What Money Can and Cannot Buy
Divorce, Gender, and Health*

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September 21, 2007

*Support for this research was provided by the National Institute of Child Health and Human Development (HD 29550) and by a Dean's Dissertation Fellowship from the Graduate School of Arts and Science at New York University, and is gratefully acknowledged. We appreciate comments and suggestions from Larry Wu, Tom DiPrete, Willie Jasso, Dalton Conley, Kathleen Gerson.

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ABSTRACT

In this paper, we apply two newly developed propensity score methods to examine the effects of divorce on health for divorced adults using data from the National Longitudinal Survey of Youth 1979 (that have not been analyzed before for this purpose). The first method is a hazard-model approach that addresses the issue that selection into divorce may not only be static but dynamic. The second method is a doubly-robust estimator that further ensures that our estimates will be resistant to potential model misspecification. Preliminary findings (based on the first method) suggest that divorce has a negative effect on mental health for both divorced men and women. Divorce also has a negative effect on divorced women's physical health and general health status, but no effect on divorced men's physical health and general health status.

In the current version of the paper, we have presented findings based on the first method that was developed by Lu (2005) and discussed in greater detail by the first author (Li 2005; 2007). We will conduct analysis using the second method, the so-called "double robust estimator" (Bang and Robins 2005; Neugebauer and van der Laan 2005) and report both sets of findings in the PAA. We anticipate these findings, as the preliminary findings reported below, to show that the average effects of divorce on health for the divorced men and women—i.e., the "average treatment effect on the treated" in the counterfactual causal inference literature (Morgan and Winship 2006; Winship and Morgan 1999)—to be substantially smaller, if not statistically insignificant, than reported in prior research.

INTRODUCTION

At the turn of millennium, data collected by the U.S. Census Bureau showed that 17% of divorced adults assessed their health status as fair or poor, compared to 11% married adults; 37% of divorced adults, compared to 30% of married adults, reported limitations in physical and social functioning; twice as many divorced adults than married adults had activity limitations in work, daily living, and instrumental daily living activities; divorced adults, compared to married adults, were also morel likely to suffer from low back pain, headaches, serious psychological distress, and become heavy smokers and drinkers (Schoenborn 2004).[1] These differences in health behaviors and health outcomes, not surprisingly, also reflect in the mortality rate differentials (Gove 1973; Goldman 1993; Lillard and Waite 1995). Despite the persistent and pronounced health disparities by marital disruption, it is unclear whether divorce *causes* poor health, the less healthy is more likely to divorce, or both. A large social science literature has devoted to the task of identifying causation versus selection in explaining the post-divorce health disparities.

This chapter joins the conversation and contributes to the literature in several ways: First, much of the previous research has examined the differences in health by marital status, and infrequently conducted a specific and focused design to study the effect of marital disruption. It should be noted that the entry into marriage and exit from marriage are very different social processes. Pooling all marital statuses and transitions makes the estimation task extremely complicated because one has to distinctly identify the selection into marriage, the selection out of marriage, and the effects of various ways of exiting marriage by multiequation models. Only a handful of empirical studies (e.g., Lillard and Waite 1995; Lillard and Panis 1996) have taken on this task, and even those have done so inevitably rely on relatively strong statistical assumptions concerning the parametric relationships among social processes. I

[1]The only health indicator on which the married appeared to fare less well than the divorced is obesity. Married men, in particular, were more likely to be overweight or obese.

employ a simple design by restricting attention to the disruption of first marriages to focus on examining the effect of divorce. Second, I apply a propensity score method developed from the counterfactual causality framework in estimating the effect of divorce. The estimate can be explicitly interpreted as "the average treatment effect of divorce for the divorced", and makes the counterfactual comparison with what a divorced individual would have fared had s/he not experienced the divorce. This way of posing the question is particularly relevant for the current debates on marriage promotion because social policy directed at preventing divorce should not be based on conclusions for an average individual randomly drawn from the population—who might be happily married and who may never have considered a marital disruption. Third, while much of the empirical literature has looked at the effect of divorce on indicators of psychological well-being, especially depressive symptoms, a surprisingly few studies have examined self-reported general health status—an outcome frequently analyzed in the health-disparity literature—and no prior study has examined composite measures of mental health and physical health. Hence, although the advocates for marriage promotion have often made the sweeping claim that marriage makes people healthy and divorce makes people sick (instead of referring to specific health outcomes), the empirical evidence rarely extends beyond a limited number of specific health outcomes and hence does not speak to overall health. This discrepancy between claims and evidence is particularly perplexing because a close examination of the literature suggests that, despite strong associations in almost all health outcomes, not all of the associations appear to be causal. In addition, selection and causal mechanisms may work differently for different health outcomes and sometimes by gender. I follow the long-standing interest since Bernard (1972) and Gove (1973) to examine to what extent the health effects of divorce differ between men and women.

CAUSATION VERSUS SELECTION

Despite the strong association, it is unclear whether poorer health is *caused* by marital disruption. Not only are healthier individuals in higher demand on the marriage market,

but spouses tend to select on other characteristics, often observed to the researcher, that are positively associated with health, e.g., education, income, and personality (Goldman 1993; Waldron et al. 1996; Wyke and Ford 1992). Therefore, the apparent health disadvantage for the divorced may be due to socioeconomic or even psychological disadvantages for the divorced, rather than a consequence of divorce. For example, Yamaguchi and Kandel (1997), using longitudinal data of married couples in the State of New York, found that the fact that divorce is associated with higher marijuana use is largely due to selection. Spouses with higher tendency to use marijuana are also more likely to divorce and continue using drugs. On the supply side of the marriage market, Lillard and Panis (1996) noted an "adverse selection" mechanism by which they meant that the unhealthy have greater incentives to get married because they need someone to take care of them. The adverse selection works in the reverse direction and is expected to reduce the health disparities across marital status. Their analysis of men in the Panel Study of Income Dynamics showed that both selection mechanisms are in operation but under different circumstances. Adverse selection dominates for self-reported health and among older men, with those who were over 50 years of age and who perceived themselves as relatively unhealthy tending to remarry quickly and to stay married longer, whereas the positive selection into marriage dominates for never-married men on unmeasured characteristics such as health behaviors and life styles. Overall, the positive selection into marriage prevails and the high mortality rates among the divorced men are explained largely by their poorer health relative to the married men.

The association between divorce and health may be causal because divorce is a major life event that increases stress levels (Bloom et al. 1978). Coping with stress takes energy and resources, and exposure to stress is linked to lower psychological well-being, depressed immune functions, and poor physical health (Pearlin and Johnson 1977; Pearlin et al. 1981). Not only is divorce itself a stressor, it also induces a variety of other stressors in that the event is often associated with a substantial loss in household income and changes in residence and employment status (Holden and Smock 1991; South et al. 1998). These stresses may

create a mere temporary crisis or become long-lasting strains (Amato 2000). Substantial declines in economic resources after divorce have also been argued to be an independent source of health differential and to multiply the effects of stress (Hahn 1993). For example, Aseltine and Kessler (1993) found that, although increased financial difficulty after divorce itself cannot explain the association between divorce and depression, the divorced become more emotionally vulnerable to external stressors.

Divorce may also be harmful to health because it removes the benefits provided by the higher level of social, economic, and emotional resources in marriage. Married people typically pool resources and are economically better off than their unmarried counterparts, and economic well-being is positively associated with health (Smith 1999). Marriage is a form of objective social integration that prevents individuals from the detrimental health effects of social isolation (House et al. 1988). Marriage may provide protective effects on mental health through social support in intimate relationships (Ross et al. 1990). Marriage may improve physical health through the social control of healthy behaviors. Social control between spouses may exert its effects through internalization of normative healthy behaviors (the commitment effect) and informal sanctions of deviant healthy behaviors (the "nagging" effect). Married people are less likely to engage in risk taking behaviors and substance use, and have better habits of diet, sleep, and exercise (Umberson 1987; 1992). Consistent with this reasoning, Lillard and Waite (1995) found that, mortality risks decrease as marriage duration cumulates; and after divorce, the mortality risks bounce back to the level when individuals are never married.

Although the majority of the literature assumes that marriage benefits individual health whereas divorce does harm, the degree to which marriage benefits health varies. Hawkins and Booth (2005), for example, found that staying in unhappy marriages is associated with lower levels of overall health, happiness, and self-esteem, and life satisfaction. The variation may depend on the quality of the marriage, and so does the effect of marital disruption (Gallo et al. 2003; Gove et al. 1983). Ending a bad marriage may indeed bring a relief

and improves mental health (Wheaton 1990). Kalmijn and Monden (2006) further showed that the effect of divorce differ by the various dimensions of marriage quality. Women who ended a relatively unsatisfying or unfair marriage had only slightly higher level depression than those who ended a relatively satisfying or fair marriage. Those who ended a marriage marked by higher conflict were about as depressed as those who ended a marriage with lower conflict. However, those who ended a highly aggressive marriage were more depressed than those who ended a less aggressive marriage.

Moreover, causal mechanisms and selection mechanisms need not be mutually exclusive. Indeed, most studies find that the association between marital disruption and divorce is smaller when selection factors are controlled but remains statistically significant—this pattern is generally interpreted as providing support for both hypotheses (Waldron et al. 1996). Two longitudinal studies using European data provide more direct evidence for the coexistence of causation and selection: Lucas (2005), using 18 years of longitudinal data from the German Socio-Economic Panel Study, found that life satisfaction declines prior to marital disruption and then gradually rebounds after divorce. However, the level of post-divorce life satisfaction is below the initial level in the marriage. This temporal pattern provides a relatively clear picture of how both causal and selection mechanisms operate at the same time. Wade and Pevalin (2004), using longitudinal data from the British Household Panel Survey, found that, consistent with the selection argument, those who subsequently divorced had poor mental health *prior to marital disruption*. They also found that their mental health is the worst around the time of marital disruption and remains worse after the disruption, which they interpreted as consistent with the causal argument.

VARIATIONS BY HEALTH OUTCOME AND GENDER

Bernard (1972) made a famous observation that there are two realities of a marriage, one for men and the other for women. She argued that marriage benefits men but hurts women because the gender roles constrain women to take the majority of household responsibilities

while men reap the benefits of women's household production activities. Indeed, early research on the health disparities by marital status found evidence consistent with this gender difference. Waite and Gallagher (2000) disputed Bernard's position, and argued that the health of *both men and women* benefit from being married, although the mechanisms might differ. They suggested marriage provides emotional support for both men and women; men are helped by wife's specializing in household work and restraining husband's risk-taking and unhealthy behaviors; for women, their husband's additional income is crucial. By implication, divorce hurts both men's and women's health by reducing mutual emotional support as well as the social and economic resources spouses provide to each other. Empirical evidence regarding gender differences in the effects of divorce is mixed and varies by health outcomes.

Bruce and Kim (1992) found that divorce increases the psychiatric disorder of major depression for both men and women, but divorced men have a greater risk of a first-onset in a community sample. Aseltine and Kessler (1993), using two waves of longitudinal data of a community sample, found that divorce increases depression only among those who did not report serious marital problems prior to the separation, but the effect of divorce on depression among those who did not report having marriage problems is more pronounced for women than men.

An analysis of a 1974-1975 U.S. national sample by Umberson (1987) found that divorced people are more likely to engage in unhealthy, risk-taking behaviors (except marijuana use), controlling for race/ethnicity, age, education, and income. Divorced men are more likely to have drinking problems than divorced women. Using 1986-1994 waves of longitudinal data from the Americans' Changing Lives, Williams (2003) found no gender difference between divorced men and women on depression (CES-D) and life satisfaction but, among the divorced, remarried men fare better than remarried women.

Studies analyzing the 1987-1988 and 1992-1994 waves of panel data from the National Survey of Families and Households yield contradictory findings: Williams and Dunne-Bryant (2006) found that the effects of divorce on depression, alcohol use and global happiness at the

second wave remain statistically significant after controlling for the same outcome measured at the first wave. Divorced women have more depressive symptoms than divorced men, but there is no gender difference in alcohol use and global happiness. Marks and Lambert (1998) found that divorced women appear to be slightly (i.e., mostly statistically insignificant coefficients) worse off than divorced men on a number measures of psychological well-being, e.g., depression, hostility, global happiness, self-esteem, personal mastery, autonomy, personal growth, etc. Simon (2002) found that divorce increases depression and alcohol use for both men and women. Divorced women are more depressed than divorced men, but divorced men tend to (the coefficient is statistically insignificant) be more likely to increase their alcohol use than divorced women. Kalmijn and Monden (2006) found that divorce has no overall effect for men but increases the depressive symptoms for women.

Gove (1973) documented mortality differentials by marital status, with the divorced having highest mortality rates followed by the widowed and the married. The differential by divorce is more pronounced for men than for women. Goldman (1993) noted that much of the mortality differentials by marital status may be due to selection of the socioeconomically advantaged into marriage. Hemström (1996) found that the mortality differential by divorce is greater for men than for women. However, part of the differential can be explained by controlling for employment status and the presence of children. Rogers (1995) conducted a case-control study of mortality using the 1986 National Health Interview Survey, and found that divorced people have higher mortality rates, with the difference being more pronounced for men than for women. For women, divorced women have higher rates of death due to accidents and suicide. Divorced men have higher mortality rates for all causes of death.

The literature examining the effect of divorce on health outcomes other than specific mental health outcomes and mortality is surprisingly thin. No study thus far has examined composite measures of physical health and mental health. Blekesaune and Barrett (2005) examined sick leave and receipt of health-related benefits and found that people with poor health are more likely to be selected out of marriage through divorce. While there is a small

effect of divorce, the effect tends to be only temporary. Zhang and Hayward (2006), using five waves of panel data from the Health and Retirement Survey (HRS), found that marital disruption is associated with elevated risks of cardiovascular disease for women, but not for men; however, even the association for women is not causal and only reflects differences in socioeconomic status and emotional distress. Wu and Hart (2002) found that divorce decreases functional health and general health status and increases depression for Canadian men, but has no statistically significant effect for women. Williams and Umberson (2004), examining longitudinal data from the Americans' Changing Lives Survey, found that divorce worsens self-reported general health status of older men, but improves that of younger men and all adult women, especially women at older ages.

DATA

National Longitudinal Survey of Youth 1979

The National Longitudinal Survey of Youth 1979 (NLSY79) is a prospective survey of a nationally representative random sample of 12,686 young adults ages 14 to 22 in 1979, with follow-ups conducted annually until 1994 and biennially from 1996 onwards. The initial wave includes three components—a main sample of 6,111 individuals, an over-sample of 5,295 racial minorities and poor non-Hispanic whites, and a sample of 1,280 military personnel. All household members within the age range as of 1979 are included in the sample, and were interviewed annually from 1979 to 1994 and biennially from 1996 onwards. The sample attrition has been very low. The retention rates were either above or close to 90% for the 1979-1994 surveys, above 80% for the next 1996-2000 surveys, and 77.5% for the 2002 survey. The response rates were above 90% until 1994, and above 80% from 1996 to 2002.[2] Over 80%

[2]Response rate is defined as the percentage of base-year respondents remaining eligible and not known to be deceased who were interviewed in a given survey year. Retention rate is defined as the percentage of base-year respondents within each sample type remaining eligible who were interviewed in a given survey year. The difference is that the latter includes in the eligible sample those deceased and difficult-to-field respondents whom the National Opinion Research Center did

of the original NLSY79 respondents remaining in the eligible sample were reinterviewed until 1987, over 70% from 1988 to 1994, and over 60% from 1996 to 2002. The racial compositions of the respondents are comparable (with less than 1% differences) between 1979 and 2002 (National Longitudinal Surveys, 2004, *NLSY79 User's Guide: 1979-2002*).

Dependent Variables

The SF-12 (see Appendix **??** for a list of items in the scale) measures the respondents' mental and physical health irrespective of their proclivity to use formal health services, and was administered to the NLSY79 respondents ages 40 and over in 1998, 2000, 2002, and 2004. These data were collected only once when the respondent first met the age criterion when interviewed, and thus provided only a snapshot of his/her health status in the middle age. I use three outcomes drawn from the SF-12 scale: A self-reported single item assessing the general health status of the respondent[3], the composite score of physical health, and the composite score of mental health. All three outcomes are coded such that a higher score means better health. As shown in Table 1, divorced men and women on average have worse health, although the differences are not very large: Divorced men scored .16 points lower than married on a five-point Likert scale for general health status, while the difference between divorced and married women is .25 points. The difference in physical health is .54 for men and 1.88 for women, and the difference in mental health is 1.61 for men and 1.35 for women—all on scales, by design, with a mean of 50 and a standard deviation of 10.[4]

not attempt to contact.

[3]The question asks "In general, would you say your health status is ...." The respondent will report from one of the following five categories: "excellent", "very good", "good", "fair", or "poor".

[4]Table 1 shows that the analytic sample has means that are 2-5 points higher than the designed means, and standard deviations that are smaller than the designed standard deviations. This suggests that the sample might be selective on those who are, on average, healthier and more homogeneous than the general population (or the sample that the SF-12 developers used to construct the norm).

Table 1: Means and Standard Deviations for Dependent Variables: Divorced and Continuously Married Women and Men

Dependent Variable	Men		Women	
	Married	Divorced	Married	Divorced
General health	3.84	3.68	3.78	3.53
	(0.92)	(1.02)	(0.96)	(1.06)
Physical health (SF12)	53.10	52.56	52.76	50.88
	(6.54)	(7.46)	(7.25)	(9.49)
Mental health (SF12)	55.05	53.44	52.99	51.34
	(6.04)	(8.49)	(7.81)	(9.21)
Number of cases	1,520	1,119	1,538	1,546

Note: General health is measured on a 5-point Likert scale,

Measures of Divorce and Marriage Duration

I focus the analysis of this chapter on the disruption of respondents' first marriage. I construct a marital history for the respondents from the questions about their current marital status and the changes in marital status between survey interviews. I code marital disruption for their first marriage as the number of months between the reported wedding date and the reported date of separation or divorce—whichever comes first. I exclude those cases whose first marriages ended in spousal death or for unidentified reasons. Thus, the "treatment" of interest is marital disruption—whether a respondent's first marriage ended in either separation or divorce prior to last interview.

Control Variables

Controls for the respondent's sociodemographic characteristics include dummy variables for race and ethnicity (coded 1 for black and for Hispanic as mutually exclusive categories, with non-black-non-Hispanic being the omitted reference group), dummy variables for his/her

education level, an age-standardized summary score on the Armed Forces Qualifying Test (AFQT), self-esteem measured in 1980, respondent's age at first birth, missing age at first birth (which stands largely for childlessness). I control for the respondent's family background with the following variables: whether the respondent was raised in the Catholic faith; an index ranging from 1 to 6 for how often the respondent attended church in 1979; mother's years of schooling, socioeconomic index of the father (or male adult in the household) when the respondent was 14 years old; dummy variables equal to 1 if the respondent's father (or adult male) was unemployed or absent when the respondent was 14; an index ranging from 0 to 3 defined by adding dummy variables equal to 1 if magazines, newspapers, or library cards were present when the respondent was 14; and whether the respondent lived in the South or in an urban area at age 14. In addition, I control for dummy variables indicating whether respondent's biological mother and father had any major health problems, which is part of the health module asked of respondents over age 40. Ailing parents may impose stress on the respondent's marriage, which may both increase the likelihood of divorce and decrease the respondent's perceived health. Appendix **??** describes the definition and construction of these control variables. Table 2 presents descriptive statistics for the background variables for both men and women.

Table 2: Unweighted Means and Standard Deviations for Background Variables: Divorced and Continuously Married Women and Men

Background Variable	Men		Women	
	Married	Divorced	Married	Divorced
Black	.19	.30	.20	.29
Hispanic	.19	.20	.18	.21
Education (< 12 years)	.16	.26	.11	.20
Education (12 years)	.34	.40	.33	.37
Education (13-15 years)	.21	.22	.25	.27
Education (>= 16 years)	.30	.12	.31	.15
Age at 1st marriage	26.3	23.3	24.7	21.4

Continued on next page...

... table 2 continued

Background Variable	Men		Women	
	Married	Divorced	Married	Divorced
	(5.4)	(4.2)	(5.7)	(4.3)
Age at 1st birth	26.5	24.1	24.9	22.0
	(5.4)	(5.1)	(5.3)	(5.0)
Age at 1st birth missing	.12	.14	.11	.12
Catholic	.39	.33	.41	.34
Catholic missing	.01	.01	.01	.01
Religiosity 1979	3.2	3.0	3.6	3.3
	(1.7)	(1.7)	(1.7)	(1.7)
Religiosity missing	.01	.01	.01	.01
AFQT score	48.2	37.7	46.5	35.3
	(29.7)	(26.9)	(27.9)	(25.0)
AFQT missing	.06	.05	.04	.04
Self esteem 1980	32.9	32.5	32.5	32.0
	(3.9)	(4.0)	(4.0)	(3.9)
Self esteem missing	.05	.04	.04	.05
Foreign born	.08	.07	.08	.07
Reading materials present[a]	.47	.38	.50	.38
Intact Family[a]	.76	.65	.77	.64
South residence[a]	.31	.40	.33	.39
Urban residence[a]	.76	.80	.78	.79
Father's education (years)	11.3	10.7	11.2	10.6
	(4.0)	(3.4)	(3.4)	(3.5)
Father's education missing	.10	.16	.10	.16
Mother's education (years)	11.1	10.7	11.0	10.5
	(3.3)	(3.0)	(3.3)	(3.0)
Mother's education missing	.05	.07	.05	.06
Father has health problem	.41	.42	.46	.49
Father health problem missing	.06	.08	.05	.09
Mother has health problem	.40	.40	.46	.51
Mother health problem missing	.02	.02	.02	.02
Number of cases	1,520	1,119	1,538	1,546

Note: Standard Deviations are in parentheses.

[a] When respondent was 14 years old.

Sample Restrictions

I restrict the NLSY79 sample to those 9,619 cases who have ever been married and with valid data on dates of first marriage. I further delete 181 cases whose first marriage has ended by the date of 2004 interview but without valid information on the date of marital disruption. Of the 7,790 respondents with valid data on the dependent variables of SF-12, I excluded (1) those who had never been married when the dependent measures were taken or illogical first marriage history (N=1,667), (2) those whose first marriages ended in spousal death or unknown reasons (N=115), and (3) those in the military sample (N=193). I then delete those respondents with missing data on highest grade completed, foreign-born status, family structure at age 14, and reading materials presence at age 14 (total N=92). These restrictions lead to a base sample of 5,723 for the analysis.

A unique design feature of the NLSY79 is that the initial 1979 survey included all youths within the age range of 14-22 living in the sampled household. Thus, there could be multiple respondents of varying relationships—including siblings, spouses, cousins, etc.—interviewed in a household. In fact, 53 percent of the original 12,686 respondents resided in a multi-respondent household (see NLSY79 User's Guide, chap. 4, p. 195). In the siblings fixed effects analysis, I construct a sub-sample from household rosters to include only respondents with one or more siblings in the original NLSY79 sample. Table 3 compares the base sample and the restricted sibling sample.

Table 3: Means and Standard Deviations for Variables: Men and Women for Base and Sibling Samples

	Men		Women	
Variable	Base	Sibling	Base	Sibling
Treatment Variable				
Separation/Divorce	.43	.39	.50	.46

Continued on next page...

... table 3 continued

	Men		Women	
Variable	Base	Sibling	Base	Sibling
Dependent Variables				
General health	3.77	3.77	3.65	3.67
	(0.97)	(0.97)	(1.02)	(1)
Physical health (SF12)	52.87	52.87	51.81	52.28
	(6.96)	(6.84)	(8.5)	(7.95)
Mental health (SF12)	54.35	54.56	52.16	52.36
	(7.25)	(7.12)	(8.58)	(8.24)
Background Variables				
Black	.24	.25	.25	.26
Hispanic	.19	.19	.20	.18
Education (< 12 years)	.20	.20	.16	.13
Education (12 years)	.36	.38	.35	.34
Education (13-15 years)	.21	.20	.26	.26
Education (>= 16 years)	.22	.22	.23	.27
Age at 1st marriage	25	25.5	23.0	24.0
	(5.1)	(5.1)	(5.3)	(5.4)
Age at 1st birth	25.5	25.7	23.4	24.1
	(5.4)	(5.3)	(5.3)	(5.4)
Age at 1st birth missing	.13	.12	.11	.12
Catholic	.36	.38	.37	.39
Catholic missing	.01	.01	.01	.01
Religiosity 1979	3.09	3.21	3.46	3.64
Religiosity 1979 miss	.01	.01	.01	.01
AFQT score	43.6	41.5	40.8	41.2
	(29.0)	(29.3)	(27.1)	(28.0)
AFQT missing	.05	.04	.04	.03
Self esteem 1980	32.7	32.6	32.3	32.2
	(3.9)	(3.9)	(3.9)	(4.0)
Self esteem 1980 missing	.04	.04	.04	.04
Foreign born	.08	.08	.07	.07
Reading materials present 14	.43	.43	.44	.47
Intact Family 14	.72	.74	.71	.76
South 14	.35	.35	.36	.35

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... table 3 continued

	Men		Women	
Variable	Base	Sibling	Base	Sibling
Urban 14	.78	.77	.79	.80
Father's Education (years)	11.1	11.1	10.9	10.9
	(3.8)	(3.9)	(3.7)	(3.9)
Father's education missing	.13	.11	.13	.11
Mother's education (years)	11.0	11.0	10.8	10.9
	(3.2)	(3.2)	(3.2)	(3.2)
Mother's education missing	.06	.06	.05	.05
Father has health problem	.41	.42	.47	.50
Father health problem missing	.07	.06	.07	.05
Mother has health problem	.40	.41	.49	.49
Mother health problem missing	.02	.02	.02	.01
Number of Cases	2,639	1,482	3,084	1,541

METHOD

Statistical Models

I use multiple methods to examine the effects of marital disruption. The ordinary least square (OLS) regressions control for selection on sociodemographic factors and family background by linearly adjusting the covariance:

$$y_{ji} = \theta \cdot D_i + \beta \mathbf{x} + e_{ji}, \tag{1}$$

where y_{ji} is the health measure for individual i growing up in household j.

The OLS regression models may be inadequate because it assumes selection only on observed variables. To eliminate potential bias from unobserved factors that are shared among family members, I estimate a fixed effects model that specifies a unique intercept c_j for all siblings in the same household j (Griliches 1979; Quesnel-Vallée 2004):

$$y_{ji} = \theta \cdot D_{ji} + \beta \mathbf{x} + c_j + \epsilon_{ji}. \tag{2}$$

Under the sibling fixed-effects specification, if siblings growing up in the same household have worse health outcomes and a higher chance of divorce either through shared social and physical environment or through heredity, OLS estimates of marital disruption θ will be upwardly biased.

The OLS model also assumes that a linear combination of the covariates will ensure comparability between the divorced and the continuously married. However, this parametric assumption may not hold. The problem worsens if there is lack of support at certain regions of distributions of potential confounding variables. The propensity score method described in Li (2005) and results presented in the Appendixaddress these two potential pitfalls. Specifically, I construct a propensity score for each individual using a logistic model regressing the log-odds of marital disruption on covariates used in the OLS model. I then subclassify the sample both by quintile of propensity score and quintile of time of exposure to the risk of divorce. For each stratum k (where m_k out of the n_k cases in the stratum are divorced), I estimate a simple OLS regression:

$$y_{ki} = \theta_k \cdot D_{ki} + \upsilon_{ki}. \tag{3}$$

I then obtain the average treatment effect of marital disruption *for those who are divorced* (or average treatment effect on the treated, ATT) by averaging the stratum-specific effect θ_k with the number of divorced cases m_k being weights (Gelman and Hill 2007:204-6):

$$ATT = \frac{\sum \theta_k \cdot m_k}{\sum m_k}, \tag{4}$$

with a standard error averaging over the stratum-specific standard error s_k's:

$$\mathcal{S}_{ATT} = \sqrt{\frac{\sum (s_k^2 \cdot m_k^2)}{(\sum m_k)^2}}. \tag{5}$$

Average Treatment Effect on the Treated

Subclassification on the propensity score and the exposure time is superior to OLS regression not only because it makes fewer parametric assumptions but also because it provides

estimates that can be explicitly interpreted as "the average treatment effects on the treated" (hereafter, ATT). The ATT gives the effect of divorce for those who are divorced, rather than for an average person randomly drawn from the general population, which will inevitably include people whose marriage is so satisfying that they will never even consider a divorce. The ATT is also derived from the counterfactual causality framework in which the treatment effect is explicitly defined as a comparison between what would have happened to a person's health had s/he not experienced divorce. In the following, I briefly describe the ATT in a counterfactual framework, and the conditions under which the ATT will be the same as the "average treatment effect" for the general population (hereafter, ATE).

Let D be the dummy indicator for marital disruption; then the outcome Y will be observed according to the following equation (suppressing individual indicator i):

$$Y = D \cdot Y_1 + (1 - D) \cdot Y_0. \tag{6}$$

Define

$$\begin{cases} Y_0 = E(Y_0|X) + U_0 = \mu_0(X) + U_0 \\ Y_1 = E(Y_1|X) + U_1 = \mu_1(X) + U_1 \end{cases} \tag{7}$$

where $E(U_0|X) = 0$ and $E(U_1|X) = 0$. Insert the above into (6), we obtain:

$$Y = \mu_0(X) + D \cdot \{[\mu_1(X) - \mu_0(X)] + [U_1 - U_0]\} + U_0. \tag{8}$$

The treatment effect is $\mu_1(X) - \mu_0(X)$, the effect for an average person with characteristics X, and $U_1 - U_0$, the idiosyncratic effect for a particular person. The ATE with characteristics X in the population is

$$E(\Delta|X) = \mu_1(X) - \mu_0(X). \tag{9}$$

The ATT for persons with characteristics X is

$$E(\Delta|X, D = 1) = \mu_1(X) - \mu_0(X) + E(U_1 - U_0|X, D = 1). \tag{10}$$

If $E(U_1 - U_0|X, D = 1) = 0$, the two are the same quantity. This happens if $U_1 - U_0 = 0$, or if agents either do not know $U_1 - U_0$ or do not act on their knowledge of $U_1 - U_0$. In brief,

$U_1 - U_0$ is the idiosyncratic effect of divorce for a particular couple with characteristics X that is unobserved/unknown to the analyst. When we want to know whether the behavioral model correspond to reality, we must ask whether a couple know their own $U_1 - U_0$, and whether a couple act upon their knowledge of $U_1 - U_0$. If $E(U_1 - U_0|X, D = 1) \neq 0$, the estimates should be interpreted as the ATT.

Heterogeneity of Effects

Following Morgan (2001), I will also explore the heterogeneity of the effects of divorce across strata. This exercise helps demonstrate to what extent an interpretation that implicitly assumes a constant effect for all individuals in the population (if the estimate is interpreted as ATE, and in the divorced population if the estimate is interpreted as ATT) is warranted. This speaks to the claim that divorced people experience a wide range of life trajectories, and some divorces may indeed yield a beneficial effect for the divorced. The other purpose of this examination of the heterogeneity of effects is to explore the adequacy of the "no-hidden-bias" assumption. Biases due to unobserved factors are plausible if there is substantial heterogeneity of the estimated effects across subgroups and particularly if the heterogeneous effects vary in a systematic way. If there are biases not captured by the observed covariates, then one cannot interpret the estimated coefficients as "effects." The estimates can only be as good as the conditioning on the selected observables works. I will use the language of the effect of divorce for the divorced men and women (i.e., corresponding to ATT) in this chapter, although I do not imply that the statistically significant coefficients should necessarily be interpreted as causal.

RESULTS

Despite wide belief in the gender differentials in the health benefits of marriage since the classic thesis of "her marriage" versus "his marriage" (Bernard 1972), I find gender differences in physical health only, and no difference by gender in general health status and mental

health.

Table 4 presents results for the commonly used self-reported general health status. On average, divorced men score -.17 lower than married men and divorced women score -.25 lower than married women on a five-point scale (Model 1). These differences are statistically significant at the .01 level. Some of these differences appear to reflect differences in sociodemographic characteristics and, to a lesser extent, differences in family background. Controlling for these factors yields much smaller coefficients than the zero-order associations reported in Model 1. For both men and women, the coefficients decline by about 2/3 in magnitude in Models 4-6, and are statistically significant at the .05 level for women[5], but not for men.

Table 5 presents results for physical health measured as a composite score using the SF-12 scale. On average, divorced men score .57 points lower than married men and divorced women score almost 2 points lower than married women in their physical health composite score on the SF-12 scale. For women, about half of the difference is due to differences in sociodemographic and family background between the two groups and cannot be attributed to the effect of divorce. The coefficient reduces to about 1 point, but remains statistically significant. For men, marital disruption appears to have no effect on physical health. Controlling for family background factors reduces the coefficient by about half (Model 3), and further controlling for sociodemographic factors flips the sign of the coefficients. In Model 4 and Model 6, marital disruption improves men's physical health by at least .1 point, although this improvement is minimal and statistically insignificant.

Table 6 presents results for mental health. On average, divorced men and women score more than 1.5 points lower than married men and women in their mental health composite score on the SF-12 scale. These differences cannot be explained by selection on sociodemographic and family background factors. The coefficients remain approximately the same

[5]The standard error in the fixed-effects model is inflated, so that the coefficient in Model 5 is insignificant for women.

across all six models. The results suggest that marital disruption has a detrimental effect on the mental health of both men and women that is not due to selection on observables.

In brief, these results on the average effect of divorce for the divorced suggest that divorced women would have fared better general health, physical health and mental health had they remained married. However, divorced men would have only enjoyed better mental health, but not general health status or physical health, had they remained married.

I obtain qualitatively similar results using a different estimation strategy to obtain the average effect of divorce for the divorced that subclassifies both on the time-varying propensity score $r(t)$ and marriage duration.[6] I present these results in Table 7 – Table 9, and show the heterogeneity of effects by substrata. It is perhaps not surprising that the ranges of the estimated effects are quite wide in these three tables. This is mainly due to the small sample sizes in certain cells that increase the sampling variability. However, it is worth noting how many cells yield a positive estimate of the effect of divorce, meaning that divorce improves his/her health outcome compared to the counterfactual if s/he had remained in the marriage: 11 out of 24 cells for men and 7 out of 25 cells for women on general health status in Table 7; 12 out of 24 cells for men and 7 out of 25 cells for women on physical health in Table 8. Even in Table 9, 5 out of 24 cells for men and 8 out of 25 cells for women yield a positive coefficient on mental health. Although these results may be interpreted as nothing but reflecting the loss of efficiency in the subclassification estimation strategy, I believe these results more likely reflect the fact that the effects of divorce may be very heterogeneous.

DISCUSSION

Largely consistent with prior research on specific health outcomes, I find strong associations between marital disruption and general measures of overall health, mental health, and phys-

[6]They are not too similar if you look at the magnitudes of the coefficients. I believe this stems from how well the subclassification in a 5 by 5 table perform in balancing the propensity scores and marriage duration.

ical health for both men and women in their early 40s. Are these associations *causal*? My estimates of the treatment effects of divorce for the divorced suggest that, holding constant a number of demographic and family background characteristics in a relatively nonparametric way, divorce hurts women's health on all three general indicators. Although divorce appears to hurt men's mental health, divorced men do not seem to suffer from a decline in self-reported global health or physical health.[7]

Although the analyses presented in this chapter have taken advantage of statistical techniques such as the propensity score subclassification and the sibling fixed-effects models, the design of the NLSY79 with health outcomes measured only cross-sectionally is far from ideal in teasing apart causation and selection. The propensity score method works only as good as to the extent that the assumption of no hidden bias holds. The sibling fixed-effects model controls only for unobserved factors that are shared by individuals growing up in the same household. However, the health selection is perhaps more likely to occur through assortative mating (on health, and other socioeconomic characteristics related to health and divorce, e.g., education) or unobservable factors associated with both the individual's health trajectory (e.g., disability) and divorce. If so, then a couple fixed-effects model or an individual fixed-effects model will be a better strategy to identify causal effects of divorce on health.

To the extent we have confidence in these estimates, divorce seems a painful psychological experience that not only makes people depressed (Simon 2002) but also deteriorates the overall mental health for both men and women. This is consistent with the argument that marital disruption is a stressful event that negatively affects a person's mental resources. It is also consistent with the social support argument that the marriage helps institutionalize the supply of emotional support for spouses, as well as their integration into the community (House et al. 1988; Ross et al. 1990). If so, then these causal mechanisms are socioemotional

[7]Although I follow the conventional language and call my estimates average treatment "effects" on the treated, they are only "effects" and not associations if the underlying assumptions (e.g., selection only on observables) hold. Hence, the reader should be cautioned not to confuse the language with its actual meaning.

resources that *money can't buy*, and provide a source of psychological well-being.

However, marriage is also an economic institution in which spouses pool incomes—the capital on which our physical health builds (Smith 1997). Because it is disproportionately women who experience a substantial decline in economic well-being following a divorce (Peterson 1996; Weitzman 1985), that divorced women, but not divorced men, suffer from declines in self-reported general health status and overall physical health is consistent with Waite and Gallagher's (2000) argument that women benefit from marriage through increased household income. However, these results do not necessarily support their conclusion that policy makers should seek to prevent the divorce of married couples, since if income were the causal mechanism producing gender differences in the effects of divorce on physical health and general health status, this points to *what money can buy.*

Note also that these estimates are for the effects of divorcing the first marriage, averaging over all sorts of trajectories following a divorce. Part of the gender difference may reflect the gender differences in life trajectories, for example, divorced men are more likely to remarry than divorced women (Casper and Bianchi 2002; Sweet and Bumpass 1987) and, thus, enjoy the benefits of marriage again with a new spouse. Because of the variation in the trajectories following a divorce, it may not be surprising that I observe a lot of variability in these estimates. Indeed, even divorced men vary substantially in their economic standing following the disruption (McManus and DiPrete 2001). Although the focus on the effect of the disruption of a first marriage limits my ability to examine these speculations empirically, this focus directly addresses the policy question: whether individuals should get a divorce (or not) based on the health consequences of divorce.[8]

If for some individuals, divorce opens up the opportunity of remarrying to a spouse that provides greater health benefits than does his/her first spouse, it is still part of the

[8]Other research that attempts to estimate a range of marital status coefficients using a more complicated design is related, but it is harder to interpret their results in this focused policy context. This policy question concerns only with the decision to voluntarily exit the marriage, irrespective of what might happen after the disruption.

effect of divorcing his/her first marriage. Estimates of the effects of divorce *only for the divorced*, rather than the general population, presented in the last columns of each table are particularly suitable by addressing both theoretically and empirically the counterfactual of what would have occurred for a divorced individual had s/he remained married and had not divorced not.

The estimates for the effects of divorce on the overall mental health and physical health have not been reported elsewhere in the literature. The gender difference in my estimates of the effects of divorce on self-reported general health status is different from that reported by Williams and Umberson (2004). Their analysis of the Americans' Changing Lives Survey data found that divorce improves women's and young men's self-reported general health status, but hurts older men's general health status. Because the health outcomes for the NLSY79 sample were measured in a narrow age range (the early 40s) and because the design presented here focuses on the effect of divorce only for those in a first marriage, it is unclear how to reconcile these different findings.

A large scientific literature and the public attention to policy debates demonstrate the importance of answering whether there is a causal link between divorce and health. The evidence presented in this chapter is consistent with the claim that divorce *causes* declines in overall mental health, but provides only conditional support for similar claims regarding overall physical health and general health status. Future research is needed to continue to unpack the specific underlying causal mechanisms.

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Table 4: Gender-Specific Regression Coefficients (and Robust Standard Errors) of Separation/Divorce on General Health Status, Men and Women, National Longitudinal Survey of Youth, 1979-2004

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Men						
Separation/Divorce	-.17**	-.07	-.13**	-.07	-.08	-.06
	(.04)	(.04)	(.04)	(.04)	(.11)	(.06)
N	2,639	2,639	2,639	2,639	1,482	1,077
Women						
Separation/Divorce	-.25**	-.11**	-.16**	-.09**	-.07	-.09*
	(.04)	(.04)	(.04)	(.04)	(.09)	(.04)
N	3,084	3,084	3,084	3,084	1,541	1,546
Controls						
Sociodemographics		X		X	X	
Family Background			X	X	X	
Sibling Fixed Effects					X	
Logit Propensity Score and Exposure Time						X

Note: ** $p < .01$, * $p < .05$

Table 5: Gender-Specific Regression Coefficients (and Robust Standard Errors) of Separation/Divorce on Physical Health, Men and Women, National Longitudinal Survey of Youth, 1979-2004

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Men						
Separation/Divorce	-.57*	.12	-.31	.11	-.10	.16
	(.28)	(.29)	(.28)	(.28)	(.90)	(.43)
N	2,639	2,639	2,639	2,639	1,482	1,077
Women						
Separation/Divorce	-1.89**	-1.17**	-1.42**	-.99**	-.81	-.93*
	(.31)	(.31)	(.31)	(.31)	(.82)	(.38)
N	3,084	3,084	3,084	3,084	1,541	1,546
Controls						
Sociodemographics		X		X	X	
Family Background			X	X	X	
Sibling Fixed Effects					X	
Logit Propensity Score and Exposure Time						X

Note: ** $p < .01$, * $p < .05$

Table 6: Gender-Specific Regression Coefficients (and Robust Standard Errors) of Separation/Divorce on Mental Health, Men and Women, National Longitudinal Survey of Youth, 1979-2004

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Men						
Separation/Divorce	-1.55**	-1.42**	-1.56**	-1.47**	-1.74*	-1.31**
	(.30)	(.30)	(.30)	(.30)	(.82)	(.45)
N	2,639	2,639	2,639	2,639	1,482	1,077
Women						
Separation/Divorce	-1.66**	-1.42**	-1.48**	-1.31**	-.94	-1.67**
	(.31)	(.31)	(.31)	(.31)	(1.01)	(.36)
N	3,084	3,084	3,084	3,084	1,541	1,546
Controls						
Sociodemographics		X		X	X	
Family Background			X	X	X	
Sibling Fixed Effects					X	
Logit Propensity Score and Exposure Time						X

Note: ** $p < .01$, * $p < .05$

Table 7: Stratum-Specific Effects on General Health Status by Propensity Score $r(t)$ and Marriage Duration

Men $b = -.18$	Propensity Score $r(t)$				
Marriage Duration	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1st Quintile	-1.86	.37	.38	-.02	.24
2nd Quintile	.33	.21	-.09	.03	-.42
3rd Quintile	.10	-.09	-.09	.28	-.20
4th Quintile	-.21	-.66	-.18	.16	-.20
5th Quintile	-.18	-.23	.37	.71	NA

Women $b = -.28^{**}$	Propensity Score r(t)				
Marriage Duration	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1st Quintile	-.41	-.77	-.83	.60	.38
2nd Quintile	-.03	.27	-.24	-.02	-.30
3rd Quintile	-.12	-.36	-.11	.63	-.15
4th Quintile	-.60	-.38	-.03	-.39	-.12
5th Quintile	-.21	-.63	.04	.10	.34

Note: ** $p < .01$, * $p < .05$

Table 8: Stratum-Specific Effects on Physical Health by Propensity Score $r(t)$ and Marriage Duration

Men $b = -1.26$	Propensity Score $r(t)$				
Marriage Duration	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1st Quintile	-19.04	.94	1.98	-.42	3.06
2nd Quintile	3.63	-.10	-.48	1.84	-1.91
3rd Quintile	.43	-1.16	-.19	1.45	-1.88
4th Quintile	.96	-3.00	1.79	-.39	5.23
5th Quintile	-3.37	-2.57	3.05	4.17	NA

Women $b = -2.05$**	Propensity Score r(t)				
Marriage Duration	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1st Quintile	-1.31	-5.67	-4.39	-4.71	-2.03
2nd Quintile	-1.72	2.48	-.68	1.94	-.23
3rd Quintile	-2.39	-2.43	-.85	-4.41	-.96
4th Quintile	-4.88	-1.15	.98	-1.82	.86
5th Quintile	-1.67	-8.86	1.80	2.00	1.80

Note: ** $p < .01$, * $p < .05$

Table 9: Stratum-Specific Effects on Mental Health by Propensity Score $r(t)$ and Marriage Duration

Men $b = -2.67$*	Propensity Score $r(t)$				
Marriage Duration	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1st Quintile	-14.36	-2.62	-6.35	-2.71	-.55
2nd Quintile	-4.15	1.50	-1.55	-2.55	-3.26
3rd Quintile	.43	-2.44	-.66	-1.79	.14
4th Quintile	-5.41	-4.27	-2.06	-.01	.73
5th Quintile	-1.92	-3.70	.21	.99	NA

Women $b = -1.57$*	Propensity Score r(t)				
Marriage Duration	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1st Quintile	-5.63	-3.32	3.51	-8.32	-.01
2nd Quintile	3.14	-.88	-4.48	-3.43	.71
3rd Quintile	1.30	-.74	-2.53	-1.93	1.57
4th Quintile	-3.66	2.97	-1.96	-2.16	-.76
5th Quintile	2.68	-6.02	.07	-4.47	-5.19

Note: ** $p < .01$, * $p < .05$