well-being and spouse's well-being for the married sample in Great Britain. There is strong evidence that 'happy' individuals are likely to be observed living with a 'happy' partner, and this effect is well-defined for most groups of married individuals in the data set. The results are also robust to controls for individual fixed effects. That is, over-time changes in the respondent's well-being are shown to be positively and significantly correlated to over-time changes in the well-being of the respondent's spouse. The estimated impacts of spouse's well-being on the individual's well-being are of a reasonable size. For instance, a change in the spouse's well-being by one standard deviation can compensate around one third of the negative impact unemployment has on individual's well-being.

In addition to the IV's findings, our estimates suggest no significant evidence of interdependence utility among those couples who may prefer cohabitation to marriage, as well as those whose marriage ended in separation or divorce, over time. Furthermore, we show that the well-being impact of a change in the

spouse's well-being from $t-1$ to t is associated with higher personal earnings, higher probabilities of remaining unemployed, and lesser chance of separation or divorce for the respondents, one wave into the future. As such, the results seem to provide some of the first direct, large-scale evidence of utility interdependence resulting from "caring" or altruism in marriage, as in Becker (1974), which has proved hard to quantify in the past. More generally, the findings of this article offer some first empirical insights as to why married individuals are, on average, happier compared to those who have never been married or have been divorced, separated or widowed.

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Table 1: The Distribution of GHQ: BHPS, 1991-2001

GHQ Score	Number of Individuals	Percentage
0	131	0.13
1	86	0.09
2	103	0.10
3	127	0.13
4	166	0.17
5	167	0.17
6	203	0.21
7	268	0.27
8	299	0.30
9	340	0.34
10	429	0.43
11	526	0.53
12	824	0.83
13	912	0.92
14	1,028	1.04
15	1,143	1.15
16	1,381	1.40
17	1,687	1.70
18	1,904	1.92
19	2,364	2.39
20	2,637	2.66
21	3,339	3.37
22	4,087	4.13
23	4,949	5.00
24	8,824	8.92
25	8,402	8.49
26	8,903	9.00
27	9,068	9.16
28	9,143	9.24
29	8,996	9.09
30	8,536	8.62
31	3,475	3.51
32	2,010	2.03
33	1,171	1.18
34	625	0.63
35	402	0.41
36	317	0.32
Total	98,972	100.00

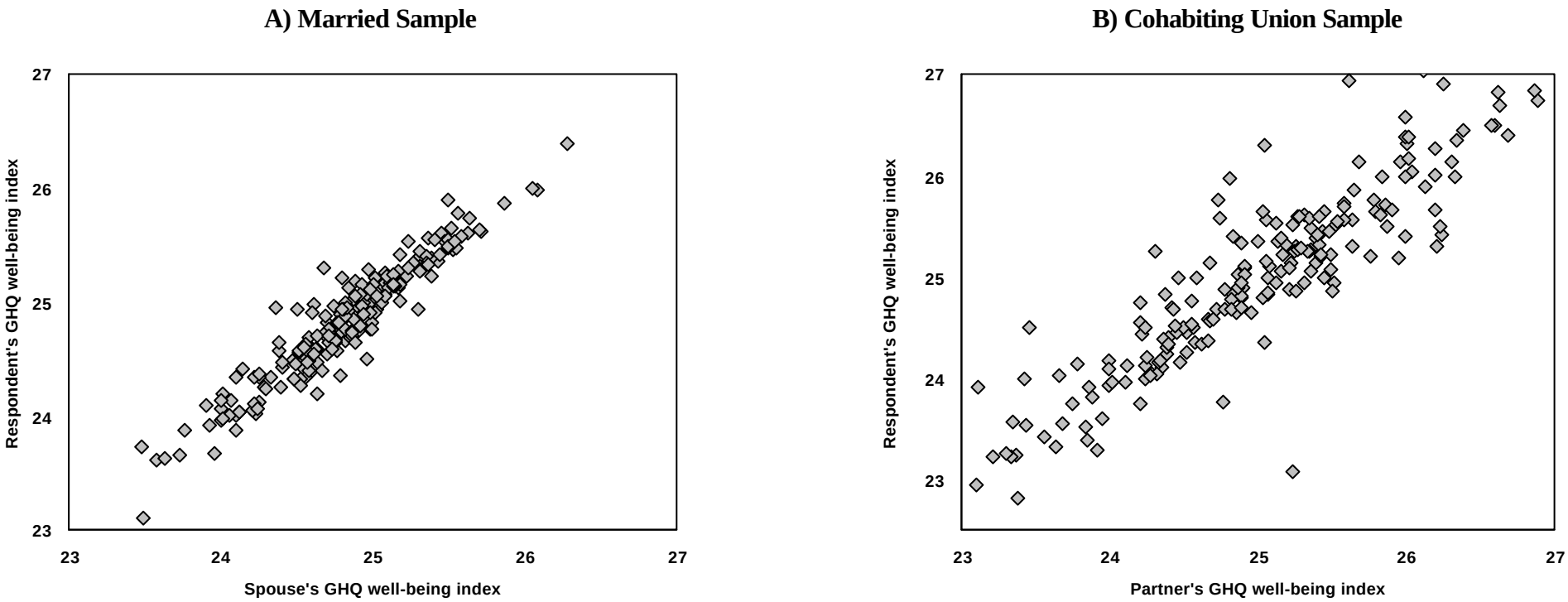
Note: GHQ = General Health Questionnaire, BHPS = British Household Panel Survey. The GHQ is reordered so that higher scores indicate higher levels of well-being, running from zero (very poor psychological health) to 36 (excellent psychological health).

Table 2: Marriage and GHQ Measure of Well-Being Regressions for the UK, 1991-2001 (OLS Results)

	Simple Specification With Exogenous Variables	With Some Controls	Broad Specification
Married	0.374	0.155	0.202
	(6.63)	(2.23)	(2.60)
Divorced	-0.965	-0.476	-0.402
	(-10.72)	(-4.50)	(-3.67)
Widowed	-1.003	-1.209	-1.143
	(-7.30)	(-9.55)	(-8.98)
Separated	-2.345	-1.944	-1.905
	(-17.24)	(-7.49)	(-7.56)
Living as couple	0.114	0.055	0.084
	(1.76)	(0.89)	(1.62)
Male	1.286	1.149	1.147
	(37.41)	(26.72)	(26.43)
Age	-0.226	-0.229	-0.217
	(-24.89)	(-13.40)	(-11.83)
Age^2/100	0.251	0.272	0.257
	(23.31)	(12.26)	(10.91)
Log of annual household income		0.145	0.138
		(3.40)	(3.01)
Unemployed		-1.631	-1.614
		(-12.19)	(-11.81)
Self-employed		-0.176	-0.162
		(-2.71)	(-2.32)
Family cared		-0.517	-0.453
		(-5.53)	(-4.52)
Retired		0.210	0.269
		(1.58)	(2.06)
Student		-0.398	-0.406
		(-4.46)	(-4.50)
Disabled		-1.715	-1.606
		(-7.42)	(-7.39)
Health: poor		3.258	3.289
		(18.03)	(18.18)
Health: fair		5.832	5.926
		(38.29)	(38.10)
Health: good		7.447	7.647
		(40.70)	(40.09)
Health: exellent		8.658	8.857
		(45.87)	(44.83)
Education: A-levels, O-levels		0.024	0.027
		(0.21)	(0.24)
Education: high		-0.105	-0.097
		(-0.91)	(-0.84)
Household size		-0.004	0.035
		(-0.15)	(0.97)
Home owner		0.184	0.175
		(1.85)	(1.92)
Number of days in hospital last year		-0.020	-0.019
		(-5.11)	(-4.81)
Constant	28.656	20.546	19.982
	(182.86)	(37.10)	(37.45)
Cluster	No	Yes	Yes
Children dummies	No	No	Yes
Wave dummies	No	No	Yes
Regional dummies	No	No	Yes
N	98,972	97,712	97,712
R-squared	0.0337	0.1653	0.1697

Note: GHQ = General Health Questionnaire. T-statistics are in parentheses.

Figure 1: The Respondent's GHQ Well-being and The GHQ Well-being of Spouse or Partner in the UK, BHPS waves 1-11

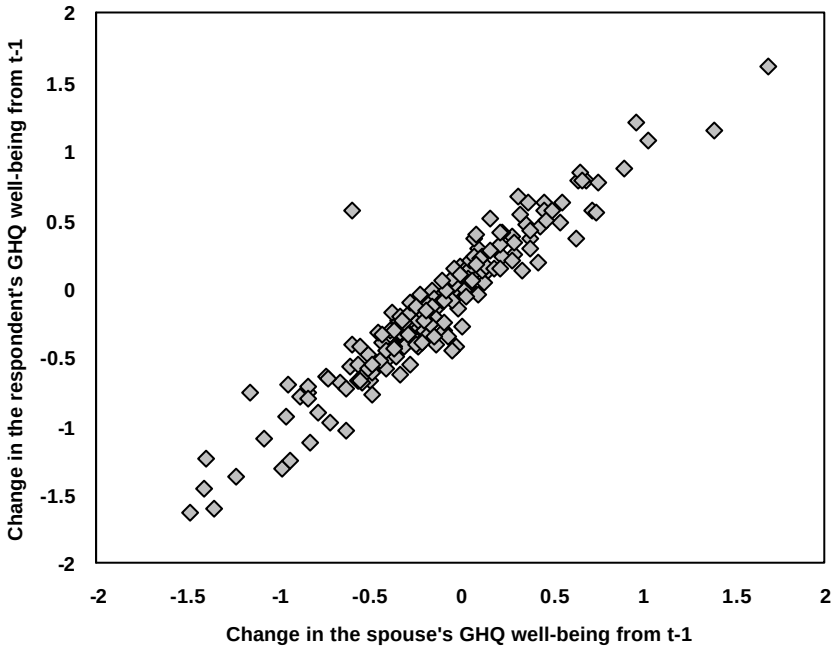


Note: Each data point is calculated with region-specific (19 regions) fixed-effect and year-specific (11 years) fixed-effect.

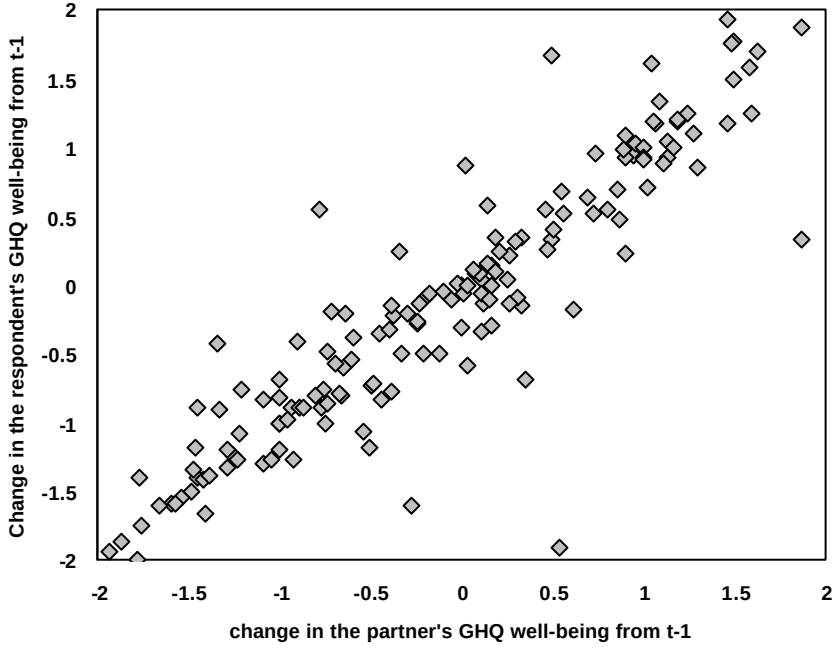
Figure 2: The Change in the Respondent's GHQ Well-being from Period t-1 and

The Change in the GHQ Well-being of Spouse or Partner from Period t-1 in the UK, BHPS waves 1-11

A) Married Sample



B) Cohabiting Union Sample



Note: The change in the GHQ well-being is defined as GHQ_t - GHQ_{t-1}. Each data point is calculated with region-specific (19 regions) fixed-effect and year-specific (11 years) fixed-effect.

Table 3: Well-Being Regressions and GHQ of Spouse for the UK, 1991-2001 (IV Results)

	(1)	(2)	(3)	(4)
Male	1.018	1.208	1.359	1.208
	(18.29)	(17.28)	(8.67)	(16.83)
Age	-0.223	-0.201	-0.170	-0.199
	(-8.06)	(-8.46)	(-5.33)	(-7.76)
Age^2/100	0.259	0.235	0.201	0.234
	(7.69)	(8.24)	(5.39)	(7.60)
Log of household income per annum	0.214	0.103	0.017	0.105
	(3.68)	(1.98)	(0.24)	(2.02)
Unemployed	-1.588	-1.460	-1.339	-1.495
	(-8.47)	(-6.76)	(-5.23)	(-6.77)
Self-employed	-0.215	-0.163	-0.133	-0.183
	(-3.04)	(-2.27)	(-1.59)	(-2.41)
Family cared	-0.352	-0.305	-0.258	-0.296
	(-2.77)	(-3.01)	(-2.32)	(-3.07)
Retired	0.338	0.248	0.213	0.303
	(1.84)	(1.31)	(1.25)	(1.64)
Student	-0.545	-0.623	-0.630	-0.610
	(-1.68)	(-1.86)	(-1.77)	(-1.66)
Disabled	-1.618	-1.471	-1.338	-1.459
	(-6.04)	(-5.54)	(-4.53)	(-5.71)
Health: poor	3.309	3.110	2.945	2.981
	(9.44)	(9.83)	(7.78)	(8.42)
Health: fair	5.793	5.523	**5.299**	5.453
	(21.83)	(24.11)	(15.41)	(20.30)
Health: good	7.502	7.127	6.843	7.093
	(26.48)	(26.58)	(17.07)	(23.20)
Health: exellent	8.708	8.264	7.927	8.257
	(31.25)	(31.04)	(18.24)	(26.71)
Education: A-levels, O-levels	0.022	0.002	**-0.006**	-0.000
	(0.20)	(0.02)	(-0.06)	(-0.00)
Education: high	-0.189	-0.224	-0.218	-0.227
	(-1.81)	(-2.22)	(-2.15)	(-2.28)
Household size	-0.035	-0.051	-0.041	-0.053
	(-0.55)	(-0.85)	(-0.73)	(-0.87)
Home owner	0.209	0.138	0.081	0.141
	(2.03)	(1.51)	(1.10)	(1.42)
Number of days in hospital last year	-0.021	-0.019	-0.018	-0.020
	(-3.67)	(-2.81)	(-2.42)	(-2.98)
GHQ well-being of spouse		**0.166**	**0.301**	**0.147**
		(15.23)	**(2.58)**	**(6.69)**
Constant	20.937	17.549	14.317	18.026
	(24.04)	(21.26)	(4.83)	(19.93)
Cluster	Yes	Yes	Yes	Yes
Children dummies	Yes	Yes	Yes	Yes
Wave dummies	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes
N	54,564	48,245	48,245	46,163
R-squared	0.1616	0.1876	0.1701	0.1877
Instrument variables on GHQ of spouse			spouse's unemployment status	spouse's residual subjective health index*

Note: * Spouse's residual subjective index is the difference between the reported health status and the predicted health status, obtained from running an ordered logit model on subjective health index (see Appendix B). The sample is restricted to those married in each BHPS wave. T-statistics are in parentheses.

Table 4: Well-Being Regressions and GHQ of Spouse - By Groups, 1991-2001 (IV Results)

	Males	Females	Age <= 30	Age > 30	HH income <= £5,000	HH income >= £17,000
Male			1.800	1.126	1.324	0.993
			(8.59)	(15.12)	(7.89)	(4.17)
Age	-0.287	-0.138	0.471	-0.210	-0.233	-0.201
	(-9.89)	(-3.18)	(1.33)	(-4.95)	(-5.83)	(-2.38)
Age^2/100	0.328	0.170	-1.070	0.247	0.284	0.224
	(9.79)	(3.26)	(-1.60)	(5.12)	(5.81)	(2.34)
Log of household income per annum	0.036	0.152	0.104	0.107	-0.161	0.045
	(0.39)	(1.63)	(1.25)	(1.83)	(-1.46)	(0.15)
Unemployed	-1.555	-1.730	-0.825	-1.656	-1.538	-2.553
	(-7.56)	(-4.20)	(-1.62)	(-7.80)	(-6.88)	(-3.76)
Self-employed	-0.122	-0.373	-0.154	-0.176	-0.384	-0.295
	(-0.85)	(-1.54)	(-0.50)	(-2.23)	(-2.24)	(-0.99)
Family cared	-0.547	-0.187	-0.642	-0.209	-0.686	1.372
	(-1.25)	(-1.86)	(-3.52)	(-1.61)	(-3.95)	(2.15)
Retired	0.081	0.475	-0.634	0.295	-0.390	1.510
	(0.34)	(2.22)	(-2.47)	(1.48)	(-1.53)	(4.60)
Student	-1.504	0.212	-0.426	-0.659	-0.292	0.484
	(-2.83)	(0.59)	(-0.48)	(-1.75)	(-0.57)	(1.09)
Disabled	-1.963	-0.957	-1.847	-1.421	-1.510	-1.612
	(-5.82)	(-2.01)	(-2.27)	(-5.13)	(-5.00)	(-0.96)
Health: poor	3.084	2.940	3.534	2.934	4.456	0.136
	(5.51)	(6.68)	(2.76)	(7.78)	(7.32)	(0.10)
Health: fair	5.418	5.490	5.380	5.496	6.831	2.215
	(9.97)	(13.64)	(5.20)	(19.20)	(16.31)	(1.76)
Health: good	6.937	7.222	7.148	7.117	8.652	3.847
	(12.34)	(17.11)	(6.22)	(22.21)	(22.47)	(3.05)
Health: exellent	7.990	8.494	8.223	8.283	9.821	5.045
	(13.97)	(17.96)	(7.09)	(26.41)	(23.84)	(4.01)
Education: A-levels, O-levels	0.022	-0.003	0.198	-0.005	-0.073	0.094
	(0.15)	(-0.02)	(0.96)	(-0.05)	(-0.59)	(0.34)
Education: high	-0.205	-0.194	0.112	-0.255	-0.327	-0.142
	(-1.23)	(-1.72)	(0.49)	(-2.62)	(-1.65)	(-0.43)
Household size	-0.064	-0.037	0.101	-0.065	0.125	0.047
	(-1.05)	(-0.40)	(1.17)	(-1.04)	(0.86)	(0.57)
Home owner	0.036	0.212	0.271	0.129	0.320	0.229
	(0.34)	(1.13)	(1.40)	(1.27)	(1.62)	(1.09)
Number of days in hospital last year	-0.020	-0.017	-0.003	-0.021	-0.009	-0.040
	(-1.58)	(-2.32)	(-0.13)	(-2.63)	(-1.00)	(-1.96)
GHQ well-being of spouse	**0.110**	**0.187**	**0.232**	**0.139**	**0.159**	**0.125**
	(4.40)	**(5.95)**	**(6.04)**	**(6.08)**	**(4.72)**	**(2.29)**
Constant	22.629	15.367	5.956	18.606	18.506	21.638
	(17.52)	(12.75)	(1.32)	(16.51)	(10.11)	(6.72)
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Children dummies	Yes	Yes	Yes	Yes	Yes	Yes
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	22,910	23,253	6,610	39,553	10,927	4,653
R-squared	0.1878	0.1748	0.1579	0.1917	0.2431	0.1333

Note: GHQ of spouse is instrumented as in Column 4, Table 3 (spouse's residual subjective health index). T-statistics are in parentheses.

Table 5: Well-Being Regressions and GHQ of Spouse, By Number of Children in the Household for the UK, 1991-2001 (IV Results)

		Number of Children	Number of Children			
	No children	2 or less	3 or more	Children aged 0-4 in HH	Children aged 5-11 in HH	Children aged 12-18 in HH
GHQ well-being of spouse	0.163	0.164	0.019	0.186	0.173	0.129
	(5.29)	(4.44)	(0.23)	(2.72)	(3.96)	(3.17)
Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Children dummies	No	Yes	Yes	Yes	Yes	Yes
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	23,386	18,461	4,316	6,684	5,880	5,741
R-squared	0.2040	0.1657	0.1915	0.1391	0.1740	0.2138

Note: GHQ of spouse is instrumented as in Column 4, Table 3 (spouse's residual subjective health index). Other personal and household controls are the same as in previous tables. T-statistics are in parentheses.

Table 6: Well-Being Regressions and GHQ of Spouse for the UK, 1991-2001 (IV with Fixed Effects Results)

		OLS with Fixed Effects		
	All	All	Males	Females
Age	-0.244	-0.281	-0.395	-0.175
	(-2.89)	(-2.93)	(-3.02)	(-1.25)
Age^2/100	0.198	0.193	0.252	0.125
	(5.29)	(4.56)	(4.48)	(1.93)
Log of household income per annum	0.056	-0.020	0.055	-0.110
	(1.06)	(-0.32)	(0.67)	(-1.20)
Unemployed	-1.845	-1.910	-2.112	-1.584
	(-14.45)	(-13.83)	(-12.73)	(-6.48)
Self-employed	0.000	-0.014	-0.041	-0.013
	(0.00)	(-0.12)	(-0.30)	(-0.06)
Family cared	-0.506	-0.503	-0.253	-0.474
	(-5.44)	(-4.87)	(-0.56)	(-4.07)
Retired	0.084	0.213	0.027	0.331
	(0.69)	(1.52)	(0.14)	(1.59)
Student	-0.273	-0.366	-1.418	0.420
	(-1.12)	(-1.39)	(-3.81)	(1.11)
Disabled	-1.810	-1.773	-2.138	-1.512
	(-11.96)	(-10.70)	(-9.94)	(-5.75)
Health: poor	2.556	2.378	2.248	2.424
	(15.75)	(13.14)	(8.92)	(9.30)
Health: fair	4.492	4.366	4.006	4.559
	(27.09)	(23.48)	(15.20)	(17.31)
Health: good	5.503	5.341	4.873	5.615
	(32.53)	(28.16)	(18.05)	(20.97)
Health: exellent	6.061	5.920	5.278	6.378
	(34.63)	(30.21)	(19.04)	(22.89)
Education: A-levels, O-levels	0.183	-0.011	-0.690	0.585
	(0.88)	(-0.05)	(-2.24)	(!.74)
Education: high	0.019	-0.121	-0.820	0.560
	(0.10)	(-0.57)	(-2.92)	(1.77)
Household size	-0.122	-0.130	-0.172	-0.086
	(-2.77)	(-2.67)	(-2.65)	(-1.18)
Home owner	0.291	0.290	0.304	0.290
	(2.95)	(2.65)	(2.07)	(1.79)
Number of days in hospital last year	-0.032	-0.031	-0.040	-0.024
	(-6.73)	(-5.98)	(-5.29)	(-3.40)
GHQ well-being of spouse		**0.085**	**0.074**	**0.104**
		(2.89)	**(2.22)**	**(1.94)**
Constant	26.699	27.214	32.407	22.810
	(8.48)	(7.47)	(6.39)	(4.35)
Children dummies	Yes	Yes	Yes	Yes
Wave dummies	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes
N	54,564	46,163	22,910	23,253
R-squared (within groups)	0.0604	0.0805	0.0806	0.0852
Average Observations within Group	5.20	4.90	4.90	5.00

Note: GHQ of spouse is instrumented as in Column 3, Table 4 (spouse's residual subjective health index). T-statistics are in parentheses.

Table 7: Well-Being Regressions and The Trend of GHQ of Current Partners and Former Spouses, 1991-2001

	Living as Couple (a)	Living as Couple (b)	Living as Couple (c)	Separated and Divorced	Separated	Divorced
A) IV results						
Cohabiting; will have married partner by 2001	0.245					
	(2.78)***					
Divorced				0.947		
				(2.26)**		
GHQ well-being of living partner	0.176	-0.100	0.212			
	(3.91)***	(-1.11)	(2.34)**			
GHQ well-being of former spouse				0.060	0.023	0.148
				(0.81)	(0.23)	(1.44)
B) IV with FE results						
Divorced				1.742		
				(2.74)***		
GHQ well-being of living partner	0.082	-0.249	0.119			
	(1.03)	(-0.79)	(0.86)			
GHQ well-being of former spouse				0.738	0.596	0.336
				(1.40)	(1.24)	(0.87)
N	9,346	1,530	2,371	1,239	550	689
Average Observation per Group	2.60	1.70	7.40	3.20	1.80	3.00

Note: ** Significant at 5% C.I. *** Significant at 1% C.I. FE = Fixed Effects. The samples are taken from living as couple, separated, and divorced individuals. Living as couple (a) = all of those living as couple individuals in the BHPS. Living as couple (b) = those living as couples who will marry each other sometimes by the year 2001. Living as couple (c) = those who have been cohabiting with a partner for at least 6 years, and still have not been married by the year 2001. The reference group for the cohabiting sample includes those who are not married to his or her partner by the year 2001, while for the separated and divorced sample is the separated category. Other controls and GHQ of future spouse are as in Column 4, Table 3 (spouse's residual subjective health index). T-statistics are in parentheses.

Table 8: Predicted Current Well-Being on Future Income, Employment, and Marital Status for the Married Sample in Great Britain (1991-2001)

	Ln (Personal Income)	Unemployment*	Divorced or Separate	
	(t+1), OLS	(t+1), Logit	(t+1), Logit	(t+1), Logit with FE
Male	0.275	1.139	-0.033	***
	(31.79)	(5.22)	(-0.63)	
Age	0.015	-0.001	-0.048	0.018
	(4.76)	(-0.02)	(-0.65)	(0.04)
Age^2/100	-0.017	-0.002	-0.025	0.370
	(-4.56)	(-0.04)	(-0.29)	(0.96)
Unemployed	-0.592		0.098	-0.210
	(-19.04)		(0.45)	(-0.44)
Self-employed	-0.125		0.463	-0.047
	(-7.98)		(3.00)	(-0.10)
Family cared	-0.523		-0.172	-0.479
	(-23.27)		(-1.24)	(-1.14)
Retired	-0.241		-0.067	-0.097
	(-7.94)		(-0.10)	(-0.08)
Student	-0.428		-0.042	0.963
	(-5.14)		(-0.06)	(0.75)
Disabled	-0.200		0.220	2.071
	(-10.12)		(0.78)	(1.76)
Health: poor	0.005	0.066	-0.414	0.127
	(0.19)	(0.15)	(-1.09)	(0.20)
Health: fair	0.026	0.705	-0.236	0.428
	(0.90)	(1.48)	(-0.74)	(0.63)
Health: good	0.048	0.888	-0.385	0.333
	(1.55)	(2.19)	(-1.26)	(0.48)
Health: exellent	0.059	0.780	-0.450	0.559
	(1.98)	(2.38)	(-1.33)	(0.78)
Education: A-levels, O-levels	0.042	-0.407	0.078	***
	(3.60)	(-2.83)	(0.72)	
Education: high	0.149	-0.859	0.115	***
	(14.38)	(-4.15)	(0.70)	
Household size	-0.054	-0.041	-0.129	0.735
	(-7.73)	(-0.40)	(-1.12)	(3.01)
Home owner	0.010	-0.531	-1.008	-1.911
	(0.75)	(-1.92)	(-2.57)	(-2.91)
Number of days in hospital last year	0.000	-0.010	-0.007	-0.068
	(0.41)	(-0.43)	(-0.50)	(-1.69)
Log of spouse's income per annum (t)	0.652			
	(53.82)			
Log of personal income per annum (t)	-0.005			
	(-1.10)			
Log of household income per annum		-0.709	-0.166	-0.051
		(-4.53)	(-1.56)	(-0.24)
Age gap in marriage^2/100			0.318	***
			(3.97)	
Predicted GHQ well-being (t)	**0.015**	**0.218**	**-0.523**	**-0.430**
	(2.62)	**(3.19)**	**(-15.69)**	**(-3.81)**
Constant	2.273			
	(10.86)			
N	37,279	1,234	34,425	1,664
R-squared	0.7123	0.1541	0.0929	0.3863

Note: * Individual is unemployed in period t. *** No positive or negative changes in the variable. Predicted GHQ scores come from running well-being regression with fixed effects on spouse's GHQ levels, instrumented by spouse's residual subjective health index. All other independent variables are measured at period t. Other controls, i.e. regional and round dummies, are as in Table 3.

Appendix A: The GHQ-12 Questionnaire

The 12 questions used to create the GHQ-12 well-being measure in the BHPS survey are as follows:

1. Here are some questions regarding the way you have been feeling over the last few weeks. For each question please ring the number next to the answer that best suits the way you have felt.

Have you recently....
a) been able to concentrate on whatever you're doing ?

Better than usual	*1*
Same as usual	*2*
Less than usual	*3*
Much less than usual	*4*

then

b) lost much sleep over worry ?
e) felt constantly under strain ?
f) felt you couldn't overcome your difficulties ?
i) been feeling unhappy or depressed ?
j) been losing confidence in yourself ?
k) been thinking of yourself as a worthless person ?

with the responses:

Not at all	*1*
No more than usual	*2*
Rather more than usual	*3*
Much more than usual	*4*

then

c) felt that you were playing a useful part in things ?
d) felt capable of making decisions about things ?
g) been able to enjoy your normal day-to-day activities ?
h) been able to face up to problems ?
l) been feeling reasonably happy, all things considered ?

with the responses:

More so than usual	*1*
About same as usual	*2*
Less so than usual	*3*
Much less than usual	*4*

Appendix B: Data Descriptions, Sample Means, and Standard Errors

Varibles	Descriptions	All (overall)	Married (overall)	(within)
GHQ-12	the GHQ well-being index, coded so that 0 = worst, 36 = best psychological well-being	24.87 (5.43)	24.86 (5.18)	(3.52)
Log of real household income per annum	log of equivalent household income per annum, adjusted to CPI index	7.87 (1.34)	7.88 (1.18)	(0.58)
Log of real personal income per annum	log of equivalent individual income per annum, adjusted to CPI index	8.90 (0.75)	8.94 (0.68)	(0.34)
Subjective health index	assessment of own health, coded so that 1 = very poor, 5 = excellent health	3.84 (0.95)	3.84 (0.95)	(0.59)
Male	gender of the respondent (male = 1)	0.49 (0.49)	0.47 (0.50)	-
Age	age of the respondent	38.46 (13.56)	43.74 (11.19)	(2.53)
Age^2/100	age-sqauared/100 of the respondent	16.63 (10.88)	20.38 (9.96)	(2.28)
Unemployed	employment status of the respondent, unemployed = 1	0.05 (0.21)	0.03 (0.17)	(0.13)
Employed full-time	employment status of the respondent, employed full-time = 1	0.56 (0.50)	0.63 (0.48)	(0.26)
Self-employed	employment status of the respondent, self-employed = 1	0.08 (0.26)	0.10 (0.30)	(0.15)
Family-cared	employment status of the respondent, family-cared = 1	0.08 (0.27)	0.10 (0.30)	(0.19)
Student	employment status of the respondent, retired = 1	0.06 (0.24)	0.01 (0.09)	(0.07)
Retired	employment status of the respondent, unemployed = 1	0.05 (0.22)	0.07 (0.26)	(0.15)
Disabled	employment status of the respondent, disabled = 1	0.04 (0.20)	0.04 (0.20)	(0.12)
Education: high	education level of the respondent, higher education, i.e. university level	0.27 (0.45)	0.32 (0.47)	(0.15)
Education: A-levels, O-levels	education level of the respondent, tertiary education, i.e. A-levels, O-levels	0.42 (0.49)	0.42 (0.49)	(0.14)
Household size	number of people living in the household	3.11 (1.36)	3.30 (1.20)	(0.46)
Own home outright	whether the respondent owns home outright (yes = 1)	0.16 (0.37)	0.18 (0.39)	(0.17)
Number of days in hospital last year	the number of days spent in hospital last year for the respondent	0.67 (5.25)	0.67 (4.22)	(3.46)
Number of children	number of children in the household	0.61 (1.00)	0.88 (1.10)	(0.43)
Married	marital status, married = 1	0.55 (0.50)		
Living as couple	marital status, cohabiting with a partner = 1	0.12 (0.32)		
Separated	marital status, separated = 1	0.02 (0.13)		
Divorced	marital status, divorced = 1	0.05 (0.22)		
Widowed	marital status, widowed = 1	0.02 (0.14)		
Age gap^2/100	the square of (age of the respondent - age of the spouse)/100		-0.09 (4.86)	(0.56)
Spouse's GHQ-12	the spouse's GHQ well-being index (0 = worst, 36 = best psychological well-being)		24.88 (5.16)	(3.53)
Spouse's change in GHQ-12 from last year	changes in the spouse's GHQ well-being index from t - 1 to t		-0.15 (5.14)	(4.87)
Log of real spouse's income per annum	log of spouse's equivalent individual income per annum, adjusted to CPI index		7.91 (1.18)	(0.57)
Spouse's smoker? (=1)	whether spouse smokes (yes = 1)		0.26 (0.44)	(0.17)
Spouse's days spent in hospital last year	the number of days spouse spent in hospital last year		0.64 (4.25)	(3.47)
Spouse's age	spouse's age		43.27 (10.86)	(2.54)
Spouse's subjective health index	spouse's assessment of own health (1 = very poor, 5 = excellent health)		3.85 (0.95)	(0.59)
Spouse's predicted subjective health index	predicted subjective health index from running an ordered logit on health equation		3.85 (0.31)	(0.17)
Spouse's residual subjective health index	spouse's residual subjective health index, which is not correlated with the usual socio-economic variables		0.01 (0.89)	(0.58)

Note: Standard errors, for overall and within group statistics, are in parentheses.

Appendix C: Subjective Health Index Regression for the United Kingdom, 1991-2001

(Ordered Logit Results)

	Spouse's Subjective Health Index
Male	0.215
	(8.71)
Age	-0.019
	(-9.54)
Log of household income per annum	0.482
	(15.91)
Number of days in hospital last year	-0.128
	(-17.29)
Smoker? (Yes = 1)	-0.455
	(-11.74)
Number of Children	0.155
	(8.43)
Cluster	Yes
Regional dummies	Yes
N	46,961
Log-Likelihood	-58108.944
Pseudo R-squared	0.0409

Note: Z-statistics are in parentheses.

[1]Only Dolton and Makepeace present evidence on the effects of marriage on both male and female's earnings. Their estimates of the residual earnings differentials for UK graduates indicate that being married affects male earnings favorably by up to 5.8%. On the other hand, being married affects female earnings unfavorably by up to 4\% conditional on participation and the number of young children in the household.

[2]This is equivalent to say that *M*'s utility depends on *F*'s consumption of household commodities. Becker's work, however, considered only the case where commodities are transferable, and hence divisible, within households. The current article, on the other hand, concentrates on household commodities that are not divisible, but can be transferred to *M* only if they raise *F*'s utility levels.

[3]The first eight waves (Wave 1-8) contain a nationally representative sample of more than 5,000 households, making a total of approximately 10,000 individual interviews. Wave 9 extends to include extra samples from Wales and Scotland, and Wave 11 includes an additional sample from Northern Ireland, pushing the total sample to approximately 19,000 individuals interviews.

[4]See Diener (1984), Fordyce (1988), Siedlitz *et al* (1988), and Eckman *et al* (1990) for psychologist's articles on reliability and validity of self-reported happiness statistics, and Arglye (1989) and Konow and Earley (1999) for discussion on some of the validation work that has been carried out with such psychological scales.

[5]Although GHQ has been treated as ordinal and not cardinal in a number of research works, there is strong evidence that regression results on such psychological scales from ordinary least square and ordered limited dependent models are qualitatively the same (Frey and Stutzer, 2000; Di Tella *et al*, 2001; Ferrer-i-Carbonell and Frijters, 2004). Based on these empirical findings, economists have concluded that it makes virtually no difference whether one assumes ordinality or cardinality of subjective well-being responses.

[6]By definition, separation means that the couples, though still legally married, are not living in the same household anymore. It can also be thought of as a transition from being married to getting a divorce later in the future.

[7]One suggestive evidence of this comes from the psychology literature's findings that severely ill patients (e.g. cancer victims and spinal-cord-injured accident victims) report only a slightly different score on the global life satisfaction scale compared to non-patients (Brickman *et al*, 1978; Silver, 1982; Breetvelt and van Dam, 1991).

[8]In this case, the subjective health score is of a 5-point scale: 1 "very poor", 2 "poor", 3 "fair", 4 "good", and 5 "excellent".

[9]This is a similar notion to "unexplained" happiness - happiness that is not correlated with the usual observable socioeconomic variables - calculated for Russia by Graham et al (2003). This "unexplained" happiness (which is more of a

psychological trait) is then showed to be correlated with individual's economic behavior in the future, i.e. people with high unexplained happiness is likely to be more productive and hence earn more income in the future.