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Marriage dissolution among American men, 2003–2010: The roles of measured earnings and latent selection

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Abstract: Research in the economics of the family has established that economic incentives play a significant role in the process of marriage formation and dissolution. This paper distinguishes between two aspects of husbands' earnings in the process of divorce. On one hand, measured earnings might exert a direct effect on the stability of marriage. On the other hand, some husbands possess unobserved traits that might simultaneously affect their earnings growth and their propensities to terminate their marriages. This research utilizes data from the United States Current Population Survey for years 2003 through 2010, and is based on samples of initially married men at two points in time. We seek first to examine whether marriage dissolution occurs in the presence of correlation between unobserved factors present in both earnings during the first period and the subsequent decision to divorce. Second, we look for an explicit role of earnings *per se* in the divorce decision. Results of the study provide support for significant effects in both dimensions. Increases in observed earnings result a tendency to stabilize marriages. Controlling for observed earnings, however, there is evidence that men with strong unmeasured earnings attributes possess latent propensities to dissolve their marriages.

Subjects: Economics; Labour Economics; Econometrics

Keywords: marriage dissolution; impact of earnings and latent earnings potential on divorce

JEL codes: J12

ABOUT THE AUTHORS

Professors Robert Nakosteen and Michael Zimmer have been studying labor market outcomes, and their relationship to individual decision-making, for nearly 40 years. Their focus has been on the influence of self-selection and latent or unobservable variables. Decisions such as whether to move, to marry, to divorce, or to participate in the labor market have been researched. These decisions are modeled in the context of their effect on labor market earnings, or the effect of labor market earnings on the decision. Their research has been published in a variety of academic journals, including the *Journal of Regional Science*, the *Journal of Population Economics*, *Papers in Regional Science*, *Economic Inquiry*, and the *Journal of Human Resources*, among others.

PUBLIC INTEREST STATEMENT

Economists have long studied the impact of "unobservables" on earnings and on decision-making. Unobservables are individual characteristics that may not be measurable in reported data, but are obvious "in person." For example, it may not be possible to enumerate traits such as self-confidence or the ability to work with others, traits that can affect both economic and personal outcomes. This research estimates the simultaneous impact of unobservables on both individual earnings and on the likelihood of divorce. Perhaps surprisingly, we find that unobservables that have a tendency to increase the earnings of males also increase the propensity that their marriages will end in divorce.

1. Introduction

One of the most remarkable changes in American society in recent decades has been an increased tendency for couples to terminate their marriages through separation or divorce. Notwithstanding recent moderation of the trend in divorce (Amato, 2010), elevated divorce rates and their consequences have prompted substantial research regarding determinants of marital dissolution. Beginning with Becker, Landes, and Michael (1977), researchers focused on inducements to divorce that arise from economic and social circumstances of families.

Economists have devoted particular attention to individual labor market factors such as employment and earnings. Most studies employ hazard models for continuous duration data (Bracher, Santow, Morgan, & Trussell, 1993; Hoffman & Duncan, 1995; Lehrer & Chiswick, 1993; Lillard, Brien, & Waite, 1995; Lillard & Waite, 1993) or probit and logit models for discrete event data (Amato & Rogers, 1997; Becker et al., 1977; Hoffman & Duncan, 1995; Jensen & Smith, 1990; Peters, 1993; Starkey, 1991; Weiss & Willis, 1997; and Whittington & Alm, 1997). A general finding in the literature is that marriages tend to be destabilized by events that adversely affect spouses' employment or earnings.

This paper focuses on earnings of husbands and their role in marriage dissolution. It extends the literature in two respects. First, the model treats husbands' measured earnings as endogenous in the process of dissolution, providing an econometric framework in which earnings and potential dissolution are estimated jointly. Second, our approach formally addresses the phenomenon of latent selection, defined here as the presence of unobserved factors that simultaneously affect both husbands' earnings and the propensity to divorce. Previous studies have not addressed these phenomena as joint determinants of marriage dissolution. Our estimates, based on a large sample of initially married males from the United States Current Population Survey, suggest that husbands who experience increased earnings are significantly less likely to divorce. Controlling for measured earnings, however, the evidence is indicative of positive latent selection into divorce. Men who possess strong unobserved earnings attributes are characterized by unmeasured propensities to dissolve their marriages.

2. Background

The extent of interest among economists and other social scientists with regard to determinants of divorce is evidenced by a large and expanding literature. Readers interested in a comprehensive survey may refer to Amato (2010) and references therein. This paper focuses on the role of husbands' earnings and divorce as joint outcomes, as introduced in Section 1.

A useful point of departure is Burgess, Propper, and Aassve (2003), who examine the role of income in transitions into and out of marriage. With respect to the latter phenomenon, their model posits two potentially opposing effects of earnings on marital stability. First, husbands who are strong earners represent marital matches of high quality (the "good catch") and are therefore more likely to remain married. Opposing that tendency is the "self reliance" effect: high earning spouses of either gender (but in our case focusing on husbands) are less likely to depend on remaining married for economic reasons. Stated differently, their outside options are relatively attractive. Using data from the National Longitudinal Survey of Youth, Burgess et al. (2003) infer that the evidence supports the good catch hypothesis: high earning husbands are characterized by a reduced hazard rate of time to divorce. Their samples consist of whites only, and they do not control for latent selection.

Other papers that examine the stabilizing role of income include Svarer (2004) and Tach and Edin (2013), who find that husbands' earnings tend to deter dissolution. However, similar to Burgess et al. (2003) both studies rely on the implied assumption that earnings are exogenous and not jointly determined with the marriage outcome, and they do not control for unobserved heterogeneity.

A recent study that focuses on wives' earnings is Schwartz and Gonalons (2016). Using the 1968–2009 waves of the Panel Study of Income Dynamics, they conclude that earnings of wives relative to husbands are not associated with increased risks of divorce for marriages formed during and after the 1990s. That reverses a tendency that was present among marriages from the 1960s and 1970s.

Studies that recognize the endogeneity of earnings include Nakosteen and Zimmer (1997) and Light and Ahn (2010), both of which conclude that increases in income or earnings are associated with reduced risk of divorce.

Individuals possess unobserved (to the researcher) characteristics that affect their earnings. These include confidence, ambition, family connections in the labor market, propensities for risk taking, or simply luck in earnings outcomes. A small body of research has endeavored to determine whether those traits are simultaneously related to the propensity for marital dissolution. One approach has been to exploit panel data in conjunction with fixed effects models, the latter to effectively difference out unmeasured heterogeneity. Examples include Reinhold (2010) and Lillard et al. (1995), which have addressed cohabitation before marriage as a possible precursor to marriage dissolution. The principal shortcoming of this approach is its reliance on the assumption that the individual fixed effect is invariant for the full extent of the panel, spanning the unmarried and married states.

Another empirical approach has been to use residuals from husbands' earnings or wage equations as a means of recognizing the potential for adverse or favorable earnings outcomes to affect marriage stability. Results from those studies are mixed. Weiss and Willis (1997), using data from the National Longitudinal Study of the High School Class of 1972, estimate husbands' regression-adjusted earnings capacities at the time of marriage. In subsequent years of the panel, they estimate earnings "surprises" in the form of discrepancies between actual earnings after marriage relative to the estimated base capacities at the time of marriage. They find that positive earnings surprises for husbands tend to reduce the probability of divorce. Contemporaneous to that study, Nakosteen and Zimmer (1997) used the Panel Study of Income Dynamics to estimate probit models of divorce for married men. Their results indicate that controlling for the *level* of husbands' earnings, the earnings residual (both variables lagged one year) is not significant in the divorce equation. In a later paper, Zimmer (2001), based on the Marital Stability over the Life Course panel data-set (Booth, Johnson, White, & Edwards, 1991), used husbands' earnings residuals as a proxy for unobserved earnings capacity. The results indicate that positive residuals are associated with increased propensity for divorce.

Our objective in this study is to capture latent selection relative to husbands' earnings in a manner that does not rely on fixed effects models or statistical constructs such as earnings residuals. Instead, as described in Section 3, our model includes an explicit parameter that lends itself to estimation and inference. In taking this approach, we adapt the outside option hypothesis of Burgess et al. (2003) to include the possibility that men with high and increasing earnings encounter outside options in the form of commensurately larger pools of potential second spouses in the event of divorce. This is in recognition of the common and well-known phenomenon of remarriage among men who divorce. (See, for example, Wolf & MacDonald, 1979.) Thus, while strong earners are on one hand more likely to remain married (as good catches), on the other hand the presence of outside options might tend to destabilize their marriages. The innovation of this paper is a model that embeds testable hypotheses about both phenomena.

3. Econometric Framework

To clarify ideas, we establish a definition of latent selection and a model that permits tests of the appropriate hypotheses. The model envisions a population of employed men observed at consecutive points in time. During the first period, each man is married. For person *i*, earnings in the first period are expressed as follows:

$$y_i = \beta' x_i + \varepsilon_i, \tag{1}$$

where y_i denotes earnings, x_i is a vector of explanatory variables, and β is a conformable vector of unknown coefficients.

By the second period, the individual has either remained married or has experienced marital dissolution. We denote these outcomes as $d_i = 0$ and $d_i = 1$, respectively. During the first period, while the marriage outcome is materializing, his anticipated earnings for the second period are denoted by,

$$y_i' = y_i + \eta_i, \tag{2}$$

where η_i represents a latent adjustment, based in part on the expected marriage outcome. Latent selection arises from the difference between husbands' expected earnings and their (counterfactual) expected earnings if they dissolve their marriages:

$$E(y_i'|d_i = 1) - E(y_i'|d_i = 0) = E(\eta_i|d_i = 1) - E(\eta_i|d_i = 0).$$

Thus, the essence of latent selection is that individuals who choose to dissolve their marriages are characterized by unobserved traits that become manifest in their earnings anticipations preceding the change. It might be, for example, that they possess propensities to undertake the inherent risk that dissolution entails. Another possibility is the fundamentally unobservable (to the researcher) nature of the outside option.

Denoting the difference expressed above as

$$\omega_i = E(\eta_i|d_i = 1) - E(\eta_i|d_i = 0), \tag{3}$$

a husband who manifests significant unobserved gains from divorce, as reflected by a large positive value of ω_i, might perceive options in the event of divorce and remarriage that would not exist by remaining married. It is possible that the positive value of ω_i is perceived not only by the husband, but also by potential succeeding spouses. In particular, he is economically attractive to other potential spouses in spite of his married status in period one. The result is a potentially destabilizing factor among marriages of men who possess potential for strong earnings growth.

The key point to emphasize is the latent nature of this phenomenon: it most likely cannot be captured as a measured characteristic, and yet it is certainly known to the men themselves and the pool of potential second wives in the event of divorce. Consequently, latent strengths in earnings constitute a potentially significant factor in determining the stability of marriages. The approach in this study, described in the remainder of this section, is to explicitly account for latent selection in the model.

At the same time, there is reason to believe that selection into divorce might also arise from sources that are measurable, in particular earnings in the period preceding the marriage outcome. This is consistent with a theoretical perspective that views high earning spouses as attractive marriage partners. In this framework, those earners are "good catches" (Burgess et al., 2003), and their spouses endeavor to maximize lifetime economic gains by remaining in the marriage. Consequently, increases in husbands' measured earnings (observable to the researcher) would be associated with a reduced tendency to divorce. There is, however, a possible offsetting influence. Since dissolution is a costly undertaking, individuals with greater earnings are better able to finance the associated monetary costs, and in that case divorce could be associated with higher earnings. Both hypotheses are plausible in the context of economics of marital behavior, and resolution of their respective merits is an empirical issue.

These considerations suggest a framework that models marriage outcomes on the basis of measured as well as unmeasured traits. We address that in the context of a two equation model.[1] Denote d_i^* as the individual's latent propensity to divorce. He chooses to divorce if $d_i^* > 0$; otherwise he remains married during the second period. Reproducing Equation (1), the joint model of earnings and dissolution is given by,

$$y_i = \beta' x_i + \varepsilon_i \tag{1}$$

$$d_i^* = \alpha \cdot y_i + \delta' z_i + \omega_i, \tag{4}$$

where z_i is a vector of measured characteristics, δ is a conformable vector of coefficient parameters and ω_i is the idiosyncratic error term as postulated in Equation (3). All variables with the exception of marriage status are measured in the initial period. Thus, our empirical approach is to compel latent selection, if it exists, to manifest itself in the marriage outcome that is revealed only in the second period.

The divorce propensity is not observed. Instead we observe the dichotomous variable described above:

$$d_i = 1 \quad if \quad d_i^* > 0,$$

$$d_i = 0 \quad if \quad d_i^* \leq 0.$$

The error terms ε_i and ω_i are assumed to possess a bivariate normal distribution with zero means, respective variances σ_ε^2 and 1, and covariance parameter $\sigma_{\varepsilon\omega}$.

The model contains two parameters that are informative about the marriage outcome. In (4), the coefficient α captures the effect of measured earnings. If $\alpha > 0$, then individuals who experience increases in earnings, holding other factors constant, are more prone to divorce. This reflects positive selection on earnings; if $\alpha < 0$, negative selection on earnings is present, and the effect of earnings growth is to stabilize marriages.

The covariance parameter $\sigma_{\varepsilon\omega}$ reflects the presence of latent attributes. If $\sigma_{\varepsilon\omega} > 0$, then individuals who, due to unobserved traits, possess strong earning characteristics in the initial period likewise possess unobserved characteristics that make them more likely to divorce. If $\sigma_{\varepsilon\omega} < 0$, negative selection is present: persons with latent earnings advantages are prone to remain married. The innovation in our approach is to treat first-period earnings as determined simultaneously with the risk of divorce, after controlling for latent selection. Absent the control for selection, the estimated effect of earnings is likely to be biased.

The phenomena captured by the parameters α and $\sigma_{\varepsilon\omega}$ are not mutually exclusive, and resolution of their respective roles is the principal objective of empirical analysis in Section 4.

Our empirical strategy is to estimate Equations (1) and (4) jointly by the method of maximum likelihood after reformulating the model as a pair of reduced form equations. Substituting (1) into (4) yields a reduced form marriage outcome equation:

$$d_i^* = \alpha\beta' x_i + \delta' z_i + \tilde{\omega}_i, \tag{4′}$$

where $\tilde{\omega}_i = \alpha\varepsilon_i + \omega_i$.

Under the assumptions of the model, the error terms ε_i and $\tilde{\omega}_i$ are distributed as bivariate normal with zero means, respective variances

$$V(\varepsilon) = \sigma_{\varepsilon}^2$$

$$V(\tilde{\omega}) = \alpha^2\sigma_{\varepsilon}^2 + 2\alpha\sigma_{\varepsilon\omega} + 1$$

and covariance $Cov(\varepsilon, \tilde{\omega}) = \alpha\sigma_{\varepsilon}^2 + \sigma_{\varepsilon\omega}$.

We partition the sample into men who experience divorce in the second period ($d_i = 1$) and those who remain married ($d_i = 0$). For individual *i*, the univariate density of the error term in Equation (1) is given by

$$g(\varepsilon_i) = \frac{1}{\sigma_{\varepsilon}}\varphi\left[\frac{(y_i - \beta' x_i)}{\sigma_{\varepsilon}}\right] \tag{5}$$

where φ denotes the probability density function of a standard normal distribution. For the population of those who experience divorce, we derive the conditional density:

$$f(\tilde{\omega}_i|\varepsilon_i; d_i = 1) = \Phi\left\{\frac{(\alpha\beta' x_i + \delta' z_i) - \left[\frac{\alpha\sigma_{\varepsilon}^2 + \sigma_{\varepsilon\omega}}{\sigma_{\varepsilon}^2}(y_i - \beta' x_i)\right]}{\sqrt{(\alpha^2\sigma_{\varepsilon}^2 + 2\alpha\sigma_{\varepsilon\omega} + 1) - \frac{(\alpha\sigma_{\varepsilon}^2 + \sigma_{\varepsilon\omega})^2}{\sigma_{\varepsilon}^2}}}\right\} \tag{6}$$

$$= \Phi\{A\}$$

where Φ denotes the cumulative distribution function associated with the standard normal distribution and *A* denotes the argument in brackets.

For the population of men who remain married, the conditional density analogous to (6) is given by $f(\tilde{\omega}_i|\varepsilon_i; d_i = 0) = 1 - \Phi\{A\}$. Accordingly, the likelihood function for the entire sample, consisting of N_1 divorces and N_2 intact marriages, is given by

$$L = \Pi_{i=1}^{N_1} f(\tilde{\omega}_i|\varepsilon_i; d_i = 1) \cdot g(\varepsilon_i) \cdot \Pi_{i=1}^{N_2} f(\tilde{\omega}_i|\varepsilon_i; d_i = 0) \cdot g(\varepsilon_i). \tag{7}$$

In Section 4, we use the sample data to maximize the likelihood function, producing estimates of (1) and (4) along with the associated variance and covariance parameters.

As noted above, the research objective advanced here emphasizes selection into divorce based on both observed and unobserved factors. This has appeared in areas of research outside the divorce literature. For example, the role of observable and unobservable factors in the process of endogenous selection has been discussed in the literature on program evaluation. Studies by economists in that literature have been concerned with labor market programs in which individuals who lack job skills or stable work histories receive training or other "treatments" intended to strengthen their employment prospects. Early examples and extensions in this area include Ashenfelter (1978), Barnow, Cain, and Goldberger (1980), and Heckman and Hotz (1989).[2] Our model is a variation of this idea, entailing direct selection into divorce on the basis of observed earnings and indirect selection based on covariation between latent earnings and the propensity to divorce.

As described in this section, the structural model necessitates a sample of husbands in intact unions and who are employed during the first period. Consequently this design precludes investigation of the effects of joblessness or job loss on marriage dissolution. Examples of papers addressing that question include Jensen and Smith (1990), Charles and Stephens (2004), Eliason (2012), and Doiron and Mendolia (2012).

4. Data and model specification

Estimation of the model is based on data from the United States Current Population Survey (CPS) for 2002 through 2010. The annual March CPS contains data from approximately 50,000 US households. Sample households in the CPS are interviewed for four consecutive months. They are then omitted from the survey for eight months, after which they return for another four month period. Thus, although the core content of the CPS is essentially cross-sectional, the rotating sampling scheme allows us to exploit the outgoing rotation groups for the purpose of accessing two adjacent years of data for each individual. This is necessary for estimation of the model represented in Section 3, since it purports to explain the individual's change in marital status, if any, in year t based on his earnings, along with exogenous controls, in year t–1. Thus, for the first outgoing rotation group, the base year is 2002 and the year for potential marriage dissolution is 2003. For this group, the only variable extracted from the 2003 CPS is d_i in Equation (7), the dichotomous indicator denoting possible marital dissolution. All other variables in the model are taken from the base year. Similarly, for the second outgoing rotation group, the base year is 2003 and the outcome year is 2004, and so on, up to the final group, with base year 2009 and outcome year 2010. The total sample consists of male salary and wage earners, all of whom are married in their respective base years, are not self-employed and not in the armed forces. The total sample for all cohorts consists of 21,241 men, of whom 586 separated or divorced between their respective base and outcome years. Since divorce is a relatively rare event at the individual level for any two adjacent years, we pooled the eight outgoing rotation groups in order to generate sufficient variation in the marriage outcome variable. Accordingly, as described below, the model adjusts the earnings variable over time to reflect constant (Year 2000) dollars and includes a set of year indicators in the divorce equation to account for trends in dissolution over time.

In addition to individual earnings and marital status outcomes, the data file contains background information for each husband, including age, education, race, disability status, union membership, and occupation, all of which are included in the earnings equation. In addition, included exclusively in the marriage outcome equation are family size, family income other than earnings of the husband, and indicators for presence of young children in the household, and home ownership. As noted above, since the sample combines outgoing rotation groups from 2002–2003 through 2009–2010, the model includes dummy variables in the marriage outcome equation as controls for the individual cohorts. The cohort effects include pervasive macroeconomic and societal changes that potentially affected marriage stability during the sample period.

The specifications are generally consistent with other studies of earnings and marriage dissolution. The earnings equation includes variables that capture the individual's human capital and demographics.[3] The dissolution equation includes husbands' earnings and other household characteristics that affect the cost of divorce. Due to lack of suitable measurements in the CPS, the latter equation does not include duration of the marriage, age at the time of marriage, nor an indicator of cohabitation preceding marriage. While these variables are common in empirical models of divorce, they function primarily as proxies for unobserved individual traits that induce individuals to marry at young ages or cohabit before marriage. (See, for example, Lillard et al., 1995). Taking, for example, cohabitation before marriage, its effect on marital stability might arise as much from what cohabitation reveals about the partners' unobserved traits as it does from cohabitation *per se*. In contrast, our approach is to parameterize unmeasured heterogeneity directly in the model, as shown in Equations (1)–(6).

Variable definitions and sample means are presented in Table 1, which partitions the sample by marriage outcome. The sample means reveal that men who are married in year t (2002, ..., 2009) and whose marriages dissolve by year $t + 1$ (here defined as separated or divorced) tend to be younger and have lower earnings and personal incomes than those whose marriages remain intact.[4] They also report lower levels of home ownership and other family income. Somewhat curious features of the data are the apparent higher proportion of husbands in professional or managerial occupations, and the lower extent of union membership, among men whose marriages dissolve. These

Table 1. Variable definitions and sample means: *N* = 21,241

Variable	Definition	Remained married *N* = 20,655	Divorced/separated *N* = 586
PER_INC (*t* = 1)	Husband's annual personal income ($): initial year (constant Year 2000 dollars)	64,886	59,634
EARN (*t* = 1)	Husband's annual labor earnings ($): initial year (constant Year 2000 dollars)	54,888	51,786
AGE	Husband's age	45.04	42.95
EDUC	Husband's years education	13.66	13.51
UNION	=1 if husband was member of labor union; =0 otherwise	0.135	0.043
PROF_OCC	=1 if husband's occupation is professional or managerial; =0 otherwise	0.188	0.278
DISAB	=1 if disability limits or prevents work; =0 otherwise	0.020	0.027
WHITE	=1 white; =0 if nonwhite	0.878	0.828
CHILD≤6	=1 if children aged 6 years or younger are present in household; =0 otherwise	0.277	0.295
FAM_SIZE	Total number of persons in family	3.45	3.67
OTH_INC	Total family income other than husband: initial year ($)	30,406	26,408
OWN_HOME	=1 if couple owns home outright or through mortgage; =0 otherwise	0.876	0.800

occupational disparities contain hints of unobserved differences between the two groups, which are a principal focus of this study. The evidence in Table 1 needs to be seen with caution, however, since it is based on a comparison of simple averages. The following section examines this issue in the multivariate context of Equations (1) and (4).

5. Estimates of the model

5.1. Principal estimates

Table 2 presents maximum likelihood estimates of the model. The first column shows estimated coefficients for the earnings equation in year one for each two-year period. The dependent variable is (log) annual earnings from wages. Column two presents probit estimates for marriage dissolution in year two, where the dependent variable is based on dissolution defined as separation or divorce. Figures in parentheses are absolute *t* statistics, testing the null hypotheses that the corresponding population coefficients are zero.

The estimates in column one are consistent with commonly reported research on earnings, indicating that earnings increase with years of formal education, with an annual return in excess of eight percent. The age profile is concave, and white husbands appear to experience an advantage equal to approximately 10 percent relative to other ethnicities. As expected, husbands in

Table 2. Maximum likelihood estimates: *N* = 21,241 with 586 dissolutions

Variable	Husband's log annual earnings	Divorced or separated
CONSTANT	0.172 (1.51)	−0.602 (3.10)
EDUC	0.086 (33.97)	0.023 (3.14)
AGE	0.099 (20.53)	−0.011 (6.16)
AGESQ/100	−0.001 (23.80)	
DISAB	−0.886 (15.87)	
Non WHITE	−0.103 (4.01)	0.098 (2.03)
UNION	0.483 (18.48)	
PROF_OCC	0.234 (10.71)	
OTH_INC		−0.0009 (1.55)
FAM_SIZE		0.048 (3.65)
CHILD≤6		−0.160 (3.59)
OWN_HOME		−0.150 (3.18)
YEAR1 = 2003		−0.449 (7.82)
YEAR1 = 2004		−0.578 (8.41)
YEAR1 = 2005		−0.496 (7.94)
YEAR1 = 2006		−0.507 (7.99)
YEAR1 = 2007		−0.552 (8.52)
YEAR1 = 2008		−0.462 (7.64)
YEAR1 = 2009		−0.407 (6.95)
Error covariance: $\hat{\sigma}_{\varepsilon\omega}$		**0.366 (4.07)**
EARN (t = 1): $\hat{\alpha}$		**−0.210 (4.00)**

*Figures in parentheses are absolute t statistics.

professional or managerial occupations are significantly higher earners than those in other occupations. The coefficients for work-limiting disability and union status show the expected signs. Both estimates are large in magnitude, likely reflecting the sample selection rules that restrict observations to married men with ongoing labor force attachments. In that population, the estimates indicate a substantial advantage for union members, holding other factors constant, and a large earnings penalty among disabled husbands.

Column two presents probit estimates of the dissolution equation. Defined in Table 2 as separation or divorce, dissolution appears significantly more likely among nonwhite households and larger families. Holding family size constant, presence of young children is a significant deterrent. Dissolution declines with the husband's age, a result commonly reported in the literature.

The positive effect of family size seems incongruous, since larger families tend to possess greater amounts of marriage specific capital, the dissolution of which is costly from a psychic standpoint. However, other researchers have also reported evidence of this phenomenon. Jensen and Smith (1990, p. 224) acknowledge that older children represent a form of shared family capital that is specific to the marriage, and as such they tend to deter family dissolution. On the other hand, they suggest that presence of children might exacerbate conflicts in household division of labor and work roles of spouses, leading to marital strains. Similar family size effects for the United Kingdom are reported by Boheim and Ermisch (2001).

Another impetus to dissolution is education. Since the model controls for earnings, which are enhanced by education (as seen in the first column), the probit coefficient assigns a positive role to husbands' schooling in addition to its strong association with their annual earnings.

Two variables in the model associated with family assets apart from husbands' earnings, namely home ownership and other family income, reduce the incidence of dissolution. They represent sources of income and wealth that are dissipated for at least one spouse in the event of dissolution, thus significantly increasing the cost of divorce.

The dummy variables for years 2003–2009 show negative coefficients relative to the base year of 2002. This reflects a generally lower incidence in divorce in recent years, a phenomenon that has been widely reported (See, for example, Amato, 2010).

The principal parameters of interest are the coefficient of earnings in the dissolution equation, α, and the covariance between random error terms in Equations (1) and (4), $\sigma_{\varepsilon\omega}$. The estimates in Table 2 indicate that the parameters are opposite in sign and strongly significant. The earnings coefficient confirms that the effect of increased earnings is to reduce the incidence of dissolution. The covariance parameter suggests positive latent selection into divorce: after controlling for measured earnings, husbands who possess unobserved positive earnings attributes are characterized by unmeasured propensities to divorce. This finding has not appeared previously in the marriage dissolution literature.

This result is somewhat related and complementary to that of Smock, Manning, and Gupta (1999). Using data from separate waves of the National Survey of Families and Households, and restricting their attention to women, they estimate a three equation model with endogenous switching. Observing the women's marital status and subsequent economic well-being over time, the model first addresses transitions from intact marriage to dissolution. The remaining equations encompass income-related outcomes following marital disruptions. For example, one specification uses personal income as the outcome variable. Self-selection is addressed by including covariance parameters to capture cross-equation associations between error terms in the equations. Their estimates indicate negative selection with regard to personal income: women who possess unmeasured tendencies to remain married tend to manifest latent weaknesses in personal income. This study differs from that of Smock et al. (1999), aside from our focus on husbands. The principal contrast is the emphasis in this paper on earnings as a determinant rather than an outcome of divorce. In particular, it treats husbands' measured earnings as jointly determined with the marriage outcome, while controlling for latent selection.

5.2. Estimates based on personal income

Recognizing that individuals generate income from sources other than wage earnings, we repeated the estimations using the log of husbands' annual personal incomes as the dependent variable in the income equation. Results are presented in Table 3 for specifications that are otherwise identical to those presented in Table 2. Estimates for the control variables are largely consistent in both magnitude and significance with those in Table 2. One possible exception is the coefficient of age in the probit equation, which becomes larger in magnitude while remaining strongly significant.

Estimates of the earnings coefficient and the error term covariance are somewhat sensitive to the change in the income variable. The estimated covariance is positive, again indicating positive latent selection, but the magnitude declines to a fraction of its counterpart in Table 2 ($\hat{\sigma}_{\varepsilon\omega} = 0.08$ as opposed to 0.37), and it is significant at only the 0.08 level ($t_{\hat{\sigma}_{\varepsilon\omega}} = 1.75$). The income coefficient is negative but declines in magnitude, again indicating negative selection with respect to measured personal income ($\hat{\alpha} = -0.15$ as opposed to −0.21), and remains significant ($|t_{\hat{\alpha}}| = 2.04$). The reduction in the covariance estimate is perhaps to be expected. Using the husband's personal income instead of the more narrowly defined labor earnings is likely to introduce variation across husbands in some individual traits that are unmeasured when the variable used is the more narrowly defined earnings. Thus, the unobserved dimension is somewhat supplanted, and accordingly the covariance estimate declines.

Table 3. Maximum likelihood estimates: *N* = 21,241 with 586 dissolutions

Variable	Husband's log personal income	Divorced or separated
CONSTANT	0.334 (4.54)	−0.780 (3.41)
EDUC	0.109 (6.82)	0.043 (2.93)
AGE	0.102 (32.53)	−0.061 (3.32)
AGESQ/100	−0.001 (33.72)	
DISAB	−0.685 (17.82)	
Non WHITE	−0.156 (9.03)	0.098 (1.87)
UNION	0.334 (4.54)	
PROF_OCC	0.319 (22.73)	
OTH_INC		−0.001 (1.68)
FAM_SIZE		0.043 (2.93)
CHILD≤6		−0.161 (3.32)
OWN_HOME		−0.173 (3.39)
YEAR1 = 2003		−0.470 (7.56)
YEAR1 = 2004		−0.611 (8.23)
YEAR1 = 2005		−0.543 (7.87)
YEAR1 = 2006		−0.560 (7.99)
YEAR1 = 2007		−0.551 (7.99)
YEAR1 = 2008		−0.503 (7.57)
YEAR1 = 2009		−0.416 (6.54)
Error covariance: $\hat{\sigma}_{\varepsilon\omega}$		0.083 (1.75)
PER_INC (t = 1): $\hat{\alpha}$		−0.154 (2.04)

*Figures in parentheses are absolute t statistics.

5.3. Estimates based on a narrow definition of dissolution

It is common in the literature to define dissolution as separated or divorced. To narrow that definition, we estimated the model with the dependent variable in the probit model restricted to formal divorce. This poses an empirical challenge, since the relative rarity of divorce significantly reduces sample variation on the left hand side of the probit equation. The consequence is a loss of precision in the parameter estimates. Column two of Table 4 presents estimates of the earnings and personal income coefficients based on the narrow definition. For the sake of comparison, column one reproduces estimates from Tables 2 and 3, which are based on the conventional broader definition that is common in the literature. The table does not present the full results of the model (available on request), focusing instead on the crucial earnings coefficient and covariance parameter. The results in column two attest to the loss of precision, as evidenced by the smaller absolute t statistics in each

Table 4. Estimates for alternative dependent variables

Parameter	Divorced or separated		Divorced**	
	N = 21,241		*N* = 21,241	
	Dissolutions = 586		Dissolutions = 471	
	Dependent variable in Equation (1):		Dependent variable in Equation (1):	
	Earnings	Personal income	Earnings	Personal income
Error covariance: $\hat{\sigma}_{\varepsilon\omega}$	0.366 (4.07)	0.083 (1.75)	0.356 (3.61)	0.077 ((1.48)
EARN(t−1): $\hat{\alpha}$ or PER_INC(t = 1): $\hat{\alpha}$	−0.210 (4.00)	−0.154 (2.04)	−0.199 (3.47)	−0.141 (1.72)

*Figures in parentheses are absolute t statistics.

**Specifications of the earnings/income equations are identical to those in Tables 2 and 3. Full results are not reported here.

case. The magnitudes of the estimates, however, are reduced only slightly relative to their counterparts in Tables 2 and 3. The evidence continues to lend general support to this paper's central hypotheses: marriage dissolution tends to be negatively selective in terms of measured earnings or income and positively selective in terms of unobserved individual heterogeneity.

5.4. Other estimates

To examine the robustness of these estimates, we attempted several other estimations of the model. First, we reduced the sample to white and black husbands only and estimated the model separately for the two race groups. The reduction in sample size was sufficient to significantly attenuate the precision of the estimates, which in many cases did not differ significantly from zero. In two other experiments, we replaced the annual earnings and annual personal income measures with hourly wages and usual weekly earnings, respectively. The resulting estimates of the parameters α and $\sigma_{\varepsilon\omega}$ were again imprecise in most cases, resulting in insignificant estimates.

6. Summary and conclusion

In the voluminous literature on marital dissolution, numerous researchers have focused attention on the effects of income or earnings in determination of marriage outcomes. It has been customary to treat income variables as exogenous or predetermined. The literature has devoted far less attention to the phenomenon of latent selection into divorce. This paper departs from that tradition in both respects. Treating annual earnings or, alternatively, annual personal income as jointly determined with marriage outcomes, it offers evidence of negative overt selection: the effect of husbands' earnings is to reduce the probability of dissolution in the form of separation or divorce, a conclusion that is sustained when dissolution is defined strictly in terms of formal divorce. In addition, we estimate the earnings/income effect in the context of a model that controls for selection on the basis of unobserved characteristics. The latent selection inference is of interest in its own right, suggesting that men who are strong earners in the latent dimension are more prone to dissolve their marriages.

We reconcile these opposing effects by appealing to arguments advanced, for example, by Burgess et al. (2003). They argue that marital stability and earnings are entangled by the influences of the "good catch" and the outside option. Since men who are strong earners are attractive as spouses to begin with (for example, Nakosteen & Zimmer, 2001), it is natural to infer that they remain attractive as husbands, holding other factors constant. The difficulty with modeling that phenomenon is that other factors may not remain constant. The latent characteristics that are often embodied in strong earners, while not observed by researchers in conventional data-sets, are apparent not only to those individuals themselves but also by other potential spouses who could match with them in the event their marriages dissolve. Attesting to that fact is the well-known high remarriage rate of once-divorced men (Wolf & MacDonald, 1979).

This study attempts to incorporate both phenomena in one model, which has not been attempted in the literature. The significance of both parameter estimates invites additional research. An important limitation of this study is its (necessary) reliance on a two-year time frame for observing and measuring marriage outcomes. In addition, this study is limited to earnings and divorce outcomes for husbands. Although it would be useful to extend the analysis to wives, that is complicated by the well-known empirical challenge of relatively weaker attachments to the labor force among married women (Heckman, 1979). Thus, in the context of our model, employment decisions by wives add another dimension of endogenous selection that has to be addressed in the likelihood function (7), a task that is beyond the scope of this paper.

Another shortcoming is the absence in our data of variables that are thought to be antecedents to divorce, such as cohabitation before marriage and marriage at young ages. To the extent that these antecedents are reflective of and proxies for unmeasured attributes of spouses, our model addresses them by explicit parameterization of latent selection in the model. As future research evolves, this study points to the importance of addressing both dimensions of the transition to divorce. In

particular, it is of interest to determine whether supposed antecedents such as cohabitation and youth-age marriage retain their explanatory roles in models that control for latent selection and recognize the endogenous nature of earnings.

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Notes
1. This model is adapted from Hausman and Wise (1979).
2. An extended discussion of program evaluation models, including various conceptions of selection on observables and unobservables, is found in Heckman, Lalonde, and Smith (1999).
3. In the empirical analysis, the earnings variable is expressed as a natural logarithm.
4. In the empirical results reported in Section 5, we estimate the model first defining dissolution as divorced or separated, and second more narrowly defining dissolution as formal divorce.

References
Amato, P. (2010). Research on divorce: Continuing trends and new developments. *Journal of Marriage and Family, 72*, 650–666. https://doi.org/10.1111/j.1741-3737.2010.00723.x
Amato, P., & Rogers, S. (1997). A longitudinal study of marital problems and subsequent divorce. *Journal of Marriage and the Family, 59*, 612–624. https://doi.org/10.2307/353949
Ashenfelter, O. (1978). Estimating the effect of training programs on earnings. *The Review of Economics and Statistics, 60*, 47–57. https://doi.org/10.2307/1924332
Barnow, B. S., Cain, G. G., & Goldberger, A. S. (1980). Issues in the analysis of selectivity bias. *Evaluation Studies, 5*, 42–59.
Becker, G., Landes, E., & Michael, R. (1977). An economic analysis of marital instability. *Journal of Political Economy, 85*, 1141–1187. https://doi.org/10.1086/260631
Boheim, R., & Ermisch, J. (2001). Partnership dissolution in the UK - the role of economic circumstances. *Oxford Bulletin of Economics and Statistics, 63*, 197–208. https://doi.org/10.1111/obes.2001.63.issue-2
Booth, A., Johnson, D. R., White, L. K., & Edwards, J. N. (1991). *Marital instability over the life course: Methodology and code book for the three wave panel study*. Lincoln, NE: University of Nebraska Bureau of Sociological Research.
Bracher, M., Santow, G., Morgan, S. P., & Trussell, J. (1993). Marriage dissolution in Australia: Models and explanations. *Population Studies, 47*, 403–425. https://doi.org/10.1080/0032472031000147216
Burgess, S., Propper, C., & Aassve, A. (2003). The role of income in marriage and divorce transitions among young Americans. *Journal of Population Economics, 16*, 455–475. https://doi.org/10.1007/s00148-003-0124-7
Charles, K. K., & Stephens, M. (2004). Job displacement, disability, and divorce. *Journal of Labor Economics, 22*, 489–522. https://doi.org/10.1086/381258
Doiron, D., & Mendolia, S. (2012). The impact of job loss on family dissolution. *Journal of Population Economics, 25*, 367–398. https://doi.org/10.1007/s00148-010-0353-5
Eliason, M. (2012). Lost jobs, broken marriages. *Journal of Population Economics, 25*, 1365–1397. https://doi.org/10.1007/s00148-011-0394-4
Hausman, J. A., & Wise, D. A. (1979). Attrition bias in experimental and panel data: The Gary income maintenance experiment. *Econometrica, 47*, 455–473. https://doi.org/10.2307/1914193
Heckman, J. (1979). Sample selection bias as a specification error. *Econometrica, 47*, 153–161. https://doi.org/10.2307/1912352
Heckman, J., & Hotz, V. J. (1989). Choosing among alternative nonexperimental methods for estimating the impact of social programs: The case of manpower training. *Journal of the American Statistical Association, 84*, 862–874. https://doi.org/10.1080/01621459.1989.10478848
Heckman, J., Lalonde, R., & Smith, J. (1999). The economics and econometrics of active labor market programs. In O. Ashenfelter, & D. Card (Eds.), *Handbook of labor economics volume3A* (pp. 1865–2097). Amsterdam: Elsevier. https://doi.org/10.1016/S1573-4463(99)03012-6
Hoffman, S., & Duncan, G. (1995). The effect of incomes, wages and AFDC benefits on marital disruption. *The Journal of Human Resources, 30*, 19–41. https://doi.org/10.2307/146189
Jensen, P., & Smith, N. (1990). Unemployment and marital dissolution. *Journal of Population Economics, 3*, 215–229. https://doi.org/10.1007/BF00163076
Lehrer, E., & Chiswick, C. (1993). Religion as a determinant of marital stability. *Demography, 30*, 385–403. https://doi.org/10.2307/2061647
Light, A., & Ahn, T. (2010). Divorce as risky behavior. *Demography, 47*, 895–921. https://doi.org/10.1007/BF03213732
Lillard, L., Brien, M., & Waite, L. (1995). Premarital cohabitation and subsequent marital dissolution: A matter of self-selection? *Demography, 32*, 437–457. https://doi.org/10.2307/2061690
Lillard, L., & Waite, L. (1993). A joint model of marital childbearing and marital disruption. *Demography, 30*, 653–681. https://doi.org/10.2307/2061812
Nakosteen, R., & Zimmer, M. (1997). Men, money and marriage: Are high earners more prone than low earners to marry? *Social Science Quarterly, 78*, 66–82.
Nakosteen, R., & Zimmer, M. (2001). Spouse selection and economic traits: Evidence of marital sorting and earnings capacity. *Economic Inquiry, 39*, 201–213. https://doi.org/10.1111/ecin.2001.39.issue-2
Peters, H. E. (1993). The importance of financial considerations in divorce decisions. *Economic Inquiry, 31*, 71–86. https://doi.org/10.1111/ecin.1993.31.issue-1
Reinhold, S. (2010). Reassessing the link between premarital cohabitation and marital stability. *Demography, 47*, 719–733. https://doi.org/10.1353/dem.0.0122
Schwartz, C., & Gonalons, P. (2016). Trends in relative earnings and marital dissolution: Are wives who outearn their husbands still more likely to divorce? *RSF: The Russell Sage Foundation Journal of the Social Sciences, 2*, 218–236. https://doi.org/10.7758/rsf.2016.2.4.08

Smock, P., Manning, W., & Gupta, S. (1999). The effect of marriage and divorce on women's economic well-being. *American Sociological Review, 64*, 794–812. https://doi.org/10.2307/2657403

Starkey, J. (1991). Wives' earnings and marital instability: Another look at the independence effect. *The Social Science Journal, 28*, 501–521. https://doi.org/10.1016/0362-3319(91)90027-2

Svarer, M. (2004). Is your love in vain? Another look at premarital cohabitation and divorce. *Journal of Human Resources, XXXIX*, 523–535. https://doi.org/10.3368/jhr.XXXIX.2.523

Tach, L., & Edin, K. (2013). The compositional and institutional sources of dissolution for married and unmarried parents in the United States. *Demography, 50*, 1789–1818. https://doi.org/10.1007/s13524-013-0203-7

Weiss, Y., & Willis, R. (1997). Match quality, new information, and marital dissolution. *Journal of Labor Economics, 15*, S293–S329. https://doi.org/10.1086/209864

Whittington, L., & Alm, J. (1997). Til death or taxes do us part: The effect of income taxation on divorce. *Journal of Human Resources, 32*, 338–412.

Wolf, W. C., & MacDonald, M. M. (1979). The earnings of men and remarriage. *Demography, 16*, 389–399. https://doi.org/10.2307/2061220

Zimmer, M. (2001). Explaining marital dissolution: The role of spouses' traits. *Social Science Quarterly, 82*, 464–477. https://doi.org/10.1111/0038-4941.00036

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