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Abstract

There is extensive evidence that married people are, on average, healthier than their unmarried counterparts. It is unclear how much this positive correlation can be explained by the selection of healthier people into marriage. In this paper, I estimate the effect of marriage relative to cohabitation on health and disability. I control for selection into marriage by instrumenting marital status using state and time variation in marriage tax penalties. After controlling for selection, low education men benefit from marriage whilst all other men are no better off if married. For women with more than high school education, marriage increases the probability of reporting a health problem.

JEL classification: H31, I12, J12, J18

Keywords: health, disability, marriage, cohabitation, marriage penalty

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1 Introduction

Marriage is associated with better self-reported health (Lillard & Panis 1996, Williams & Umberson 2004), lower mortality (Lillard & Panis 1996, Manzoli, Villari, Pirone & Boccia 2007), better mental health (Simon 2002) and less damaging health-related behaviours (Duncan, Wilkerson & England 2006). The consistent finding of better outcomes not only for health but for income, children and relationship stability, has led to the suggestion that marriage should be promoted as an ideal family structure not only over single parent families but also over unmarried cohabitation (Waite & Gallagher 2000). The increasing prevalence of cohabitation and decline of marriage in the United States (Kennedy & Bumpass 2008) has contributed to this recommendation.

The bulk of the evidence used to support these recommendations compares the outcomes of married individuals to those of single, divorced or widowed individuals. When considering health, it is clear that the presence of a partner to notice problems and increase available resources is likely to lead to better health for people who are married relative to people who live alone. Such mechanisms do not, however, directly apply to the comparison between marriage and unmarried cohabitation. Explanations of any beneficial health effect here rely either on marriage providing a commitment mechanism or improving other outcomes which contribute to health production. Where marriage is explicitly compared to cohabitation, Musick & Bumpass (2011) find that entering cohabitation is associated with a smaller health improvement than getting married in the US, but Canadian data suggest no additional health benefit of marriage (Wu & Hart 2002).

Moreover, although it is widely acknowledged that there is likely to be selection into marriage on the basis of health status, few studies directly address this issue (Ribar 2004). Most attempts to control for selection use fixed effects (Williams & Umberson 2004, Prigerson, Maciejewski & Rosenheck 2000, Duncan et al. 2006, Musick & Bumpass 2011). This does not control for selection on expected trends in health. Lillard & Panis (1996) directly control for selection when considering

the effect of marriage on health for men, and conclude that there is significant positive selection into initial marriage and negative selection of divorced men into remarriage, and no causal effect of first marriages on health.

This paper estimates the causal effect of marriage, compared to cohabitation, on reporting health problems for both men and women ages 18 to 50. It controls for selection into marriage using a simulated instrument that captures variation in marriage tax penalties. Fisher (2011) has shown that couples respond to these financial incentives in their choice between marriage and cohabitation. Since the paper focuses on the margin between marriage and cohabitation, the results can be used to draw conclusions about whether marriage causes health benefits over cohabitation.

I use data from the March Current Population Survey (CPS) from 1988 to 2008, and study self-reported health problems and disability. Responses to these questions have been found to be strongly correlated with clinical measures of disability (Bound & Burkhauser 1999).[1] In line with the literature, a smaller proportion of married people than cohabiting people report a health problem. After controlling for selection, I find that women with more than high school education are 1.4 to 1.7 percentage points more likely to report a health problem or disability if they are married. This is a 50% increase, and is not explained by these women having more children: indeed, the harmful effect is concentrated amongst women without dependent children. Since women are less likely to work when married, two potential explanations for this result are justification bias and lower access to health insurance: women report health problems to justify the fact that they are not working, or have reduced access to healthcare through less employer-provided health insurance which is not offset by the extension of the man's insurance to spouses. There is no causal effect of marriage for less educated women. The selection of healthier women into marriage completely explains the apparent protective health effect found in previous literature.

[1]The question wording is "Do you have a health problem or a disability which prevents you from working or which limits the kind or amount of work you can do?"

Men with above high school education also gain no protective health benefit from marriage: they are also positively selected. However, men with low education do derive a benefit from marriage: they are 2.8 percentage points (or 50%) less likely to report a disability if they are married.

It is likely that the effect of marriage on disability is heterogeneous and so these are estimates of a local effect of marriage on health for individuals whose marriage decision is changed by the marriage penalty they face. This is a local effect of particular interest, since the marriage penalty is a policy lever directly available to governments and so a mechanism by which marriage promotion may be pursued. However, the evidence presented in this paper below suggests that the marginal marriages induced by financial incentives do not come with the health benefits seen in cross section data, and so casts doubt on the desirability of such a policy.

The paper proceeds as follows. Section 2 discusses the potential mechanisms through which marital status might affect health. Section 3 describes my data and section 4 sets out my empirical strategy. Results for the effect of marriage on health are presented in section 5, and potential mechanisms to explain these results are investigated in section 6. Section 7 concludes.

2 Marriage and health

An individual's health status can be interpreted as the level of a stock of health capital (Grossman 1972). Health is an input to an individual's utility both directly and indirectly, for example by increasing productivity and wages. On the other hand, the choices an individual makes affect their health status, and neglecting to invest in health results in depreciation over time. Inputs to health production include both physical resources such as food and medicines, and time investments such as exercising, monitoring and appointments with a physician.

Much of the existing literature relating marital status to health compares married people to those who are single, divorced or widowed. There are a number of mechanisms by which it is expected that married people achieve different health

outcomes to those who live alone. For example, increased resources should follow from the economies of scale and ability to share risk inherent in a two person household, and this may be further enhanced through specialisation. This will directly allow an increase in resources available for health production. In addition, the cost of monitoring health will fall as partners monitor each other as well as themselves. An increased value of time at home due to the presence of the partner may also reduce risky behaviours such as drug taking and extreme sports, as well as encouraging a more sedentary lifestyle. Overall these mechanisms suggest that individuals should experience better health when married than when living alone, and this is reflected in the substantial body of literature that finds a positive correlation between marital status and health (Waite & Gallagher 2000).

In this paper I am comparing married individuals to unmarried but cohabiting individuals, not to those living alone, and so the mechanisms discussed above are not immediately applicable. Marriage differs from cohabitation as it is a contract supported both by the law and by social support and expectations. Dissolving a marriage contract is more costly and time consuming than separating from a cohabitation. These distinctions suggest a number of mechanisms by which marriage might have differential effects on health relative to cohabitation.

First, the higher cost of relationship dissolution reduces the rate of dissolution of married couples (Lillard, Brien & Waite 1995), which could reflect a higher level of commitment. This may reinforce the mechanisms discussed above: more specialisation (reflected by a reduction in women's labour force participation) and so higher financial resources meaning more resources to devote to healthcare and healthy lifestyle choices. The value of time at home may be even higher, further reducing the prevalence of damaging health behaviours, and suggesting a positive health benefit of marriage over cohabitation.

On the other hand, increasing specialisation and lower female labour force participation may restrict the opportunities available to women and so lead them to perceive more health problems. Men may intensify their labour force activity and suffer more stress and related illnesses, and both men and women may devote less

energy to physical fitness as they feel less need to remain attractive for their partner. The higher level of commitment might also lead to married couples having more children, which might lead to higher stress levels and physical health strains, particularly for women.

The other key feature of marriage relative to cohabitation is the social context and external support afforded to it. Despite increasing rates of unmarried cohabitation, a majority still aspire to marriage (Bumpass, Sweet & Cherlin 1991). The social norms governing marriage are stronger than for cohabitation, and this is reflected in the lower integration of cohabitees with family and society (Eggebeen 2005). This wider social support and interaction with the community could have implications for health. More support might be provided to married couples, and this could support health and aid recovery from health problems, although this support may make acknowledging such problems less costly. On the other hand, married couples who do not follow social norms may find others' expectations stressful or even feel pressured into adopting lifestyles which they otherwise would not choose, and this may damage health.

A further manifestation of the external support provided to married couples is in employer-provided health insurance, which is often extended to spouses and not to unmarried partners. Marriage may therefore provide better access to healthcare than cohabitation, and so improve health outcomes. However, access to better healthcare may allow health problems to be more easily acknowledged.

Besides these potential causal mechanisms for marriage to affect health, cross sectional correlations between marital status and health may also be explained by selection. The potential selection of healthier people into marriage is widely acknowledged in existing literature (Ribar 2004): as marriage is more costly to dissolve than cohabitation, individuals will wish to marry someone with better characteristics, including better health. In addition, couples who have characteristics associated with better health, for example those who are more committed to their relationships or who undertake less risky behaviours, are more likely to choose to increase the costs of dissolving their relationship. On the other hand, if an indi-

vidual is in poor health, the potential health gains from a more stable relationship might be higher, both directly and due to a higher cost of finding an alternative partner. This may lead to adverse selection into marriage (Lillard & Panis 1996). Both positive and adverse selection will bias the results relating marital status to health.

It is not clear that marriage should provide the same health benefits over cohabitation as it does over living alone. There is also expected to be substantial selection into marriage. The aim of this paper is to estimate the magnitude of the causal effects of marriage versus cohabitation on health outcomes, explicitly controlling for selection into marriage.

3 Data

I use data from the March Current Population Survey supplement covering tax years 1988 to 2008. The CPS interviews around 50,000 households each month, and collects the data I require for this study in the supplement to the March survey. With this repeated cross section I observe the stock of married and cohabiting couples, and their reported health status, at each point in time. I do not observe transitions between marital statuses, or how long relationships have lasted.

I consider both married and unmarried cohabiting couples aged between 18 and 50 years old. An individual is married if he (she) reports being married and residing with his (her) spouse. Where an individual is unmarried but reports living with a partner they are classified as cohabiting.[2] Individuals who are not observed in a coresidential relationship are discarded.

In the analysis below I control for various characteristics which may affect marriage and health. Demographic characteristics are included, as are variables to control for the state of the local marriage market[3] and an indicator for whether the

[2]Prior to 1993 the CPS does not record which couples are unmarried cohabitees. I infer cohabitation by considering non-relative partners and roommates where there are just two opposite sex adults in the household. When it becomes possible to report unmarried cohabitation, the number of so inferred cohabiting households declines dramatically.

[3]Sex ratios are calculated by state, age and race using census data and projections from the Bureau

Table 1: Descriptive statistics

	Married		Cohabiting	
Men				
Age	37.77	(7.40)	32.32	(8.08)
Education (years)	13.28	(2.56)	12.70	(2.29)
Non white	0.12	(0.33)	0.19	(0.39)
Earnings ($000)	41.38	(39.27)	24.63	(25.78)
Sex ratio (women/men)	1.00	(0.07)	0.99	(0.08)
Disability	0.04	(0.19)	0.05	(0.22)
Private health insurance	0.81	(0.39)	0.58	(0.49)
Women				
Age	35.89	(7.45)	30.70	(8.22)
Education (years)	13.30	(2.47)	12.92	(2.25)
Non white	0.12	(0.33)	0.17	(0.38)
Earnings ($000)	17.08	(21.66)	16.45	(18.56)
Sex ratio (men/women)	1.01	(0.07)	1.02	(0.09)
Disability	0.03	(0.18)	0.05	(0.23)
Private health insurance	0.81	(0.39)	0.56	(0.50)
Household				
Household earnings ($000)	61.77	(52.27)	43.00	(39.22)
Dependent children	1.46	(1.20)	0.81	(1.10)
Observations	453100		51117	

1. Calculations from 1988-2008 CPS
2. Standard deviations in parentheses
3. Dollar amounts in 1997$
4. Low education - no college; medium education - some college; high education - advanced degree

couple lives in a metropolitan statistical area (MSA) or a city within an MSA.

After eliminating observations with missing data, I am left with a sample of 504,217 couples, of whom 51,117 are unmarried. Average characteristics by sex and marital status are given in table 1.

Cohabitees are on average younger, slightly less educated, more likely to be nonwhite and have fewer children than those who are married. Whilst married men have higher income than their cohabiting counterparts, the opposite is true for women.

I measure health status using responses to the question "Do you have a health problem or a disability which prevents you from working or which limits the kind or amount of work you can do?". Such self-reported measures of health might be doubted due to framing effects (Crossley & Kennedy 2002) and the fact that self-reported health is rarely revised downwards (Wood, Goesling & Avellar 2007). However it has also been shown that such self-reported disability measures are strongly correlated with clinical disability measures (Bound & Burkhauser 1999). The raw data suggests that a higher proportion of cohabiting than married individuals report having a health problem, which is consistent with previous studies.

4 Empirical strategy

The discussion in section 2 suggests that there is no clear theoretical prediction of the effect of marriage over cohabitation on health: there are plausible mechanisms by which marriage may both positively and negatively affect health, and there may be both positive and negative selection into marriage. Controlling for selection into marriage and so identifying the causal effect is therefore the main aim of this paper.

My health outcome is the reporting of a health problem or disability affecting work. Dis^*_{ist} is individual i's disability index in state s at time t, and is a function of marital status M^*_{ist} and other covariates X_{ist}:

of Labor Statistics. Prior to 1990 my data is grouped into five-year age groups. A higher value of this sex ratio indicates better odds on the relationship market.

$$Dis^*_{ist} = \alpha M_{ist} + \beta X_{ist} + u_{ist} \tag{1}$$

We observe Dis_{ist}:

$$Dis_{ist} = \begin{cases} 1 & \text{if } Dis^*_{ist} > 0 \\ 0 & \text{if } Dis^*_{ist} \leq 0 \end{cases} \tag{2}$$

Initially I estimate this relationship using a probit model. This assumes that there is no selection into marriage on the basis of health and disability status. As discussed above, the possibility of such selection is a crucial concern in this literature and so I take an instrumental variables approach, using a simulated instrument. This instrument captures variation in financial incentives for marriage in marriage tax penalties and is described fully in section 4.1 below.

If my measures of disability and marriage were continuous, I could apply standard instrumental variables techniques to estimate my results. However, both variables are dichotomous. There are various strategies suggested in the literature for dealing with this issue. Angrist (2001) suggests that two stage least squares can be applied to linear probability models of the dichotomous variables to recover treatment effects.[4] However, Bhattacharya et al. (2006) show that a multivariate probit model is a preferable estimator when the average probability of the dependent variable is close to 0 or 1, or when the data generating process is not normally distributed. In my sample the probability of reporting a disability is close to zero. I therefore estimate the effect of marriage on reporting a disability using a bivariate probit model. The equation for marriage is:

$$M^*_{ist} = \phi \overline{Penalty}_{st} + \psi Z_{ist} + v_{ist} \tag{3}$$

where $\overline{Penalty}_{st}$ is the simulated instrument. We observe M_{ist}:

[4]Two stage estimators with a probit first or second stage are generally not consistent (Bhattacharya, Goldman & McCaffrey 2006).

$$M_{ist} = \begin{cases} 1 & \text{if } M^*_{ist} > 0 \\ 0 & \text{if } M^*_{ist} \leq 0 \end{cases} \tag{4}$$

I assume that u_{ist} and v_{ist} are jointly normally distributed with arbitrary correlation ρ. Whilst this imposes substantial structure on the estimator, it is a natural generalization of the probit model and avoids the limitations of the linear probability model.[5]

4.1 Marriage penalties

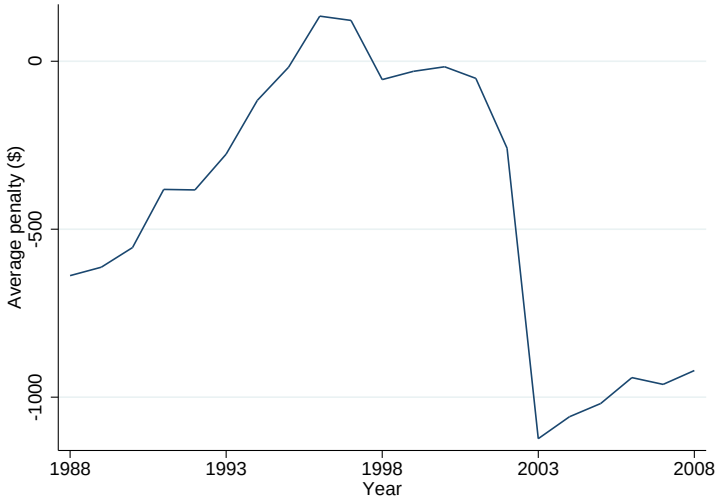
I control for selection into marriage by exploiting exogenous variation in the probability of marriage that is driven by marriage tax penalties. The US personal income tax is not neutral to marital status: a married couple's tax liability is based on its combined income,[6] whilst single individuals (including unmarried but cohabiting couples) are taxed individually. The income brackets in the married tax schedule are less than twice as large as those in the single schedule, meaning that both marriage penalties and subsidies exist. In addition, there is variation between state income tax systems which may exaggerate, mitigate or have no effect beyond the federal penalty experienced. Generally if a couple's income is divided equally between them, their combined income will fall into a higher married tax bracket than their individual incomes would on the single schedule, and so they experience a marriage penalty. On the other hand, a couple with a more traditional division of labour with one low earner and one high earner are likely to experience a marriage subsidy.

The marriage penalties and subsidies faced by couples have varied substantially over time. This is shown in figure 1, which shows the average marriage penalty faced

[5]Estimating the effect of marriage on disability using linear IV results in predicted average probabilities of disability below zero, and exceptionally large marginal effects of marriage (up to 80 percentage points).

[6]Whilst a married couple can choose to file separately, this does not change the overall rate schedule they face and so this does not reverse any marriage penalty or subsidy that exists. In addition, some tax credits including the Hope and American Opportunity tax credits for education are unavailable if married filing separately, so these two statuses are not close substitutes.

Figure 1: Average marriage tax penalties over time



Average total (federal plus state) marriage penalties by year for the CPS sample described in section 3. The average penalty increases due to the expansion of the EITC. The Bush tax cuts in 2003 dramatically reduce the marriage penalties.

by couples between 1988 and 2008 (drawn from the sample described in section 3). Starting from average subsidies in the 1980s, the average penalty experienced generally trended up over the period up until the Bush tax cuts of 2001 and 2003 which eliminated marriage penalties for low to middle income couples. However average penalties obscure substantial heterogeneity: in 1994 the average penalty experienced was $350 per annum, but 60% of couples faced an average penalty of $1200 and 30% an average subsidy of $1100 (Alm & Whittington 1996).

There are two factors driving the changes in marriage penalties faced. First, there are changes to the tax code including the expansion of the earned income tax credit (EITC) and the Bush tax cuts. Second, the increased labour market participation of women has contributed to increases in marriage penalties as couples' incomes become more equally split between partners. Eissa & Hoynes (2000*a*) find that from 1984 to 1997, these demographic trends explain 40-45% of the change in marriage penalties.

In order to deal with selection of individuals into marriage rather than cohabitation, I need variation in the marriage versus cohabitation choice which is otherwise

unrelated to health. It has been established that a couple's marital status does respond to the marriage penalty they face (Alm & Whittington 2003, Eissa & Hoynes 2000*b*, Fisher 2011). However, the marriage penalty a couple experiences is not exogenous to health outcomes since it is determined by the earned incomes of the couple which will also clearly be affected by health status. Instead, then, of using a couple's experienced marriage penalty as an instrument for a couple's marital status, I exploit variation in marriage penalties that is driven only by variation in the tax codes faced by couples in different states and years.[7] This is done by creating a simulated instrument that estimates the average marriage penalty faced by a fixed sample of couples in each state and year.

The instrument is constructed by taking a random sample of 1000 couples from my sample and simulating their tax liabilities as a married couple and as a cohabiting couple in each state and time period.[8]. This sample is drawn from observations in 1998.[9] I take the average penalty faced in a given state and year for this fixed sample of couples to construct the instrument, giving 1122 state-year averages. So my instrument reflects the prevailing tax code and not demographic or economic conditions. This is a similar strategy used by Currie & Gruber (1996) to simulate variation in children's Medicaid eligibility.

Using this simulated instrument controls for selection into marriage if these average marriage penalties are unrelated to disability outcomes, except through their effect on marriage probability: that is, changes in tax codes have not been motivated by disability reporting rates. State dummies and state time trends are included to allow interstate variation in levels and trends of disability.

[7]This follows the method used in Fisher (2011) to identify the effect of marriage penalties on marital status.

[8]Liabilities are calculated using TAXSIM (Feenberg & Coutts 1993), which calculates state and federal income taxes including the EITC. The calculated marriage penalty is the difference between the penalty a couple experiences when married and the penalty experienced when cohabiting. I assume that if a couple is cohabiting then the wife would have custody of any children and the husband would file as a single, and unearned income is split equally. The conclusions drawn in this paper do not change if instead the children are allocated to a partner to minimise the total tax liability.

[9]The conclusions drawn in this paper are unchanged if a base year of 1988 or 2008 is used: results for the full sample are presented in table 4.

5 Results

Table 2 reports results of the estimation of the causal effect of marriage on self-reported disability for the full sample for men and women respectively. Columns 1 and 4 show the raw association between marriage and the probability of reporting a disability, estimated using a probit model. These correlations reflect the wider literature: being married is associated with a 1.3 percentage point lower probability of reporting a disability for men, and a 2.1 percentage point lower probability for women. Controlling for observable characteristics does not eliminate this negative correlation.

Columns 3 and 6 report the causal effects of marriage on reporting a disability. These are the results from the joint estimation of the disability equation and the marriage equation using a bivariate probit model as discussed above. Estimates from the marital status equation are presented in table 3. The coefficients on the instrument, the average penalties by state and year, are highly significant and negative. This is the expected sign: living in a higher penalty state and year is associated with a lower probability of being married. The chi-squared statistics associated with a test of the instrument are 253 and 235 for men and women respectively, indicating a strong instrument. In addition, the correlation between the error terms in the two equations is found to be significantly different from zero in all cases, suggesting that selection into marriage is indeed a problem.

Turning back to columns 3 and 6 of table 2, we see that having controlled for selection into marriage, the coefficients on the marriage dummy are insignificantly different from zero: there is no evidence of any effect of marriage on reporting a disability. This reflects the selection of healthier people into marriage, and is in contrast to the results of previous studies.

Table 4 demonstrates that these results are robust to changing the base year from which the sample is drawn to construct the simulated instruments. Using a sample drawn from 1988 or 2008 does not change the conclusion that, having controlled for selection into marriage, there is no causal effect of marriage on health.

Table 2: Effect of marriage on reporting disability

	Men			Women		
	Probit		BVP	Probit		BVP
Disability=1	(1)	(2)	(3)	(4)	(5)	(6)
Married	**-0.0133**	**-0.0167**	-0.0054	**-0.0209**	**-0.0250**	0.0057
	(0.0016)	*(0.0015)*	*(0.0056)*	*(0.0015)*	*(0.0014)*	*(0.0047)*
Education		**0.0072**	**0.0074**		**0.0072**	**0.0080**
		(0.0008)	*(0.0008)*		*(0.0007)*	*(0.0008)*
Education^2		**-0.0006**	**-0.0006**		**-0.0005**	**-0.0006**
		(0.0000)	*(0.0000)*		*(0.0000)*	*(0.0000)*
Age		**0.0011**	0.0006		**0.0013**	-0.0003
		(0.0004)	*(0.0005)*		*(0.0003)*	*(0.0005)*
Age^2		0.0000	**0.0000**		0.0000	**0.0000**
		(0.0000)	*(0.0000)*		*(0.0000)*	*(0.0000)*
Black		**0.0144**	**0.0154**		**0.0091**	**0.0114**
		(0.0020)	*(0.0021)*		*(0.0020)*	*(0.0022)*
Other race*		**0.0061**	**0.0063**		-0.0009	-0.0005
		(0.0021)	*(0.0022)*		*(0.0016)*	*(0.0018)*
Time trend		**-0.0014**	**-0.0013**		**-0.0004**	**-0.0003**
		(0.0000)	*(0.0001)*		*(0.0000)*	*(0.0000)*
Instrument			**253.29**			**234.84**
Estimated ρ			**-0.6951**			**-0.2030**
Mean of disability			0.038			0.035

1. Table reports marginal effects from probit estimation. Standard errors clustered by state in parentheses
2. Other controls: other income variables, size of city (3 dummies), state dummies, state time trends. Other race: not white or black.
3. Bold indicates significance at 5% level
4. Test of instrument gives chi-squared statistic from test that the instrument's coefficient is equal to zero in the marriage penalty equation
5. 504217 observations

Table 3: Marital status equation parameter estimates

Married=1	Men (1)	Women (2)
Instrument	**-0.1508**	**-0.1463**
	(0.0129)	*(0.0139)*
Education	**-0.1708**	**-0.1494**
	(0.0101)	*(0.0137)*
Education^2	**0.0091**	**0.0076**
	(0.0006)	*(0.0008)*
Age	**0.1934**	**0.2203**
	(0.0073)	*(0.0066)*
Age^2	**-0.0021**	**-0.0026**
	(0.0001)	*(0.0001)*
Black	**-0.3661**	**-0.2981**
	(0.0229)	*(0.0251)*
Other race	-0.0865	-0.0625
	(0.0618)	*(0.0535)*
Time trend	**-0.0350**	**-0.0370**
	(0.0010)	*(0.0011)*

1. Table reports coefficient estimates from marital status equation in bivariate probit estimation. Standard errors clustered by state in parentheses
2. Other controls: other income variables, size of city (3 dummies), state dummies, state time trends. Other race: not white or black.
3. Bold indicates significance at 5% level
4. 504217 observations

Table 4: Effect of marriage on reporting disability: robustness to instrument construction

	Base year for instrument calculation		
	1998	1988	2008
Men	-0.0054	-0.0057	-0.0053
	(0.0056)	*(0.0056)*	*(0.0056)*
Women	0.0057	0.0059	0.0062
	(0.0047)	*(0.0047)*	*(0.0046)*

1. Table reports estimates of coefficient of married dummy in bivariate probit estimation as in table 2 above, with simulated instruments created from different base years. Standard errors clustered by state in parentheses
2. Other controls as in table 2
3. Bold indicates significance at 5% level
4. 504217 observations

The point estimates do not change substantially.

Table 2 also shows that reporting a disability is more likely for older individuals, black women and non-white men. I do not control for the presence of children, being covered by private health insurance, or income, as I expect these variables to be endogenous: they both influence and are influenced by having a disability, and are also related to marriage. All can be described as 'bad controls' (Angrist & Pischke 2009). The causal estimates reported should therefore be interpreted as the effect of marriage, including any effect that marriage has on income, health insurance and having children, on the probability of reporting a disability.

Table 5 breaks down these results by education group. Whilst simple analysis suggests that all groups benefit from being married (columns 1 and 2), controlling for selection gives a different result. Men in the lowest education group experience a fall in their probability of reporting a disability of 2.8 percentage points if they are married, an effect which is at least as large as suggested by raw correlations. These men are if anything negatively selected into marriage on the basis of observable characteristics: they are more likely to choose to marry when its expected protective effect is greatest.

Men in other education groups see no effect of marriage at all once selection has been controlled for: they are positively selected into marriage.

In contrast, women with medium and high education suffer from marriage. Column 3 of table 5 shows that women with more than high school education are significantly more likely to report a disability if they are married. The effect is as much as 1.7 percentage points for the medium education women, compared to an average prevalence of disability reporting of 3.6%: a 50% increase in the probability of reporting a disability. Low education women gain no benefit from marriage.

Tables 2 and 5 demonstrate that selection plays a substantial role in explaining the protective effect of marriage for disability observed in simple analysis. Whilst low education men gain protective benefits, all other men are positively selected into marriage rather than cohabitation and gain no benefits in terms of their probability of having a disability. Low education women similarly appear to gain no benefit

Table 5: Effect of marriage on reporting disability: by education group

Education group	N	Probit: No controls (1)	Probit: Controls (2)	BVP (3)	Inst. (4)	ρ (5)	Mean (6)
Men							
Low	232106	**-0.0096**	**-0.0225**	**-0.0275**	**73.44**	0.0204	0.054
		(0.0021)	*(0.0024)*	*(0.0119)*			
Medium	128678	**-0.0072**	**-0.0188**	0.0183	**28.81**	**-0.2680**	0.038
		(0.0022)	*(0.0024)*	*(0.0072)*			
High	143433	**-0.0029**	**-0.0074**	0.0074	**49.03**	**-0.2683**	0.013
		(0.0016)	*(0.0018)*	*(0.0037)*			
Women							
Low	225577	**-0.0232**	**-0.0322**	-0.0033	**94.39**	**-0.1386**	0.047
		(0.0024)	*(0.0023)*	*(0.0102)*			
Medium	141666	**-0.0167**	**-0.0263**	**0.0169**	**29.31**	**-0.3012**	0.036
		(0.0019)	*(0.0022)*	*(0.0056)*			
High	136974	**-0.0059**	**-0.0109**	**0.0136**	**32.57**	**-0.4234**	0.016
		(0.0018)	*(0.0018)*	*(0.0024)*			

1. Table reports marginal effect of marriage on the probability of reporting a disability from probit estimation. Standard errors clustered by state in parentheses
2. Other controls as in table 2
3. Bold indicates significance at 5% level
4. Inst. (column 5) gives F statistic from test of coefficient on the instrument being equal to zero in marriage penalty equation
5. Low education: no college education; medium education: some college education; high education: 4 years of college education or more
6. Column 6 shows mean of reporting disability for each group

from marriage over unmarried cohabitation, but women with more than high school education are far more likely to report a health problem or disability when married.

The effect of marriage on disability is likely to be heterogeneous, so these results estimates a local causal impact of marriage on disability.[10] It is valid for those whose marital status is changed by the marriage penalty they face. So it is women who would cohabit, were it not for a tax subsidy, who are harmed by marriage. Whilst it is for a small subpopulation, this result is important. It shows that whilst a policymaker can induce marriages though an appropriate tax system, these extra marriages may have undesirable consequences: women's health may suffer. In addition, far from providing the perceived protective benefits of marriage to everyone, these extra marriages will only bring health benefits to low education men.

6 Potential explanations

The analysis above shows that the apparent protective effect of marriage for women is explained by selection. However, it also raises the question of why well-educated women are more likely to report a health problem if they are married. Three possible mechanisms that I have data to examine are children, private health insurance, and labour supply. Below I examine the evidence for these explanations.

6.1 Children

Married women may be more likely to have children, and both childbirth and the presence of children might present health problems. This might be a pathway through which the harmful health effect of marriage works. I examine this possibility in columns 1 and 2 of table 6. Here, I estimate the causal effect of marriage on whether an individual has own children present in their household. I limit the analysis to those aged 40 and under, since I expect this measure to reflect whether

[10] Appendix B in Goldman, Bhattacharya, McCaffrey, Duan, Leibowitz, Joyce & Morton (2001) provides a detailed description of the assumptions required to obtain a local average treatment effect when using a bivariate probit model.

Table 6: Effect of marriage on children and health insurance by education group

	Children		Private health insurance	
	Mean	BVP	Mean	BVP
Men				
All	0.7166	0.0054	0.7911	-0.0660
		(0.0157)		*(0.0316)*
Low	0.7371	0.0352	0.6877	**-0.0362**
		(0.0302)		*(0.0324)*
Medium	0.7110	-0.0419	0.8309	**-0.0628**
		(0.024)		*(0.0247)*
High	0.6841	**0.1677**	0.9265	0.0074
		(0.0691)		*(0.0191)*
Women				
All	0.7527	**-0.0757**	0.7875	**-0.0791**
		(0.0114)		*(0.0255)*
Low	0.7928	**-0.0808**	0.6764	0.0006
		(0.0265)		*(0.0394)*
Medium	0.7521	**-0.0799**	0.8300	**-0.0973**
		(0.0291)		*(0.0213)*
High	0.6841	0.0056	0.9265	-0.0123
		(0.0514)		*(0.012)*

1. Table reports marginal effect of marriage on outcomes from bivariate probit estimation. Standard errors clustered by state in parentheses
2. Other controls as in table 2
3. Bold indicates significance at 5% level
4. Sample sizes as in table 5, except for children where sample restricted to those aged 40 and under
5. Low education: no college education; medium education: some college education; high education: 4 years of college education or more
6. Mean shows mean of each outcome for each group

Table 7: Effect of marriage on health: by presence of children

Children group	N	Raw (1)	Probit (2)	BVP (3)	Inst. (4)	ρ (5)	Mean (6)
Men							
Some children	360607	**-0.0216**	**-0.0174**	0.0023	**221**	**-0.1346**	0.035
		(0.0019)	*(0.0018)*	*(0.0052)*			
Young children	164989	**-0.0232**	**-0.0154**	0.0018	**103**	**-0.1525**	0.026
		(0.0023)	*(0.0019)*	*(0.0064)*			
Older children	195618	**-0.0223**	**-0.0179**	0.0099	**108**	**-0.1703**	0.043
		(0.0031)	*(0.0030)*	*(0.0070)*			
No children	143610	0.0007	**-0.0120**	0.0009	**27**	-0.0009	0.047
		(0.0018)	*(0.0018)*	*(0.0131)*			
No children (under 35)	67702	**-0.0074**	**-0.0061**	0.0037	**7**	-0.1179	0.027
		(0.0019)	*(0.0017)*	*(0.0079)*			
No children (over 35)	75908	**-0.0184**	**-0.0179**	0.0169	**33**	-0.1651	0.065
		(0.0042)	*(0.0034)*	*(0.0188)*			
Women							
Some children	360607	**-0.0241**	**-0.0221**	0.0020	**186**	**-0.1664**	0.029
		(0.0021)	*(0.0016)*	*(0.0066)*			
Young children	164989	**-0.0173**	**-0.0129**	0.0032	**102**	**-0.1693**	0.020
		(0.0020)	*(0.0016)*	*(0.0060)*			
Older children	195618	**-0.0340**	**-0.0290**	0.0045	**79**	**-0.1860**	0.037
		(0.0018)	*(0.0020)*	*(0.0079)*			
No children	143610	**-0.0068**	**-0.0201**	**0.0281**	**24**	**-0.3194**	0.051
		(0.0010)	*(0.0008)*	*(0.0061)*			
No children (under 35)	67702	**-0.0086**	**-0.0078**	0.0035	**6**	-0.1206	0.029
		(0.0020)	*(0.0017)*	*(0.0071)*			
No children (over 35)	75908	**-0.0431**	**-0.0370**	0.0327	**20**	**-0.3009**	0.071
		(0.0042)	*(0.0039)*	*(0.0230)*			

1. Table reports marginal effect of marriage on disability status from probit estimation. Standard errors clustered by state in parentheses
2. Other controls as in table 2
3. Bold indicates significance at 5% level
4. Column 5 gives chi-squared statistic from test of coefficient on the instrument being equal to zero in marital status equation
5. Some children: any dependent children; young children: child under five; older children: children but not under five; No children: no dependent children
6. No children (under 35) comprises couples in which the woman is aged 35 or under; no children (over 35) comprises couples in which the woman is aged 36 or more
7. Column 6 shows mean of disability status for each group

women have any children.[11] Even after controlling for characteristics, married people appear to be far more likely to have children than their cohabiting counterparts: as much as 64 percentage points for high education men.

However, after controlling for selection into marriage this is not the case. Married women are no more likely to have children than if they were cohabiting, and all but the highest educated are 8 percentage points less likely to have any children. This clearly indicates that it is not the presence of children that is driving my results. Those who marry due to a financial incentive are no more likely to have children than if they remain cohabiting.

This conclusion is backed up by the results presented in table 7. Here, the causal effect of marriage on disability is analysed for subgroups determined by the presence of children. I find no causal effect of marriage on reported disability for men, regardless of whether they have children or not. Women with dependent children exhibit no causal effect of marriage, even for those with children less than five years old.

In contrast, marriage has a harmful effect on health for women without dependent children. This subpopulation is bimodal in age, so I further break down the group into couples where the woman is aged 35 or under, and those where the woman is over 35. Whilst these results lose statistical significance, there is some indication that the harmful effect is concentrated amongst the older women. These women may have had children who are no longer dependent, suggesting that the process of raising children to adulthood may lead to health problems acknowledged once the children are no longer dependent. Certainly the presence of young children in the household does not appear to be the mechanism by which marriage has harmful health effects for women.

6.2 Private Health Insurance

It is expected that married women are more likely to have private health insurance, since employer-provided policies often extend to spouses but not unmarried part-

[11] Altering the cutoff to 45 or 50 (the full sample) does not change the conclusions drawn here.

Table 8: Effect of marriage on women's health: by employer-provided health insurance of partner

Sample	N	Raw (1)	Probit (2)	BVP (3)	Inst. (4)	ρ (5)	Mean (6)
Full sample							
Partner not covered	130695	**-0.0175**	**-0.0262**	0.0028	**48.16**	**-0.1519**	0.055
		(0.0025)	*(0.0026)*	*(0.0101)*			
Partner covered	373522	**-0.0126**	**-0.0168**	-0.0032	**111.87**	-0.0926	0.028
		(0.0012)	*(0.0012)*	*(0.0058)*			
Low education							
Partner not covered	79944	**-0.0203**	**-0.0284**	-0.0026	**44.59**	-0.1173	0.064
		(0.0036)	*(0.0033)*	*(0.0152)*			
Partner covered	145633	**-0.0152**	**-0.0234**	-0.0118	**66.79**	-0.0571	0.038
		(0.0021)	*(0.0022)*	*(0.0145)*			
Medium education							
Partner not covered	32179	**-0.0137**	**-0.0246**	**0.0198**	**15.50**	**-0.2628**	0.052
		(0.0033)	*(0.0035)*	*(0.0097)*			
Partner covered	109487	**-0.0105**	**-0.0185**	0.0051	**30.37**	**-0.1635**	0.031
		(0.0021)	*(0.0026)*	*(0.0079)*			
High education							
Partner not covered	18572	**-0.0081**	**-0.0134**	**0.0148**	**8.87**	**-0.3534**	0.024
		(0.0039)	*(0.0039)*	*(0.0050)*			
Partner covered	118402	-0.0023	**-0.0065**	0.0078	**31.26**	-0.2442	0.014
		(0.0015)	*(0.0017)*	*(0.0043)*			

1. Table reports marginal effect of marriage on disability status from probit estimation. Standard errors clustered by state in parentheses
2. Other controls as in table 2
3. Bold indicates significance at 5% level
4. Column 5 gives chi-squared statistic from test of coefficient on the instrument being equal to zero in marital status equation
5. Low education: no college education; medium education: some college education; high education: 4 years of college education or more
6. Column 6 shows mean of disability status for each group

ners. Having private health insurance should improve access to healthcare which could improve health and so guard against significant health problems and disabilities developing. This mechanism would not explain the results presented above. The harmful effect of marriage for more highly educated women may instead be explained by health insurance in two ways. First, women with health problems may be more likely to marry in order to access their partner's employer-provided health insurance. Second, there may be a problem of moral hazard: extended access to health insurance increases the diagnosis and reporting of health problems.

Columns 3 and 4 of table 6 shows the effect of marriage on private health insurance coverage.[12] Consistent with expectations, married people appear more likely to be covered by private health insurance, even after controlling for characteristics. However, this is not the case once selection into marriage has been controlled for. Both men and women are less likely to be covered by private health insurance if they are married. This suggests that the protective health effect of marriage for low education men is not driven by improved insurance coverage, but that poorer insurance coverage could contribute to the harmful effect for women.

Table 8 presents further results that shed light on the potential mechanism for health insurance to affect both marriage and health. The table contains results for the estimation of the effect of marriage on health for various sub groups of women. I group the women by whether their partner has employer-provided health insurance.[13] 23% of married women and 48% of cohabiting women have partners without employer-provided health insurance. This partitioning of the full sample may not be random. For these results to have a causal interpretation, male access to and take-up of employer-provided health insurance needs to be invariant to

[12]This is the Census bureau recoding of survey responses to include coverage by any kind of private health insurance.

[13]I infer the availability of employer-provided health insurance for the male partner by whether they report being covered by any employer-provided health insurance. This will include some men who are covered by their partner, or someone else's, health insurance. Alternatively I could assume that health insurance availability is indicated by the male partner reporting employer-provided health insurance in their own name only. Since some men will be covered by their female partner's employer provided health insurance and will take that insurance rather than that available to them through their own employer, the actual division of women between those with a partner who can and cannot access employer-provided health insurance will lie somewhere between these two extremes. Results with the second assumption are broadly similar to those presented in table 8.

marital status. Nonetheless the results presented in table 8 shed some light on the mechanisms causing my results. Column 3 of this table shows that the harmful health effect of marriage for women is concentrated amongst those more highly educated women whose partner is not covered by private health insurance. This suggests that my results are not explained by women in poor health marrying to access insurance.

Further examination of the data shows that amongst this group of medium and high education women, cohabitees are 14% more likely to be covered by private health insurance than the married. So, it is not being married that is harmful to health, but being married to a husband without health insurance. This could occur both due to the poorer treatment of existing health problems, or the influence of unobserved characteristics of husbands without employer-provided health insurance.

This result might be linked to labour force participation. As is discussed below, married women are less likely to work than cohabiting women. If the cohabiting women are in jobs which provide health insurance, they may have better access to healthcare than married women whose husbands are without health insurance.

For women, moral hazard driven by better health insurance provision appears to be ruled out by these results, with poorer health insurance access instead being a candidate explanation for the negative effect of marriage on health. However, it is possible that a woman's alternative insurance mechanisms, for example support from family members, may be improved by marriage. This could in turn lead to more women acknowledging and reporting a health problem. I am unable to test for these informal insurance mechanisms.

6.3 Labour supply and unemployment

The health measure used in the analysis above is an individual's reporting of a health problem or disability *which prevents him/her from working or which limits the kind or amount of work*. This raises the concern that employment status may

affect how the question is answered: those that are not in the labour market are less likely to be aware of a work limitation. If educated women are more likely to work when they are married, then this might explain their higher reporting of a work limitation. On the other hand, answers to this question might suffer from justification bias (McGarry 2004): people report a disability to justify the fact that they are not working.

Since the prevailing marriage penalty regime is expected to affect a couple's decisions regarding labour force participation, it is not possible to make the case that the penalty only affect labour supply decisions through its effect on marital status. It is therefore not possible to repeat the analysis in table 6 for labour force participation. The data does, however, show clearly that married women are less likely to work than cohabiting women: a point estimate of around 10 percentage points for all education groups when controlling for observable characteristics including partner's income.[14] If all women are equally likely to report disability to justify that they are out of the labour force, then this lower labour force participation from married women could explain the negative effect of marriage on reported health outcomes. Since low education women are equally more likely to not work when married, the propensity to justification bias must also be increasing with education level to explain the results presented above.

Alternatively, as discussed in section 6.2 above, the labour force participation might result in poorer access to healthcare through reduced health insurance: the higher male labour force participation and so potential access to health insurance from marriage does not offset reduced access through reduced female labour force participation. This suggests a real rather than reporting effect of marriage on health.

Labour market activity may also be important in explaining the protective marriage effect found for low education men. If low education men are in more physically demanding jobs, they may be the men who are most likely to benefit from being married. This would be the case if these lower education men are more prone

[14]Results from these regressions are available on request.

to physical illnesses and disabilities, and marriage has a causal effect on the man's likelihood of seeking treatment and so recovering. Distinguishing a causal effect from a selection effect (that is, men who are more likely to seek help are more likely to be married) is not possible with the available data.

7 Conclusion

This paper estimates the effect of marital status on reporting a health problem or disability. Whilst there is a substantial body of research concerning marital status and health, the importance of cohabitation has not been closely examined. In addition, most previous studies have not directly controlled for selection into marriage. This paper controls for selection by instrumenting marital status with average marriage tax penalties. I find that the protective effect of marriage found in raw data is caused by selection for all individuals except for the lowest educated men. Marriage increases the probability of more highly educated women reporting a health problem.

These results suggest strong implications for policy. It is not clear that the additional marriages that can be induced with financial incentives are desirable: women will become more likely to report a disability, whilst only less educated men will gain any protective health benefit. Marriage is not a 'magic bullet' for improving health outcomes, and failing to control for properly for selection when estimating the effects of marriage will lead to incorrect conclusions.

The effect of marriage on health is likely to be heterogeneous, and so these estimates are local treatment effects: they apply to individuals whose decision to marry rather than cohabit is changed by the marriage tax penalty they face. Those couples who change their marital status due to the financial incentive are couples with low expected benefits from marriage. The financial incentive induces marriage but brings a higher probability of disability for the women involved.

The exception to this conclusion is for less educated men, who benefit from marriage. They are negatively selected into marriage rather than cohabitation.

Those men with the most to gain from marriage initiate the formal relationship, whilst healthier men might face better prospects on the relationship market and so prefer the greater flexibility offered by unmarried cohabitation.

Whilst I find a harmful effect of marriage for educated women, the mechanisms causing this are not clear. Women who suffer from marriage are less likely to have children than if they were cohabiting, and the harmful effect is concentrated amongst those without dependent children. The additional stress and health risk accompanying having children therefore does not explain this result. The most promising explanation involves labour supply. Married women are less likely to work than cohabiting women and this reduces their direct access to employer provided health insurance. This reduction in access is not offset by increased access to partner's health insurance via marriage, and so marriage can in fact restrict access to healthcare for some women. Alternatively, the lower labour force participation of married women may affect reported, rather than actual, health due to justification bias.

Beyond the mechanisms considered in this paper, the group of women who marry as a result of a financial incentive are likely to place little value on the traditional view of marriage. Sociologists suggest that cohabitors reject the strong legal structure and social norms associated with marriage, and have more egalitarian attitudes to the division of household labour (Musick & Bumpass 2011). A couple who marry for a financial benefit might subsequently feel under pressure to conform to the social norms related to marriage, which might induce additional stress and contribute to an increased probability of reporting a health problem.

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