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How Does Marriage Affect Physical and Psychological Health? A Survey of the Longitudinal Evidence

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Economists have for some time been aware that human beings reap financial benefits from marriage. Even after controlling for other factors, married individuals earn higher wages than single people (e.g. Chun and Lee (2001), Daniel (1995), Loh (1996), Reed and Harford (1989). There are gains, too, from economies of scale and specialisation within the family (Becker 1981). Yet economists are probably less aware of a body of research that finds wider benefits from marriage. Sociologists, psychologists and epidemiologists have recently documented evidence of married people's better physical health, longevity (length of life), psychological health, and happiness. Married individuals fare better in these terms than the never married, who in turn generally fare better than the divorced, separated and widowed. Formal marriage itself seems to matter. In the few studies that compare married and non-married cohabiters, the results tend to show an apparent beneficial effect from being married. A common view also asserts that these benefits are larger for men than for women; pioneering work here was done by Gove et al (1983). Finally, some argue that the benefits to happiness may be declining over time, relative to the non-married (Lee et al 1991, Glenn and Weaver 1988).

This review describes these findings. It is not comprehensive: the literature is too large for that. Past reviews include Burman and Margolin (1992) and Ross et al (1990) for the health evidence, Coombs (1991) on wellbeing, and Waite (1995) for evidence on health, financial and other benefits. We concentrate on longitudinal evidence. One reason is that this type of evidence is inherently more persuasive than that from cross-sections. In cross-sections, causality is particularly difficult to unearth. Although panel data does not provide a magical solution (the philosopher David Hume reminded his readers that it was not the cock's crowing that brought up the sun every day), looking at events before and after is an advantage. Clark and Oswald (2002) describe a way to use regression equations to value longitudinal life events. We start in section I by looking at the possible mechanisms at work behind a correlation between health / happiness and marriage. In doing so we discuss the methodological problems in this area, and how researchers have tried to resolve them. Section II reviews

the effects of marriage on mental health. In the research studies, the benefits of marriage are commonly measured by studying its effect on depression and alcohol abuse. Section III examines mortality. It shows that, controlling for all other factors, married people are less likely to die in a given period than the non-married. Section IV reviews the correlations between marriage and physical health. Finally, before concluding, section V discusses tests of the channels from marriage to wellbeing.

Section I: ***Mechanisms and Methodology***

How are wellbeing and marital status intertwined? First, marriage may itself lead to improved physical and mental health. This has been called the protective effect of marriage. Alternatively, simple correlations could also be interpreted as telling us merely that certain types of people can persuade a partner to marry them. This is a so-called selection effect. Distinguishing between the two is the main methodological problem in the field. It would be no surprise if physically and mentally healthier individuals are more attractive to mates and hence more likely to be married (and stay married).

Most evidence has pointed to roles for both these explanations. [1] The mechanisms and channels leading to possible benefits from marriage have been explored. In section V, we look at some of the research evidence, but here we briefly review the suggested explanations. For further discussion, see Ross et al (1990) and Wyke and Ford (1992).

First, on the grounds that two may live almost as cheaply as one, marriage may simply provide a higher standard of living. Poorer standards of living are known to been correlated with mental health problems (Ross et al 1990), and can be thought of as reducing physical health. Ross (1995) shows that the married have the lowest incidence of economic hardship, while Smock et al (1999), who studies 'switchers', find financial benefits for especially married women.

Second, marriage provides emotional and instrumental support. Emotional support seems to reduce the incidence of depression and mental illness (Ross et al 1990), and provides an important buffer against stress (Kessler and Essex 1982, Berkman 1988). Marriage can also enhance feelings of attachment and belonging, thought to affect mental health, (House et al 1988) while releasing possible social stigmas of being unmarried. The unmarried are more likely to live alone, for instance, which is associated with depression (Ross et al 1990).

[1] There are extensions to the common, 'positive' selection effect. Joung et al (1998) explain with reference to Collins and Coltrane (1992) that if assortive mating occurs whereby partners marry similar partners, then unhealthy people with unhealthy partners are more likely to be widowed. This would give a spurious relationship indicating widowhood causes ill health.

Alternatively, Lillard and Panis (1996) suggest that if marriage does give beneficial effects, then physically and mentally unhealthy individuals will face the greatest incentive to marry, giving an 'adverse' selection effect.

Emotional help can, of course, come from sources outside marriage. Social networks are important, especially for the unmarried, because similar but weaker emotional support can be gained. As discussed later, Waldron et al (1996) show the impact of social networks in the workplace on the benefits from marriage. A common conjecture about why the benefits from marriage are larger for males than females is that women have more developed social networks outside marriage, and these already give valuable support (Schumaker and Hill 1991).

A third mechanism comes from the so-called guardian effect. Married individuals tend to engage in less in risky activities and in more in healthy ones - perhaps for the sake of their partner (Umberson 1987, Ross et al 1990, Power et al 1999). For example, married people smoke and drink less (Umberson 1987). Another possible channel is that partners monitor each other for early symptoms of illness. The guardian effect can also indirectly help mental health, as there exists evidence of a link between physical health and mental health (Friedman 1991).

These are deep issues. Understanding whether the empirical relationship between marriage and wellbeing is one of selection or protection is of prime importance.

Divorce is probably a source of stress. The strain caused by separation may be very important and temporary, and that could lead to misleadingly high values being placed on the benefits of marriage. This problem can be resolved by comparing married people with those who never married.

Early cross-sectional evidence could not distinguish these selection and protection effects. As researchers became aware of the problems faced in measuring the benefits from marriage, approaches began to change. Longitudinal data have been essential to the latest and more persuasive analyses. One line of attack has been to estimate the selection effect on its own; this is done by using pre-marital characteristics to predict later marital status (e.g. Joung et al 1998, Masterkaasa 1992). This allows us to understand its relative strength in explaining the correlation between marriage and wellbeing. More commonly, the benefits of marriage have been estimated while accounting for the selection problem. Longitudinal data allow pre-marital characteristics to be used to show the change in characteristics caused by changes in marital status. In measuring the effects on mental health, for instance, the following approach is common. Measures are obtained of mental health at time T1, before marriage, and at time T2, when marital status has changed for some of the individuals in the sample. OLS regressions are then performed to explain mental health at time T2, while including both a set of explanatory variables and the mental health measure at time T1. The inclusion of mental health at T1 is a control for pre-marital

psychological wellbeing. In principle, any relationship then found between mental health and marriage should not be spurious. Most evidence of this sort discovers a selection effect but also suggests that a protective effect exists.

Of course the regressions must be specified with all explanatory variables that affect mental health at T2. Often-included variables are measures of social integration outside marriage, employment status, income and frequency of financial problems, age, gender, race, and parental status. Unfortunately, only a portion of these variables is included in most studies, and physical health is often neglected. This seems a serious omission, because health is an important determinant of happiness (Stack and Eshleman 1998 – who also make this point). If health is positively correlated with the likelihood of marriage, as we shall see in the later sections, then that will produce an upward bias on the marriage coefficients, thereby overstating the benefits of marriage. Misspecification often gives doubt to otherwise sophisticated studies.

With this in mind, we now go on to review the evidence of marital benefits in mental health, in section II.

Section II: *Mental Health Benefits from Marriage*

Gove et al (1983) is a much-cited cross-section study. This used US data, and found marriage to be the best predictor of happiness after controlling for education, age, gender and race. The authors took steps to try to counter the selection problem by including a "bad childhood experiences" variable, which they thought would predict pre-marital wellbeing. The paper found the beneficial effects of marriage to be larger for men than for women. Also, using the married sample only, marriage quality was the best predictor of wellbeing.

A more recent cross-section study, by Stack and Eshleman (1998), considered 17 developed nations. Controls for gender, age, health, financial situation, children, education, religion, national marriage and divorce rates, GDP/cap, and income distribution measures are included. Tests for multicollinearity are passed. They found financial situation to be the best predictor of happiness, followed by health, followed by marital status. The married turn out to be happier than those who cohabit, who are themselves happier than single individuals, ceteris paribus. In regressions for each nation separately, in sixteen of the seventeen nations the marriage coefficient was positive in a wellbeing equation.

Longitudinal evidence in this area is relatively sparse. Several papers have used longitudinal data to estimate the benefits of marriage in terms of mental health, and attempt to adjust for the selection problem.

Horwitz et al (1996) find significant benefits from marriage -- both reductions in depression for married women, and reductions in alcohol abuse for married men.

Simon and Marcussen (1999) show that marriage reduces the probability of depression.

In Horwitz et al (1996), psychological health gains are measured by using a standard 10-item depression index, and alcohol abuse by a similar index measuring the frequency of various drinking problems. This data set does have limitations. The Rutgers Health and Human Development Project in the US that followed 1380 subjects aged 12,15 and 18 years old for seven years, from sixteen of the twenty-one New Jersey counties. The subjects were tested at four points across the seven years. Seven years may be too short a follow-up period. A low response rate of less than 50% was obtained. Only the respondents who never married over the whole period (482) and the respondents who were consistently married between the 3rd and 4th period (347) were used.

The research found that depression and alcohol abuse fell over the seven years for all groups, but it fell most steeply among the married sample. Independent variables included age, gender, individual income and a 22-item index of social integration; the last of these was used to account for the anti-depressive effects from external social networks.

First, the authors use the depression measures. Those show a large and significant effect on depression at the 4th period. This reveals the role of the persistence of depression in the selection interpretation. Higher incomes and greater levels of social support significantly reduce depression, while age and gender have no effect. Even after the controls are added, being married gives a significant reduction in the depression index ($p<0.05$). Second, the alcohol abuse measures are used. Again initial scores on the index give a significant effect, though not so large. Men have much higher levels of problems with drink than women. Age reduces drinking problems. Neither income nor social support has a statistically significant effect. Marriage produces a reducing effect above these controls, which is quite large and significant at less than 1%. It would appear that marriage gives a beneficial effect in terms of reducing alcohol abuse especially for men and reducing depression for both men and women, above a selection explanation.

As an extension, the regressions are split into male and female sub samples. For depression, being married only has a beneficial effect among men. No significant difference is shown between married and single women. The results are reversed when using alcohol abuse measures. Only married women report a significant benefit, with no benefit for married men.

To investigate the exact nature of the benefit, attention was then concentrated on the married sample. The level of depression / alcohol abuse was regressed on the control variables, and some new variables, including a marital quality 20-item scale, were used to incorporate differences in the nature of marital relationships, the presence of children, and marital duration. Aside from

initial characteristics the marriage quality index is the strongest explanatory variable, with a large beneficial effect at a significance level of less than 0.1%. Marriage quality rather than marriage itself is very important in reducing mental health problems, echoing the results of Gove et al (1983).

Simon and Marcussen (1999) extend these results by showing how beliefs about marriage are correlated with the benefits gained from marriage. The authors demonstrate that individuals who value the permanence and importance of marriage gain more in terms of reduced depression, and lose more from marriage dissolution.

Panel data from the US National Survey of Families and Households (1987-88 and 1992-1994) are used. Knowing peoples' beliefs and initial status at 1987/8 (T1) allows an examination of the effect of beliefs on marital status. In total, 10005 adults were interviewed, with 74% and 82% response rates. Attrition is a problem, especially among those unmarried at T1, so results should be evaluated with care.

A standard depression scale is used -- based on responses to questions on the number of days they felt feeling lonely, or not having an appetite, etc. Two dummies were constructed to show marital gain and loss between the two time intervals. Marital beliefs were measured by asking about the perceived importance and desirability of marriage. Control variables included age, years of education, gender, race, household income and parental status. Noticeably, measures of social integration and health are missing.

Depression at T1 was significantly higher for individuals due to experience a marital loss. Selection effects are not supported, however, because depression at T1 was not significantly different for those about to experience a marital gain, or for the never married. The belief variables show marital loss is likely for those who do not think marriage is important or permanent. Alternatively, those who felt strongly about marriage were more likely to experience a gain from marriage.

The paper then investigates the effect of changes in marital status upon depression. It uses T1 depression measures to control for selection effects. Older, more educated, higher income, employed individuals are significantly less depressed. Parenthood has no significant effect, which confirms results reviewed in McLananhan and Adams (1987) and Ross et al (1990). Initial depression is a strong predictor of depression at T2, as would be expected. Even with other factors held constant, marital break-up had a large depressive effect ($p<0.001$) and getting married gave a smaller beneficial effect ($p<0.001$). With the use of interaction terms it is shown that the only gender difference is that women have more depression after a marital split. This perhaps runs counter to the view that men benefit more from marriage. When the belief variables are added (interacted with marital gain/loss) the expected results are found. In terms of depression, those who believe in

the importance and permanence of marriage gain/lose more after marriage/divorce. Empirical support for the protective effect is found, with less support for the selection effect.

Barrett (2000) investigates marital history. The paper uses the Piedmont Health Survey, which gives full marital and mental histories for a group of adults from North Carolina. A premarital mental health measure is given, with symptoms of disorders in the past 12 months, categorised into depression, anxiety and substance abuse.

Variables are created to compare the various marital history groups - C1 Unmarried Vs Married, C2 Widowed Vs Divorced, C3 Twice Widowed Vs Once Widowed, C4 Double losses but different types of loss, C5 Twice divorced Vs Once divorced, C6 Twice or Third Marriage Vs Consistently married, C7 Third marriage Vs Second Marriage, C8 Remarried (from divorce) Vs Remarried (from widowhood).

Other controls are limited: union duration, age, education and race. A premarital measure of mental health is included as an independent variable in the regressions. The results confirm the beneficial effects of marriage relative to being single (C1). An important finding showed the remarried to have less beneficial effects in terms of anxiety and substance abuse. Thus second and third marriages appear to give less protection to individuals.

Non-married partnerships are also of interest, because one would imagine that many of the benefits from being married would exist for those who simply cohabit. If not, then it might be possible to learn about the channels giving the benefits.

There are a number of differences between marriages and non-married partnerships. Obviously the level of commitment may be different, but more subtle differences are also present. Cohabiters seem more likely to have lower quality (Brown and Booth 1996) and unstable (Brown 2000) relationships, and are more likely to have lower socio-economic status (Rindfuss and VandenHeuvel 1990, Brown 2000). Second, the unmarried living-together group is of interest because in Western society its size is growing.

In the US, more than half of marriages are preceded by cohabitation (Bumpass and Sweet 1989). In 1970, half a million cohabiters existed; the figure was four million in 1999 (U.S. Bureau of the Census 1999).

Two papers find less depression among the married than among cohabiters. Brown (2000) argues that this is likely to result from reduced relationship instability. Horwitz and White (1998) establish that single people are similar to cohabiters in having more depression than the married. Cohabiters are shown to be the group with the highest alcohol abuse.

Brown (2000) investigates depression. Panel data from the US National Survey of

Families and Households (1987-88 and 1992-1994) are used. This includes 646 cohabiters and 3086 married respondents who had relationship durations of less than 10 years. This allowed the entire sample to be single at the first point of measurement (to control for initial characteristics). Restricting these again to the pure married people (never cohabited) and pure cohabited (never married) led to a small sample of 387 married and 131 cohabiters.

To assess depression, Brown uses the same scientific scale as in Simon and Marcussen (1999). The average cohabiter score was 16.3, against an average married score of 13.0. Two measures of socio-economic status were used -- years of education and total couple's earnings. Cohabiters' average years of education were 12.4, compared to 13.2 for the married (significantly different at <1%). The couples' earnings, by type, were also significantly different. Cohabiters averaged $30340, and the married $36620. This is consistent with previous studies. Dummy variables are included for the presence of biological and step children. In case of differences in relative power, the different respondents were asked their individual earnings and housework hours per week. Relative measures of these are used. Interestingly, respondents were also asked to scale their relationship in terms of instability on a scale of 1-5. The cohabiters' average showed significantly (<1%) more instability than the married: a mean score of 1.91 compared to 1.45 for the married. Other controls for depression included age, gender, race, prior union experience, and current union duration. Social integration and health measures were missing.

At first, cross-sectional OLS regressions were carried out. Without including union characteristics, cohabiters had significantly more depression. Depression scores were 2.5 points higher at a significance level of less than 0.1%. However, the addition of union characteristics explained this; the cohabitation dummy lost its significance. The instability measure was large and significant (<0.1%). Couple's earnings were negatively related to depression at the same significance level. The presence of children had no significant effect, which is consistent with the findings of Ross et al (1990), and McLanahan and Adams (1987). As usual, age and education appeared to reduce depression, as did being male. The duration of the union had a positive effect on depression, significant at <5%. This is contrary to conventional view, and was due to the high depression scores of long-duration cohabiters and long-duration childless couples.

To account for selection into the two groups, the longitudinal nature of the data was then used. At the first point in time, pre-union depression scores were not significantly different between the two groups. The scores by the second period are striking (their table 1,p.246). Cohabiters (Time 1 (pre) 17.16, Time 2 (post) 16.48), Married (Time 1 16.85,Time 2 12.15). In other

words, marriage is associated with an enormous improvement in later mental health.

Marriage seems to be causing the change, but this can be checked more fully by using a Heckman correction estimator. The decision to marry was estimated, and used to model depression in time 2, while including the explanatory variables and period 1 depression scores. Cohabitation gave a negative 2.8-point change on the depression score. ($p<0.05$). The selection variable from the first stage of the Heckman method was insignificant; that suggests a minor role for selection effects between marriage and cohabitation. As would be expected, time 1 depression does independently affect time 2 depression. When union characteristics are added, the results roughly mimic the cross-sectional findings.

Horwitz and White (1998) use the same data as Horwitz et al (1996) to examine how the incidence of depression and alcohol abuse of cohabiters compares to that of married and single men and women. The same data problems exist – low response rate, limited age cohort and no account for social networks or health. Nevertheless, a comparison of single people with cohabiters reveals no significant difference in depression. Only financial need and prior depression are significant predictors of depression in the two groups. Comparing the married and cohabiters, no statistically significant difference existed in depression levels, although cohabiters had higher scores. Relationship quality and financial need were good predictors. Compared to married people, cohabiters reported 25% more alcohol problems, which was in turn insignificantly different from the figure for the unmarried. This was especially strong for males. Cohabiting men had significantly the highest levels of alcohol problems. The broad conclusion was that cohabiting provided no benefits in terms of depression or alcohol abuse, which suggests that the benefits from marriage do not originate solely from having someone with whom to live.

A cross sectional study by Ross (1995) re-categorised the traditional marital statuses to try to take account of modern trends. Personal attachments were classified as: no significant other, the existence of a significant other, living with that person, being married to them, and being widowed/divorced. Does each level 'towards' marriage add beneficial effects? A random sample of 2031 respondents was used to test this, with a 10-item depression scale. Controls were introduced for the quality of the relationship, other household members, children, social support outside the relationship, household income, economic hardship, sex, race, and age.

The married were found to have higher incomes and a lower incidence of economic hardship. Looking at separate sub samples, the mean income increased steadily up the different levels of social

attachment. The means were: Without partner $28876, partner $32911, living with partner $36262, married $44453. Self-reported relationship quality was highest among the married group. A regression of psychological health against the variables showed a significant depressive effect from being without a partner, but no other effects from levels of social attachment. The statistically significant effects were instead from economic hardship, emotional support, age and gender.

Another way to tackle the selection problem has been to model the choice mechanism directly. One paper is Masterkaasa (1992). The mental wellbeing of a sample of 9000 unmarried individuals in Norway was assessed. This sample was then reinterviewed 2-4 years later. Causality can be studied by assessing how the initial wellbeing assessments predict marital status at the follow up stage. It might be guessed that the happier, more satisfied individuals were the ones more likely later to be married. To test this, a Cox regression[2] was used to estimate the duration before marriage. Independent variables included age, education, job, urban residence and health. The sample was split into 4 age-gender categories. Only 2 out of the 4 sub samples had the characteristic that initial wellbeing was a significant predictor of later marital status. This is evidence against the view that selection effects explain the link between marriage and mental health. However, the study was for a short period, and the existence of a partner at the start would perhaps increase wellbeing and the probability of marriage, and yet was not accounted for.

In general, the papers reviewed here are consistent with the idea that marriage improves mental health. This is even when comparing against cohabiters and controlling for selection effects. Most of the longitudinal evidence is from the US and it could be that with America's high divorce rates only the successful marriages remain. Second, the lack of physical health data as part of the longitudinal evidence is a weakness.

Section III: *Longevity Benefits from Marriage*

In the next two sections, we consider the physical health benefits from marriage. The reported findings associated with death are first reviewed. Married people have longer life spans and are less likely to die in a given period. In section IV, the health benefits in terms of illness are considered.

[2] Cox regressions or proportional hazard models are in the branch of models labelled as duration models. A probability density function for the duration is estimated through maximum likelihood methods, in terms of time and explanatory variables. The data is often censored, as some individuals will still be under duration at the time of sampling. The duration density function can be transformed into a hazard function, representing the probability of transition, which is easier to interpret. The effect of the explanatory variables on the probability of transition can then be seen. (For more discussion see Greene 2000, p.937-950)

The divorced/separated/widowed seem to be at particularly high risk of mortality. Those who were never married face somewhat lower risks of death in any given period, and the married have the lowest risk of all the groups. Evidence for this is quite widespread across the world - as far, for instance, as rural Bangladesh (Rahman 1993). Studies that do not control for the selection effect but still confirm the main finding are - a 16 nation study (Hu and Goldman 1995), Israel (Manor et al 2000), and the US (Johnson et al 2000), among others.

The longitudinal studies of marriage and mortality adopt the same methodology as the mental health studies. Some initial health measures are taken and used with other explanatory variables, including marital status, to predict mortality. Initial health measures are usually self-reported, which can be criticised. However, it has been shown that self reported health measures are fairly good predictors of actual mortality (Idler and Kasl 1991). Cox regressions are often used to estimate duration to death, or probability of death within a given period. Results are typically described in Relative Risk ratios (RRs). These describe the relative risk of each marital-status group compared to people who are in conventional marriage. Unlike in the mental health papers, the selection effect in this literature is often estimated separately.

An obvious difficulty is that initial health measures may not be detailed enough to cover all threats to survival. If not, then it is possible that the selection problem may not fully solved, which would leave the estimates of the benefits from marriage biased. Another common problem is that marital status is often measured some years before death, so full marital history is not, and often cannot be, included in the regression. Tucker et al (1996) and Cheung (2000) try to use marital history, but in doing so struggle to account for the selection effect or control for other variables. Results are also hindered by another problem: most data sets still include people who are alive.

Murray (2000) resolves this problem by using a complete historical data set. The paper follows a sample of subjects from an unmarried state at 18 years of age through to death. The sample consists of graduates from Amherst College, Massachusetts, born between 1832-79. Those who did not graduate are not followed. The sample shows date of first marriage only, so full marital history is unknown. The date of wife's death, however, is known. At 18 these men had their height and weight measured. Height -- although affected genetically -- depends on a person's nutrition and health. A BMI (Body Mass Index = height/mass squared) measure can be calculated. Research has found a non-linear relationship between both height and BMI with mortality (Costa 1993), although the height relationship is thought by some investigators to be spurious.

For the historical Amherst study, height was divided into 5 groups (very short [>2sd from mean], short [2sd from mean], normal [+/- 1 sd from mean] tall, very tall)

and BMI into 4 (underweight, recommended, overweight, obese). Other controls accounted for the person's occupation and birth cohort.

Regressions were estimated to explore the selection question: can initial health account for marital behaviour? First, a logit model was constructed to estimate the consequences of marriage versus lifelong bachelorhood. Other models were used to estimate the duration until first marriage. Underweight men were found to be 4% less likely ever to marry ($p<0.05$) and 12% less likely to marry in a given year ($p = <0.05$). Overweight men were 7% more likely to marry ($p<0.05$). Obesity among men led to no negative effects on their marital prospects. This may seem surprising, given modern tastes. In terms of height, only the extremes produced any significant differences in life outcomes. Very short men were much less likely to marry (-11%). The very tall were much more likely to marry (15% more likely). Height and BMI may signal future health or productivity, or the findings may reflect tastes in physical attractiveness.

Similar regressions were then carried out to establish the effect of marriage on mortality, while accounting for selection effects. The duration model techniques were used again to estimate time before death. Using a dummy for married or not, the coefficient indicated a 47% reduction in within-period mortality risk for those who were married ($p<0.01$). Using a more sophisticated dummy activated in the years after marriage and not before, there was a 15% reduction in risk of death ($p<0.01$). This effect existed after controlling for initial height and BMI, occupation, and cohort. The BMI categories showed an increased risk only for the obese. None of the height categories led to significantly increased risk of death. Occupation indicated significant risks for physicians and attorneys compared to, for instance, teachers and ministers. The paper seems to find clear evidence that marriage is protective.

Early evidence on social networks came from House et al (1982) and Berkman and Syme (1979), who found that more isolated individuals had higher mortality rates. The Tecumseh Community Health Study 1967/9 sampled 35-69 year olds and then assessed mortality in 1978/9. A full medical examination and medical history gave initial readings on morbidity. Other variables included age, smoking, alcohol consumption, education, employment and occupation. Social network variables measured the number of intimate social relationships, formal organisation involvement, and leisure activities (passive and active). These were used to predict mortality in the usual fashion, with a binary logit equation. For men, being retired and smoking were significant predictors of death, ceteris paribus. The social measures proved especially interesting. Frequency of attending voluntary associations, spectator events or classes/lectures all appeared to reduce mortality ($p<0.05$). Marriage had a large protective effect ($p<0.05$). For women,

however, the results were different. No marriage benefit existed. Time spent watching television increased mortality ($p<0.005$), and the frequency of church attendance reduced mortality ($p<0.025$). This research supports the idea that social activities and networks promote longevity. This study also found a larger health gain from marriage for men than women. Schoenbach et al (1986) attempt a similar study with different social measures, which they argue are more appropriate. The 1960 Evans County Study is used with a 6-7 year follow up. They only find support for the social networks argument in older people with few ties. This longevity-increasing effect is especially strong in white males.

We now turn to some UK evidence. Ben-Shlomo et al (1993) fail to find clear support for the benefits of marriage. They use a sample of middle-aged males from the UK civil service, over an 18-year period, to try to quantify the effects of marriage on the probability of death, after controlling for initial health.

In 1967-69, their sample of 18403 men, aged between 40-64 years old, were medically examined. Measures were taken of height, weight, blood pressure, diabetes, and lung volume. Questionnaires also ascertained age, marital status, employment grade within the civil service (administration, professional/executive, clerical, manual) and smoking habits (ex smoker, never, smoker – if so how many per day). Ten percent of the sample was asked to keep a three-day record of their diet and alcohol consumption.

After an 18-year follow up period, those who had died (3433) were categorised by cause of death. Unfortunately, no account for change in marital status over the 18-year period was made. Mortality rates per 1000 persons were calculated for the different marital groups and adjusted for age. These are reported below (from table 1, p.201)

Mortality Rate per 1000 (All Causes)

Married	Widowed	Single	Separated
13.9	20.6	16.9	21.0

The main difference between married and single men seems to come from differences in rates of cardiovascular disease and lung cancer. This may tell us something about how a protective effect operates. A reduction of stress might, in principle, decrease cardiovascular deaths; the guardian effect may prevent smoking, thereby reducing the chance of lung cancer. Nevertheless, this does not account for the initial health assessments and risk factors. A comparison of initial health and risk factors highlights some things of interest. The men who had never married were very significantly ($p<0.001$) less likely to be in the top employment grade; only 45% were, compared to 68% for the married men. Single men also had higher blood pressure. Moreover, 46% of single men smoked, compared to 41% of married men. Among those who smoked, the unmarried also consumed more cigarettes per day: 18.7 for

the single and 15.8 for the married. These differences are significant at less than 0.1%. Also, 16.8% of single men were heavy drinkers (>34 units /week) compared to only 12.5 % of married men (p=0.04). The guardian effect might have an explanatory role: marriage may moderate these risky behaviours. However, the selection problem can reappear if those making risky choices are less likely to marry, e.g. heavy drinking may reduce the chances of being married.

The paper calculates mortality odd ratios using Cox regressions, allowing for the control variables including the initial health/risk factors. 95% confidence intervals are given around the ratios. Considering all causes of deaths the ratios (relative to the married) are given below. (Table V, p.203)

Widowed	**Single**
1.43(1.16,1.76)	**1.24(1.02,1.51)**
Separated	
1.05(1.00,1.24)	

Only the separated and divorced had a significantly higher mortality rate compared to married men, after controlling for initial health and risk factors. However, as the paper states, p.203, "This suggests that being single itself is not associated with increased mortality, but the effect of remaining single on risk factors such as blood pressure and smoking, both high in this group, compared with married men cannot be ruled out."

This research suggests there are interesting differences for the married and never married, but finds no significant difference in mortality between the two groups in which we are interested.

Different conclusions were drawn by Ebrahim et al (1995). Only the single had excess mortality risk, and not the divorced or widowed. They monitored British men aged 45-59 years old for eleven and a half years, from 1978/80 to 1983/85. Explanatory variables in their statistical work included employment and occupation status, medical history with medical assessments including activity measures, and smoking/drinking consumption. Married men showed the smallest percentages of current smokers, manual labourers, and heavy drinkers, and had the lowest unemployment rate. Single men had the most unfavourable cardiovascular factors – they were more inactive, obese, with higher incidence of smoking, high blood pressure, diabetes and bronchitis. Cox regressions were estimated: only the single had excess mortality risk. An odds ratio of 1.4 with a confidence interval of [1.1, 1.8] was reported. The risks for the divorced and widowed were insignificantly different from those for the married. Even so, for non-cardiovascular deaths the widowed showed a high odds ratio of 2.4 (1.1-5.3).

The papers described have failed to allow for changes in marital status in the follow up period. These could be important omissions. As mentioned previously, papers that try to account for marital history include Tucker (1996) and Cheung (2000).

In Tucker (1996), marital history is monitored up to the middle of life. Four taxonomic types are defined -- those consistently married, the never married, the divorced/separated, and the inconsistently married (divorced and remarried). The health of these groups is then investigated. The Terman Life-Cycle Study tracked 11 year olds from 1921 to 1991. The individuals were picked from schools in California, and only chosen if their IQ exceeded 134. 99% of the sample was white. The sample was therefore not representative of the population as a whole. 1077 individuals are used here, and marital history at 1950 is used as the reference point. Changes in marital status after this point are ignored. The independent variables in the analysis included measures of social ties and of self reported health (a primitive measure from 1-4) in 1950. The measure of social ties captured the number of living children and siblings, and the number of organisation memberships that a person had. The analysis discovered that those who were consistently married has more children and organisation memberships than the inconsistently married and divorced, who had more than those people who never married. A rough correction for selection was made by using childhood personality measures from 1921. These were measures for conscientiousness, cheerfulness, humour, permanency of moods, and a dummy for parental divorce before the age of 21. There were no controls for health.

Cox regressions were used to predict mortality. For men, after adjusting for self-reported health, the inconsistently married had a 40% greater risk of dying, the divorced had a 250% greater risk, and the single had no significant risk above the married males. When social-ties measures were added, the risk for single males was eliminated and the risk for divorced males was reduced by 22% but was still significant. For females with no social tie measures, only the divorced showed any risk – having a 200% greater risk of mortality than the married. With social tie variables included as controls, this fell by 18%. All risks for other groups were eliminated. Interaction terms showed no significant difference in risk effects between males and females.

The childhood personality measures reveal that more conscientious children are more likely to be consistently married than inconsistently married ($p<0.05$). 10.9% of the consistently married sample had experienced parents' divorce by the age of 21. This was lower than for the inconsistently married (25.8%) and the never married (14.7%). The other variables had no statistically significant effect. Adding the significant measures to the Cox regressions to partly account for selection effects reduced the inconsistently married risks -- by 21% for males and 15% for females. This suggests some role for selection processes. But this could be interpreted as a damaging effect from divorce, because the never-married had no supplementary risk of mortality compared to the married. Only the

divorced and remarried were more likely to die, when compared to the married, but the study has the weakness that it lacks strong controls for health and mental health.

Cheung (2000) studies a longitudinal data set on British women, and has a time-varying independent variable to allow for marital status durations. An initial assessment in 1984-5 in which the women were 35 and older was followed up twelve years later. Self-reported health, height, education and smoking /drinking habits are included, but social networks and financial status are not. The results find excess mortality in the unmarried but not the divorced or widowed. The single face an odds ratio of 1.45 ($p<0.05$); the divorced and widowed both have the same odds ratio, 1.09. Drinking, smoking and self-reported ill-health are all significant predictors of death.

A different non-longitudinal approach is employed in Rogers (1995). With a case control method, which is common in epidemiology, interesting conclusions are drawn about the causes of death. Contrary to the idea that selection effects explain the correlation between marriage and wellbeing, the biggest observed gaps were in social causes of death (suicide, accidents, and cirrhosis of the liver). The National Mortality Followback Survey sampled 18733 deaths in 1986. Socio-economic status and cause of death were measured. Matched to this was another sample of individuals who lived through 1986, to give a total sample of 36142 individuals.

After controlling for socio-economic status and income, which had a strong effect, the consequences of marriage are calculated. Marriage offers a 20% protection to women, and much higher protection to men. In this sample, unmarried males were 2-3 times more likely to die than married men. The protective effect was especially strong against 'social' causes of death. Divorced and separated men were 3-5 times more likely than married males to die from accidents /suicide /homicide / cirrhosis.

Section IV: *Health Benefits from Marriage*

Since the much-cited study by Verbrugge (1979), many investigators have tried to work out whether marriage makes people healthier. In this section we examine papers that use different ways to resolve the selection problem (that is, the statistical problem that the healthy may be the ones who are most likely to marry). Waldron et al (1996) estimate separate selection and protection effects. Joung et al (1998) directly estimate the selection effect. We introduce the evidence on 'adverse' selection effects, mentioned in footnote 1. Lillard and Panis (1996) explore this empirically, with support from Cheung (1998) and Cheung and Slogett (1998).

Joung et al (1998) takes longitudinal data from the Dutch GLOBE Project. The data are used to test whether health

measures can predict marital status i.e. if there is a health-driven selection effect. The GLOBE study is longitudinal and follows individuals aged between 15-74; the subjects come from around Eindhoven; the survey response rate was 70%. Here all those living in Eindhoven are used (10811). Between 1991 and 1995, marital status changes, deaths and migrations were all monitored. Perceived general health, subjective health complaints and chronic conditions were used as health measures. Age, sex, education level, religion and employment status were controlled for. Regressions were used to establish relative risks (RRs) of the various changes in marital status. 95% confidence intervals were constructed around the risks. One issue is that at the time of measurement a troublesome marriage may be giving health problems, and a subsequent divorce could occur. This would look like a selection effect, when it is actually the bad marriage causing the heath problems. To control for this, time between health measurement and first observations were gradually increased -- to filter out the divorces before monitoring. Another problem is that the never married may have a partner at the start of the study. This will increase the probability of marriage, and possibly increase the health of the individual, which would bias the measurement (Masterkaasa 1992). Cohabitation, non-cohabiting partner, and no-partner states are controlled for, to try to resolve this.

***Results*. i) Never married to married. The introduction of the partner status controls made little difference to the relative risks. In terms of all the health measures, no significant differences were found in relative risk of marriage. The control measures did show some significant results. Older, less educated, non-religious, unemployed, no-partner males were less likely to be married. Employment and partner status were particularly significant ($p<0.01$), while the other factors were significant at 5%.**

ii) Divorced to married. Again none of the health measures was a significant predictor. This is evidence against health selection. Partner status was significant again. Marriage after divorce was much more common for younger people, and twice as common for males.

iii) Marriage to divorce. The probability of divorce was significantly and positively related to subjective health complaints and chronic conditions, at 5% and 1% significance levels, respectively. To control for the problems mentioned earlier, a 2-year gap was created between initial measurement and follow up, but results were unchanged. Married people with 4+ subjective complaints were 1.5 times more likely to divorce than others with fewer complaints. Those with 2+ chronic complaints were 2 times more likely to divorce. Probability of divorce fell with age, but other controls were only weakly significant.

iv) Marriage to widowhood. Health measures gave no significant prediction of widowhood. Thus, only the transition form marriage to divorce revealed any evidence

that health determines the probability of marriage. Minor evidence for a selection effect is found by Waldron et al (1996).

Waldron et al (1996) demonstrate that jobs provide valuable social networks outside marriage, and that these improve mental and physical health. The unemployed lose this channel of emotional support, (Waldron and Jacobs 1988,1989).

The authors use the National Longitudinal Surveys of Labour Market Experience, covering US women in 1968,1978,1983,1988. The cohort started aged 14-24yrs, and ended at 34-44yrs.

A health scale was constructed from 11 questions on physical difficulties and 6 questions on more general difficulties, e.g. tiredness. Working hours were measured. Other controls included age, gender and parental status. No measures for income or social networks were available.

For 1978 and 1983-88, OLS was used to predict health status – to test for protective effects from being married. Initial marital status seemed to be a good predictor of later health. This varied, however, as interaction terms were included. Part-time and full-time married women appeared to gain no protection; only non-working married women did. No other significant differences in the protective effect were found. Hours employed was positively correlated with health. Initial health and age had the usual significant effects.

Next, selection effects were tested by predicting marital status over the 2 periods. In the 1st period, initial health was a strong indicator, but not in the 2nd. Again the effect varied by employment. No selection effect was discovered for full-timers.

To conclude, selection and protection effects depend on employment status. The effects seem stronger for the unemployed. It is possible that full time workers are already receiving beneficial benefits from work networks reducing the effects of marriage. Alternatively, those likely to be in full time work, may be more immune to any marriage benefits.

An important study has been done by Lillard and Panis (1996). The authors write down an explicit model in which marriage and health are simultaneously determined. This is a valuable thing to do because it makes clear that it is not necessary to choose between selection and protection. Very plausibly, both will exist in the data. The difficulty then is to disentangle the strength of the effects of marriage upon health and the effects of health up marriage.

The authors take data from the Panel Study of Income Dynamics, which is a US longitudinal data set in which approximately 5,500 households have been interviewed annually. Self-reported health information is provided in the PSID: would you say your health is excellent, very good, good, fair, or poor? Lillard and Panis begin by replicating the finding that, when there is no control for health, married men die later than those in other marital-status groups. Once health is included as a regressor, however, divorced

and married men have the same mortality risk per unit of time. Never-married and widowed males, however, do die earlier. Lillard and Panis explore the effect of health on the likelihood of marriage; strikingly, they find that healthy men are less likely to marry or remarry. The authors go on to estimate a simultaneous-equation model involving mortality, health, marriage formation, and marriage disolution. Their 4-equation model is probably the most sophisticated attempt in the published literature to understand the links among these variables.

Perhaps the most interesting finding of Lillard and Panis is that the decision to marry for the first time does not seem to confer health benefits on men. Divorced men, by contrast, do reap a health gain by marrying. Relatively unhealthy older men do tend to marry and remarry early, and they stay married for longer. This is so-called adverse selection into marriage. It is likely that marriage provides a kind of insurance, and support, and that both of those are more valuable to people with a higher probability of illness. Among younger men, there is evidence, the authors conclude, of positive selection (more specifically, healthy people enter marriage more because they have unmeasured characteristics that are correlated with good health). The authors also make a technical contribution: the joint estimation of their equations allows estimation of correlations due to unmeasured influences. Assuming the estimating equations are correctly specified, therefore, it is possible to learn more about the links among the variables than it is by merely instrumenting marriage in a health equation.

The idea of adverse selection is supported by studies using a British cohort (Cheung 1998, Cheung and Sloggett 1998). The National Child Development study followed children born in a particular week of 1958 with follow-ups at 7,11,16,23, and 33. Variables included were social class and housing tenure, education, unemployment record, alcohol / smoking consumption, health measures – height, weight, self-reported measures and limiting illnesses. Also included was a variable aimed at estimating temperament. Cheung (1998) uses those married or divorced at 33 years of age to try to understand the probability of divorce. Logit models for females indicated that council renters and heavy drinkers were more likely to divorce. An adverse selection effect in health was found. Those with poor self-rated health were less likely to divorce, with an odds ratio of 0.57 $p<0.1$. For men, heavy smokers were less likely to divorce (OR 0.54, $p<0.05$). Replicating this study, but using the selection from single to married, Cheung and Sloggett (1998) find only positive selection effects between the 23-33yrs assessments. Between 16-23 the results were less clear. This work is consistent with the hypothesis that that there are adverse selection effects from marriage to divorce, but not from single to married.

There is a branch of the literature that studies the health benefits of marriage among the elderly (Goldman et al (1995), Pienta et al (2000)). Pienta et al confirm the benefits of marriage across a wide sample. Goldman et al, using longitudinal data over a 6 year follow-up period, struggle to find statistically significant results. Only widowers show increased risk. A potential sampling problem is that many institutionalised persons are not included in the data.

An interesting study into the effects of marriage on the incidence of Alzheimer's disease is Helmer et al (1999). Using a French longitudinal data set including measures for sociodemographics, social support, living conditions, health and depression measures, and medical history, the authors found significantly higher risk among the never-married. There was no excess risk for the divorced or widowed, however.

Summarizing, these papers, while showing the complexities of the measurement problems, and resolving them in varying degrees, give evidence of mental and physical health benefits from marriage. We feel that on balance, the evidence is in favour of the existence of protective effects. The absolute certainty of these effects can only be increased with more sophisticated studies, (such as Lillard and Panis) and with better data.

Section V: *Investigations into the Channels Providing the Benefits from Marriage*

If we accept that human beings gain some kind of protective effect from marriage, where and how are those benefits actually transmitted? We described some theoretical possibilities, in section I, but here we survey some of the literature that has tried to get to the bottom of the mechanism.

First, married couples may gain financially. Second, marriage may bring increased emotional and instrumental support. Third, marriage may change lifestyles because of some kind of guardian effect, where healthy activities are increased and risky behaviours reduced. We have already seen some possible evidence for such channels; but again, selection effects may distort these results. Higher socio-economic status and financial advantages for the married have been shown (Brown 2000, Ross 1995, Rindfuss and VandenHeuvel 1990). Ross (1995) established that the married have higher levels of emotional support. Evidence of married individuals drinking and smoking less has been found, perhaps suggestive of a guardian effect (Horwitz et al 1996, Ben-Shlomo 1993). Rogers (1995) proved that married people were less likely to die from social causes of death (accidents / suicide / cirrhosis of the liver). This may indicate a guardian effect.

We now briefly consider three papers that have tried to test these explanations. All

use cross sectional data, so have limitations, but the patterns where the married have advantages can be seen. Whether or not marriage has actually caused these advantages cannot, however, be determined. Joung et al (1997) have data that come from the GLOBE project in Eindhoven and its surroundings. The response rate was 70%. Wyke and Ford (1992) review the explanations, and test them. A sample of 55-year old women from around Glasgow is used. Hahn (1993) is a cross sectional study using 14000 households in the US.

All three papers point to financial advantages. Joung et al partially support the financial channel; it concludes that 40% of widows, 55% of divorced women, and only 18% of married women came into the low-income category. The authors suggest that the material circumstance explanation is particularly strong for married women. However, the male results showed little difference between groups in terms of income. Hahn demonstrates that married women are more likely to have excess income above their own, have health insurance more often, and tend to own their home.

Wyke and Ford use analysis of variances to prove that health advantages are likely to come from material gains and emotional support. With this and Joung et al showing that the emotional support channel is strong for men, the case for that seems a serious one.

The guardian channel is supported too. Joung et al establish that married men take part more in activity and have lower alcohol consumption. Hahn finds that married women are less likely to smoke and be obese, and more likely to exercise and take preventative health measures. But this channel finds no clear support in Wyke and Ford.

Unfortunately, the evidence again can be criticised for ignoring selection, and so can only point to possible avenues of effect. The guardian channel has been investigated more thoroughly.

Umberson (1987, 1992) investigates the guardian effect further. A US sample of 1826 married or divorced/separated individuals in the mid 1970s is used to investigate this channel. Six indices measuring orderliness of lifestyle, risk taking behaviour, drinking problems, drinking and driving, marijuana use and substance abuse related to stress are all constructed. Parental status (kids at home, kids not at home, no kids), age, education, gender and race are also all controlled for statistically.

The divorced were found to be more likely to have adverse (higher) scores in the indices -- showing a lack of healthy behaviour and dominant risk taking behaviours. All were significantly higher than the married scores, apart from marijuana use. The widowed had higher scores than the married but were insignificantly different. People with kids at home showed some significant improvements, but not when the

children lived away from them. Men scored significantly higher than women. This evidence supports the idea of a spouse imposing a guardian effect and improving lifestyle behaviours. Umberson (1992) finds that married men are the most likely group to be under this effect, and their wife is the most likely person exerting it. Such a mechanism is less strong for married women and is a possible explanation for the apparent larger marital benefits for men over women. The guardian channel is thought to be less strong for cohabitants, because the commitment is lower, which makes control weaker.

Power (1999) attempts to factor out the selection effect by looking at the changes in drinking patterns. A birth cohort all born in 3-9 March 1958, in England, Wales or Scotland had data collected about them at ages 7,11,16,23 and 33. At age 33, 69% of the sample (11045) remained. Attrition was associated with disadvantaged backgrounds, so care must be taken in interpretation, but biases are small. At ages 23 and 33, alcohol consumption (units) in the past week was established. Heavy drinking is categorised as >20 units for women, and >35 units for men. Marital status was defined as usual but with cohabiters being classed as marrieds, as the number of cohabiters was small. This study is rare in taking into account change in marital status between the "23" and "33" interviews. Parental status was obtained at the 33-year-old interview.

Analysis of variance compared the cross sectional evidence at 23 and 33, and was used to test the change in drinking between 23 and 33. Logistic regressions then investigated the causal effects. We start by looking at the cross sectional findings. Men drank more than women on average ($p< 0.001$). Consumption was consistently higher at 23 than 33 ($p<0.001$). The usual pattern of divorced/separated drinking the most followed by the singles and then the married was confirmed in mean consumption and proportion of heavy drinkers. Tests to see if the sample attrition affected this were passed. A look at the drinking patterns in terms of changes in marital status may give an idea of selection processes. Three comparisons were made. Continuously single was compared to single→ married, continuously married to married → divorced/sep, and married → divorced to divorced → remarried. The only significant finding showed marriage to be more likely for those single men who drank heavily at 23, than for those single men who did not. This seems to go against the accepted patterns, and would contradict selection effects in terms of low levels of drinking. The findings also contradict the selection effect of heavy drinkers being more likely to be divorced; the effect was not statistically significant.

If we look at the changes in drinking habits, some of the causation can be investigated. The largest fall in drinking came from the single to married group, and the smallest came from the continuously single. An attempt to establish if this was

due to marital status alone, or parental status instead, showed no effect of parental status on male drinking, but a strong effect on female drinking habits. Getting married per se seems to reduce male drinking; but parenting seems to be a stronger force in reducing married women's drinking.

The recently divorced change their drinking behaviour after remarriage. They show a large rise in drinking but the continuously married and not recently divorced show small declines in drinking. This paper has demonstrated the absence of strong selection effects in terms of alcohol consumption, but strong effects for those experiencing changes in marital status. Becoming married apparently makes alcohol consumption fall, and recent divorce cause it to rise. This would seem to confirm the guardian effects, but the limits of the study are apparent. Omitted variables include any account for mental health, employment status, and social integration.

The papers covered in this section do not offer overwhelming evidence for any of the explanations suggested about why marriage is good for people. Power et al (1999) is the only study that can reject the selection explanation, and Power et al's study is limited by possible misspecification.

Conclusions

Married people live longer and are healthier. This fact has been found many times and in many countries. What is less clear is whether the pattern tells us anything reliable about what marriage <u>does</u> to health. Causality, in other words, is the real issue.

This paper is a review of the longitudinal evidence. By studying people through time -- in panel data sets - it is possible to draw more persuasive judgements than by looking solely at cross-sectional evidence. The same person can be followed through the years, and that makes it possible, in principle, to factor out a host of subtle influences that are specific to the person. Longitudinal data make it possible for people's early health to be held constant, for instance, within an equation that explains their health and mortality later in life. It is important to be clear, however, that longitudinal data do not solve all problems in this or other fields. First, as the philosopher David Hume pointed out, because something moves first does not always mean that it causes what goes second, no matter how reliable the correlation. Second, human beings are not randomly assigned to marriage. They choose it. Because of that, there are likely always to be doubts about how to interpret what might be called the deep causal links between marriage and wellbeing.

Nevertheless, our reading of the longitudinal evidence is that, in so far as can be proved using current statistical methods, after looking across studies for a variety of settings, it is possible to draw conclusions:

- **Marriage does make people less likely to suffer depression and psychological problems**
- **Marriage makes people live longer**
- **Marriage makes people healthier**
- **This is probably not merely because people engage in less risky activities when they have a spouse.**
- **Marriage quality and marital beliefs can increase these effects.**

In the terminology of this research field, there is a genuine protection effect from marriage. What we see in the data is not a cross-section illusion; the pattern is not merely because healthy men and women get married more often or more quickly.

Exactly how marriage works its magic remains mysterious. It is important that a new generation of tests be designed to find the answer.

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