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Marriage and Consumption Insurance: What's Love Got to Do with It?

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When markets are incomplete, individuals may choose to marry to diversify their labor income risk. Love, however, can complicate the picture. If love is fleeting or the resolution of agents' income uncertainty occurs predominantly later in life, then marriages with good economic matches last longer. In contrast, if love is persistent and the resolution of uncertainty to agents' income occurs early, then marriages with good economic matches are more likely to be caught short with too little love to save a marriage. Consequently, once married, the partners will be more likely to divorce. Evidence is provided to distinguish between these alternative scenarios.

I. Introduction

In his seminal work on the economics of marriage, Becker (1974) argued that the fundamental reason for marriage is the creation of one's own children, since "sexual gratification, cleaning, feeding and other services

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can be purchased" (p. 304), but one's *own* children cannot be. He also emphasized the role the marriage market plays in sorting individuals on the basis of their traits: positive assortative mating would rely on these traits to be complements, whereas negative assortative mating would require these traits to be substitutes.

In contrast, several economists have also considered the pure risk-sharing elements of marriage.[1] Kotlikoff and Spivak (1981) analyze the gains from marriage from risk sharing when expected lifetimes are uncertain. Rosenzweig and Stark (1989) explore the marriage market from the perspective of how families in different Indian villages arranged marriages in order to offset weather-related risk. Recently, Ogaki and Zhang (2001) find further evidence that women migrate to distant villages to marry as a means of family risk sharing.[2]

The broader risk-sharing literature, however, contains strong evidence against complete risk sharing and complete markets. At the macro level, Backus, Kehoe, and Kydland (1992) demonstrate incomplete cross-country risk sharing; among others, at the micro level, Cochrane (1991), Mace (1991), and Hess and Shin (2000) provide evidence against complete aggregate risk sharing across households within a country, whereas Hayashi, Altonji, and Kotlikoff (1996) demonstrate incomplete risk sharing across generations even within a family.

This paper analyzes the role that economic factors such as risk sharing play in the decision to get married and stay married, and how the presence of love interacts with these economic motives. In this model, individuals are faced with randomly fluctuating labor incomes, which they can smooth intertemporally by borrowing or saving at a risk-free rate, exactly as in the permanent income hypothesis. However, there is assumed to be no formal market to diversify idiosyncratic risk to income.[3] Marriage, whereby two individuals consume out of common resources, does provide an opportunity to partially offset the idiosyncratic shocks to their income.

While the desire to offset idiosyncratic labor risk could be a powerful inducement to marry, it is also the case that other issues also matter when it comes to marrying and staying married. I simply term this factor "love." In the model, love is an additively separable, exogenous non-pecuniary endowment good, which two individuals mutually share. It is, for better or for worse, subject to shared fluctuations. As will be

[1] Indeed, some would argue that in societies in which the means of intertemporal consumption smoothing are limited, children themselves would provide a type of income insurance for old age or disability. This paper does not consider the use of children for this role.

[2] See Bergstrom (1996) and Weiss (1997) for a broader survey of the literature on the economics of the family.

[3] Moral hazard is a good reason for why labor income risk is not fully insurable (see Chami and Fischer 1996).

shown, how long initial love can be expected to last and when the resolution of agents' income takes place crucially affect the way in which observed economic characteristics can be used to predict whether a marriage will succeed or end in divorce.

A number of strong predictions about the relationship between mates who are good economic matches (e.g., those that provide consumption insurance for one another) and their ability to get married, as well as stay married, are implied by the model. First, if love is a short-lived phenomenon or the resolution of uncertainty to agents' income occurs primarily in the future, then married couples who are better economic matches actually stay married longer. This holds because, for this case, the costs of being married to a poor match (e.g., a poor hedge) rise too steeply in the future. Alternatively, if love is persistent and the resolution of uncertainty about shocks to income occurs primarily early in life, married couples who are better economic matches for one another are more likely to divorce, not less. The reason lies in the substitution between consumption insurance and love at the time of the decision to marry. Operationally, while both good economic match characteristics and love will cause a couple to marry, if love is long-lasting and future income uncertainty is low, initial love becomes more important to keep them together in the long run. The results below, however, clearly indicate that there is strong evidence for the former scenario: namely, that marriages between partners who are good economic matches for one another lead to marriages of longer expected duration. A direct implication is that a good deal of initial love is not a sufficient substitute for marrying a good economic match in order for a marriage to be expected to last longer.

The paper is organized as follows: The model is presented in Section II, and five propositions are derived that link marital income characteristics to the decision to get married and stay married. Section III provides a test of the propositions relating the effect of marital income characteristics on marital duration. I present conclusions in Section IV.

II. The Model

The model has three time periods: 0, 1, and 2. In period 0, two individuals, i and j, randomly meet and decide whether or not to get married. They learn the expected correlation of their incomes, ρ_{ij}, and observe how much they initially love each other in period 1, α_1; ρ_{ij} and α_1 are assumed to be independent.[4] Unfortunately, initial love, α_1, is a noisy signal of how much they will love each other in period 2, α_2.

[4] In cases in which it is clear that the notation applies to both individuals, I drop the i and j subscripts. All variables are given per person. A timing of events table for the model is available in Hess (2002).

Each individual, $k = i, j$, also learns in period 0 the present value of his or her expected lifetime earnings, $\bar{y}_i$. A fraction θ of this income is earned in period 1, and the remaining $(1 - \theta)$ fraction is earned in period 2. Each individual has a random income error in each period (t), ϵ_{tk}, so that actual income in each period is $y_k = \bar{y}_k + \epsilon_{tk}$, where $E_0(\epsilon_{1k}) = 0$, $E_1(\epsilon_{2k}) = 0$, and $\text{Var}(\epsilon_{ti}) = \sigma_k^2$. To keep the expected present discounted value of income fixed at $\bar{y}_k$ as of period 1, regardless of when it was earned, I assume that each agent receives θy_k in period 1 and $(1 - \theta)(1 + r)y_k$ in period 2, where $1 + r$ is the risk-free gross rate of return. Individuals receive labor income in periods 1 and 2 yet decide whether or not to marry in period 0. Further, for simplicity, I assume that agents have only one opportunity to marry and that if they marry they share resources evenly. I discuss the terms of marriage adopted in the paper below.

In period 1, all individuals observe the realized shocks to their incomes, ϵ_{1k}, and each consumes c_{1k}^M if married and c_{1k}^{NM} if unmarried. Depending on the timing of income, θ, each agent will borrow or save. In period 2, if the agents are married, they learn how much they will love each other in period 2. Love is assumed to follow the exogenous process

$$\alpha_2 = \delta\alpha_1 + (1 - \delta)\overline{\alpha} + \nu, \tag{1}$$

where ν is a random disturbance unknown to either agent in period 1 but learned by both before period 2. Namely, $E_t(\nu) = 0$, for $t = 0, 1$, and ν has the cumulative density function $F(\nu)$.[5] The parameter δ controls for the extent to which love is temporary $(\delta \to 0)$ or permanent $(\delta \to 1)$.[6] After learning ν, but before observing their second-period income shocks, ϵ_{2i} and ϵ_{2j}, couples decide whether to divorce or stay married. After this decision, each consumes c_{2k}^D and c_{2k}^M, respectively. If they have never married, each simply consumes c_{2k}^{NM} in period 2.

The model's marital institutions are as follows: First, if i and j are married, they consume out of their joint resources, including both income and savings, and maximize their joint welfare for as long as they are married. Within marriage, each individual's utility is weighted equally. Second, if i and j marry in period 1, they each receive α_1. If they do not marry, they receive no love. If the couple marries in period 1 and subsequently divorces in period 2, the individuals receive no love in period 2 and they must pay the utility cost ϕ to divorce. Third, divorce agreements are assumed to split evenly marital savings as well as all

[5] Love and all income characteristics are assumed to be independent.

[6] William Shakespeare's view appears to be that love is quite permanent: "Love's not Time's fool, though rosy lips and cheeks / Within his bending sickle's compass come; / Love alters not with his brief hours and weeks, / But bears it out even to the edge of doom" (sonnet 116, ll. 9–12).

expected future labor earnings.[7] If the partners stay married, they then receive love α_2.

A. The Two-Period Problem

If i and j do not marry, they individually choose the path of consumption and savings that maximizes their individual sum of discounted utilities:

$$\max_{\{c_{tk}\}} E_0 \sum_{t=1}^{2} \beta^{t-1} U(c_{tk}) \quad \text{for } k = i, j \text{ and } 0 < \beta \leq 1 \tag{2}$$

subject to their budget constraints $c_{1k} + s_k = \theta y_k$ and $c_{2k} = (1 + r)[s_k + (1 - \theta) y_k]$ for $k = i, j$.

If i and j marry, they choose the path of consumption and the decision to remain married or divorce later to maximize their welfare. As long as they remain married, they maximize their joint welfare out of joint resources. Otherwise, as stated above, they evenly split their resources (current savings and expected future income) and maximize their individual utility. Let D refer to the decision in period 2 whether to divorce and P be the probability that they divorce.[8] The probability of divorce, P, the decision to marry, and the subsequent decision to stay married or divorce are endogenously determined below.

The consumption decision for i, given that she is married to j, is to choose a consumption path and divorce decision D (agent j solves a similar problem):

$$\max_{\{c_{ti}, D\}} \alpha_1 + E_0 \left(.5 \sum_{k=i,j} U(c_{1k}) + \beta \left\{ P \cdot [-\phi + U(c_{2i})] + (1 - P) \cdot \left[\alpha_2 + .5 \sum_{k=i,j} U(c_{2k}) \right] \right\} \right) \tag{3}$$

subject to their budget constraints in periods 1 and 2,

$$\sum_{k=i,j} c_{1k} + \sum_{k=i,j} s_k = \sum_{k=i,j} \theta y_k, \tag{4}$$

[7] This latter assumption is helpful in two regards. First, it equates the marginal utility of consumption across partners in the first period. Second, it makes the probability of divorce, conditional on marriage, independent of the expected level of individual resources. This is extended in Sec. II*D*4.

[8] Since P is endogenous but does not depend on a consumption choice variable (see expression [9] below), the expected marginal utility of consumption is the same whether one remains married or divorces. Furthermore, given the certainty equivalent specification of the utility function assumed, the results are unaffected if expression (3) is changed so that in period 1 individuals i and j jointly maximize their expected welfare even when they are divorced in period 2.

$$c_{2i} = \begin{cases} \beta^{-1}\left[.5 \sum_{k=i,j} s_k + (1-\theta)(\bar{y}_{ij} + \epsilon_i)\right] & \text{if } i \text{ and } j \text{ divorce} \\ \beta^{-1}\left[\sum_{k=i,j} s_k + (1-\theta)(\bar{y}_{ij} + \sum_{k=i,j} \epsilon_k)\right] - c_{2j} & \text{otherwise,} \end{cases}$$

where $\bar{y}_{ij}$ is their average joint expected income, $\bar{y}_{ij} = .5\sum_{k=i,j}\bar{y}_k$.

B. *The Second-Period Consumption Problem and the Decision to Divorce*

The model is solved recursively. In period 2, after i and j have learned of their new love for one another, α_2, i and j make the decision to stay married or not. To simplify, I assume that the utility function is quadratic, $U(c) = c - (b/2)c^2$, which provides certainty equivalence. In addition, I assume that the discount factor is the reciprocal of the gross interest rate, $\beta^{-1} = 1 + r$.

If the kth individual has never married (NM), then period 2 consumption is

$$c_{2k}^{NM} = \beta^{-1}[s^{NM} + (1-\theta)y_k], \quad k = i, j. \tag{5}$$

If a couple was married in period 1, yet, having learned ν, decides to divorce and pay the utility cost ϕ, the period 2 consumption level for individual $k = i, j$ is

$$c_{2k}^{D} = \beta^{-1}[s^{D} + (1-\theta)(\bar{y}_{ij} + \epsilon_k)], \tag{6}$$

where $s^D = .5\sum_{k=i,j} s_k^M$. Recall that if divorced, i and j equally divide total savings, $\sum_{k=i,j} s_k^M$, and fully share their expected future labor incomes.

If i and j are married and choose not to get divorced (denoted in period 2 by M), they maximize their equally weighted, joint welfare:

$$\max_{\{c_{2k}\}} \alpha_2 + .5 \sum_{k=i,j} U(c_{2k}) \tag{7}$$

$$\text{subject to } \sum_{k=i,j} c_{2k} = \beta^{-1} \sum_{k=i,j} [s_k^M + (1-\theta)y_k]. \tag{8}$$

The first-order condition is for the married individuals to equate their marginal utilities, $U'(c_{2i}^M) = U'(c_{2j}^M)$. By implication, $E(c_{2k}^M) = E(c_{2k}^D)$ for $k = i, j$. This result is a property of the sharing rules for divorce and marriage and the fact that divorce is assumed to have only a utility cost but not a financial cost.

The decision to divorce hinges on whether $U(c_{2k}^M) < U(c_{2k}^D)$ for either

$k = i, j$. It is determined by the second-period shock to love, ν, namely, divorce if either

$$\nu < -[\delta\alpha_1 + (1-\delta)\overline{\alpha} + \phi + (1-\theta)^2\beta^{-1}\zeta\sigma_i^2(1-\Omega)] \equiv \hat{\nu}_i \tag{9}$$

or

$$\nu < -[\delta\alpha_1 + (1-\delta)\overline{\alpha} + \phi + (1-\theta)^2\beta^{-1}\zeta\Phi^2\sigma_i^2(1-\Omega)] \equiv \hat{\nu}_j$$

and remain married otherwise, where $\zeta = \beta^{-1}(b/2)$, $\Omega = (1 + 2\rho_{ij}\Phi + \Phi^2)/4$, ρ_{ij} is the correlation of their income shocks, and Φ is the ratio of their standard deviations, $\Phi = \sigma_j/\sigma_i$.

Four important aspects of the model are worth noting. First, Ω provides a measure of the hedging benefit since as ρ rises, married individuals become worse hedges for one another and Ω rises.[9] Second, if $\theta = 1$, so that all income is earned in period 1, then economic factors play no direct role in the period 2 decision to divorce or stay married.[10] Third, if $\delta = 0$ so that all fluctuations in love are temporary, a couple's initial level of love has no effect on its decision whether or not to divorce. Finally, because of the assumption that couples share lifetime expected labor resources even if they divorce, consumption-utility levels will be the same regardless of whether the couple divorces or stays married.

Given the couples' parameters (α_1, ρ_{ij}, $\bar{y}_k$, and σ_k, for $k = i, j$) and the technology and institutional parameters (δ, θ, and ϕ), $\hat{\nu}$ is defined as the worst shock to their love that i and j can receive and still remain married. Since, in general, individuals will have different expected income volatilities, $\Phi \neq 1$, each individual within a marriage will have a different threshold point. Thus we must consider the highest threshold (i.e., the greatest lower bound for love) between the two partners, namely, $\hat{\nu} = \max(\hat{\nu}_i, \hat{\nu}_j)$. The probability of divorce is then $P = \int_{-\infty}^{\hat{\nu}} dF(\nu) = F(\hat{\nu})$.

C. *The First-Period Consumption Problem and the Decision to Marry*

Having solved the period 2 consumption problem and the decision to stay married or to divorce, I now solve the period 1 consumption problem. In period 1, both i and j know each other's economic characteristics and the initial level of love they have for each other, α_1. Below, I examine their consumption and welfare levels over periods 1 and 2 under both marriage and nonmarriage conditions to solve their decision to get married.

[9] For example, if $\Phi = 1$, then $\Omega = 1$ when incomes are perfectly positively correlated and $\Omega = 0$ when incomes are perfectly negatively correlated.

[10] However, economic factors will have an indirect effect, since love may be substituted for economic factors in period 1.

If i and j do not marry, they individually maximize (2). Given the assumption that the discount factor equals the inverse of the interest rate factor, the optimality condition is that $U'(c_{1i}^{NM}) = E_1U'(c_{2i}^{NM})$. Once the period 1 income shock is observed, the consumption solution is

$$c_{1i}^{NM} = E_1(c_{2i}^{NM}) = \left(\frac{1}{1+\beta}\right)(\bar{y}_i + \theta\epsilon_{1i}). \tag{10}$$

Prior to their learning their period 1 income shocks, the expected welfare levels for individuals i and j if they do not marry are, respectively,

$$E(W_i^{NM}) = \bar{y}_i(1 - \psi\bar{y}_i) - \sigma_i^2[\psi\theta^2 + (1-\theta)^2\zeta] \tag{11}$$

and

$$E(W_j^{NM}) = \bar{y}_j(1 - \psi\bar{y}_j) - \sigma_i^2\Phi^2[\psi\theta^2 + (1-\theta)^2\zeta], \tag{12}$$

where $\psi = (b/2)/(1+\beta)$.

If i and j do marry, they maximize (3) subject to (4). The solution for the consumption path c_{1k}^M and c_{2k}^M, $k = i, j$, is to equate marginal utility across partners in period 1, along with expected marginal utility in period 2:

$$c_{1i}^M = E_1(c_{2i}) = c_{1j}^M = E_1(c_{2j}) = \left(\frac{1}{1+\beta}\right)\left(\bar{y}_{ij} + \frac{\theta}{2}\sum_{k=i,j}\epsilon_{1k}\right). \tag{13}$$

According to equation (13), each individual in a marriage smooths his or her consumption across time, knowing that all labor resources earned in period 1, all marital savings, and all expected future labor income are shared if the partners divorce.

The expected utility from marrying, conditional on learning α_1, $\bar{y}_k$, and σ_k for $k = i, j$ and ρ_{ij}, is

$$\begin{aligned} E(W_i^M) = \alpha_1 + \beta\Bigg(-\phi\cdot P + (1-P)\cdot\Bigg\{\delta\alpha_1 + (1-\delta)\overline{\alpha} \\ + [1-F(\hat{\nu})]^{-1}\int_{\hat{\nu}}^{\infty}\nu\, dF(\nu)\Bigg\}\Bigg) + \bar{y}_{ij}(1-\psi\bar{y}_{ij}) \\ - \sigma_i^2\{\theta^2\Omega\psi + (1-\theta)^2\zeta[P + (1-P)\cdot\Omega]\} \end{aligned} \tag{14}$$

and

$$E(W_j^M) = \alpha_1 + \beta\Bigg(-\phi \cdot P + (1 - P) \cdot \Bigg\{\delta\alpha_1 + (1 - \delta)\overline{\alpha} + [1 - F(\hat{\nu})]^{-1}\int_{\hat{\nu}}^{\infty} \nu dF(\nu)\Bigg\}\Bigg) + \bar{y}_{ij}(1 - \psi\bar{y}_{ij}) - \Phi^2\sigma_i^2\{\theta^2\Omega\psi + (1 - \theta)^2\zeta[P + (1 - P)\Omega]\}, \qquad (15)$$

where P is derived above. The decision to get married is therefore to marry if $E(W_k^M) \geq E(W_k^{NM})$ for both individuals and to not marry otherwise and is summarized in the following proposition.

PROPOSITION 1. Two individuals are less likely to marry the more correlated their earnings are, the greater the difference in their expected earnings, and the greater the difference in the uncertainty about their individual earnings.

On the basis of the decision to marry and the welfare from not marrying, expressions (11), (12), (14), and (15), proposition 1 follows directly. First, the more positively correlated individuals' incomes are, the poorer the individuals are at providing income insurance for one another. Second, if two individuals are identical in all respects except mean income, one must wonder why the individual with a higher income would ever agree to marriage.[11] The answer is that without a great deal of mutual love, she will not, and the likelihood becomes less likely the bigger the income differential. As a result, they will be less likely to marry. Finally, the implication that a greater difference in earnings uncertainty lowers the likelihood of marriage follows similarly.

Interestingly, love allows individuals to marry spouses who may not improve and could even worsen their economic outlook, for example, a poor hedge, or someone with more volatile income and fewer expected resources. Whether or not this results in longer-lasting marriages, of course, depends on the willingness of individuals to substitute economic characteristics for initial love. It will also depend on how long the love between the couple is expected to last, δ, and the fraction of labor income that is earned in the future, θ.

D. The Decision to Divorce

This subsection examines the properties that govern whether partners who marry will stay married or divorce. I inspect each mechanism separately.

[11] One can think of this as "Why would a millionaire want to marry you?"

1. The Impact of Income Correlation on the Probability of Divorce

In this subsection I analyze the impact of more correlated incomes on the decision to stay married or divorce. To isolate this feature, I assume that individuals have the same mean incomes ($\bar{y}_i = \bar{y}_j$) and variances ($\Phi = 1$). In this case, individuals i and j will have the same threshold love shock levels, $\hat{\nu}$. As of period 1, an increase in ρ_{ij} affects the probability of divorce as follows:

$$\frac{dF(\hat{\nu})}{d\rho_{ij}} = F'(\hat{\nu}) \cdot \left[\frac{\partial \hat{\nu}}{\partial \rho_{ij}} + \left(\frac{\partial \hat{\nu}}{\partial \alpha_1} \cdot \frac{\partial \alpha_1}{\partial \rho_{ij}}\right)\right]. \tag{16}$$

This total effect takes into account that individuals must still find it incentive compatible to get married in the first place, $E(W_k^M) \geq E(W_k^{NM})$ for $k = i, j$. The term in brackets is the total effect of a change in ρ_{ij} on the threshold love shock $\hat{\nu}$. The first term is the direct effect that a change in ρ_{ij} has on the threshold love shock. The second term is the effect of an increase in ρ_{ij} inducing a substitution toward more initial love, which will indirectly affect the threshold level of love in period 2. Note that love and hedging have the following effects on this threshold level of love: $\partial\hat{\nu}/\partial\alpha_1 = -\delta < 0$ and $\partial\hat{\nu}/\partial\rho_{ij} = [(1-\theta)^2\zeta\beta^{-1}\sigma_i^2]/2 > 0$.

When we solve for the "love-correlation" trade-off, $\partial\alpha_1/\partial\rho_{ij}$, by differentiating expression (14) given the constraint that $E(W^M) \geq E(W^{NM})$, the solution to (16) is

$$\frac{dF(\hat{\nu})}{d\rho_{ij}} = F'(\hat{\nu})\left(\frac{\sigma_i^2}{2}\right)\Phi\left(\beta^{-1}(1-\theta)^2\zeta - \delta\left\{\frac{\theta^2\psi + (1-\theta)^2\zeta[1-P(\hat{\nu})]}{1+\beta\delta[1-P(\hat{\nu})]}\right\}\right) \gtreqless 0. \tag{17}$$

The first term inside the large parentheses is positive and reflects the costs of having a partner who is a poorer hedge (i.e., higher ρ_{ij}) in period 2. This term goes to zero as θ approaches one, since the role of a hedge is no longer needed in the future if all permanent income uncertainty has been resolved. The second term inside the large parentheses is negative and reflects the fact that having a partner who is a poorer hedge makes an individual require more love in period 1 to get married. The fact that being a poorer hedge "crowds in" initial love will be more important for keeping marriages together as initial love becomes more persistent and there is less uncertainty to future income. More generally, the derivative is decreasing as either δ or θ is increasing. When we substitute terms, the sign of (17) depends critically on the magnitudes of θ, δ, and β, as the following proposition indicates.

Proposition 2. An increase in the correlation of couples' individual incomes, ρ_{ij}, will raise, lower, or have no effect on the probability of divorce if the fraction of income that is earned early in life, θ, satisfies $\theta < \theta^*$, $\theta > \theta^*$, or $\theta = \theta^*$, respectively, where $\theta^*(\delta, \beta) = \sqrt{1+\beta}/(\beta\sqrt{\delta} + \sqrt{1+\beta})$.

Note that if either the persistence of love, δ, is sufficiently low or the fraction of income that is earned early in life, θ, is sufficiently low, then $\theta < \theta^*$, and an increase in the correlation of couples' individual income will raise the probability of divorce. The intuition is that since initial love is temporary or there remains a strong demand for income insurance in period 2, couples that marry in period 1, despite having highly correlated incomes, will do so early only if they start out with a very high initial amount of love. However, because this love is not likely to last and couples have a strong continued need for income insurance, they will be more likely to divorce than couples that started out as good hedges for one another. Moreover, even if love is permanent, $\delta = 1$, $dF(\hat{\nu})/d\rho_{ij} > 0$ for all $\theta < \sqrt{1+\beta}/(\beta + \sqrt{1+\beta})$. The intuition is clearest for $\theta = 0$. In this case, since couples that marry expect to get love in periods 1 and 2, a large fraction of the expected present value of love has already been enjoyed by the time the decision to stay married has to take place, and no income uncertainty has been resolved. Hence, in period 2, income insurance becomes relatively more important in the decision to stay married.

In contrast, if most income uncertainty has been resolved in period 1 and initial love is relatively permanent, then $\theta > \theta^*$. Indeed, for this case, those who are better hedges tend to have less love initially and hence are more susceptible to a love shortfall in period 2 as long as love is sufficiently persistent. Hence, for this case, marriage between partners who are good hedges will actually have a shorter expected duration, as initial love becomes more important in the decision whether to stay married.

2. The Impact of Income Uncertainty on the Probability of Divorce

While the discussion so far has focused on the correlation of the partners' incomes, one can repeat the exercise considering individuals who are the same in all respects except income volatility. Let $\Phi \geq 1$, so that conditional on $W_k^M \geq W_k^{NM}$ for $k = i, j$, the effect of an increase in the difference of income uncertainty on the probability of divorce is

$$\frac{dF(\hat{\nu}_i)}{d\Phi} = F'(\hat{\nu}_i)\left(\frac{\sigma_i^2}{2}\right)(\Phi + \rho_{ij})\left(\beta^{-1}(1-\theta)^2\zeta - \delta\left\{\frac{\theta^2\psi + (1-\theta)^2\zeta[1-P(\hat{\nu}_i)]}{1+\beta\delta[1-P(\hat{\nu}_i)]}\right\}\right)$$

$$\gtreqless 0,$$

where $\Phi + \rho_{ij} > 0$. The sign of $dF(\hat{\nu})/d\Phi$ depends critically on the magnitudes of θ, δ, and β, as the following proposition indicates.

PROPOSITION 3. An increase in the gap between a couple's individual income uncertainties, Φ, will raise, lower, or have no effect on the probability of divorce if the fraction of income that is earned early in life, θ, satisfies $\theta < \theta^*$, $\theta > \theta^*$, or $\theta = \theta^*$, respectively, where $\theta^*(\delta, \beta) = \sqrt{1+\beta}/(\beta\sqrt{\delta} + \sqrt{1+\beta})$.

The intuition follows that for proposition 2: If a couple differs greatly in the volatility of its partners' incomes, one must consider why the individual with stable income married the individual with the volatile one. The answer lies in the fact that the low-volatility individual must have been compensated with a large initial level of mutual love. If initial love is transitory or a large fraction of permanent income is still to be earned, then this couple is more likely to divorce because there will not be enough love in the future to compensate the individual with lower income risk. In contrast, if initial love is persistent and little income is left to be earned in the future, then the couple will be less likely to run short of love and divorce.

3. Spousal Mean Income Differences and the Probability of Divorce

The conditions that affect the impact of mean income differences on the probability of divorce depend critically on the way in which divorce agreements split marital income. Since all expected future labor income is shared once married in the model presented here, there is no direct effect of expected income differences on the probability of divorce and on the threshold levels for the love shock, $\hat{\nu}$ (see expression [9]). However, differences in mean income do have an indirect effect on the probability of divorce since they will induce a substitution effect toward a higher initial level of love. If this love is permanent (δ is high), then we should expect marriages with larger mean income differences between partners to have lower probabilities of divorce. This holds regardless of θ. If love is temporary, however, then differences in spousal mean income will not help in predicting marital durations.

The total effect of an increase in i's expected income relative to j's is, conditional on $W_k^M \geq W_k^{NM}$ for $k = i, j$ and $\bar{y}_i \geq \bar{y}_j$,[12]

$$\left| \frac{dF(\hat{\nu}_i)}{d\bar{y}_i} \right|_{\bar{y}_i = \bar{y}_{ij}} = F'(\hat{\nu})(1 - 2\psi\bar{y}_{ij}) \left\{ \frac{-\delta/2}{1 + \beta\delta[1 - P(\hat{\nu})]} \right\} \leq 0. \qquad (18)$$

The following proposition classifies how love affects the impact of larger differences in mean incomes on marital duration.

PROPOSITION 4. An increase in the gap between a couple's individual

[12] The term $1 - 2\psi\bar{y}_{ij}$ is assumed to be positive as a consequence of obtaining an interior solution with quadratic utility.

mean incomes will lower the probability of divorce if $\delta > 0$ and will have no effect if $\delta = 0$.

4. The Imperfect Sharing of Expected Future Resources in the Case of Divorce

An important simplifying assumption is that all remaining expected permanent income is shared if a married couple divorces in period 2. Consequently, proposition 4 indicates that even when love is temporary, a big difference in spouses' expected future incomes is not a harbinger of future divorce. This would not be the case, however, if couples did not fully share their expected future incomes in the case of divorce.

To focus on this issue, assume that couples differ only in their mean incomes and that there is no income uncertainty. While I maintain the assumption that marital assets, $\sum_{k=i,j} s_k^M$, are shared at the time of divorce, let χ be the fraction of future permanent income remaining that an individual does not share with his or her partner if they divorce. Also, let individual i have the higher income, so that i has the binding reservation love level:

$$\hat{\nu} = z[1 - b(x + z)] - \phi - \alpha_1\delta - \overline{\alpha}(1 - \delta), \tag{19}$$

where $z = \beta^{-1}(1-\theta)\chi(\bar{y}_i - \bar{y}_{ij})$ and $x = \beta^{-1}[(1-\theta)\bar{y}_i - .5\sum_{k=1}^{2} s_k^M]$.[13] Note that, unlike before, the probability of divorce depends on agent i's and j's consumption-savings decisions in period 1.

Now, reconsider the case in which i and j marry in period 0 and then must optimally choose to stay married or divorce in period 2. Assume that the shocks to love are uniformly distributed over the interval $[-\Delta, \Delta]$, so that $P = [1 + (\hat{\nu}/\Delta)]/2$, where $\hat{\nu}$ is defined in (19). When the steps outlined earlier in the paper are repeated, optimal consumption in period 2 for the case in which i and j remain married is

$$c_{2i}^M = c_{2j}^M = \beta^{-1}[A + (1-\theta)]\bar{y}_{ij}.$$

In the case of divorce, the optimal consumption levels for i and j are, respectively,

$$c_{2i}^D = \beta^{-1}[A + (1-\theta)]\bar{y}_{ij} + z$$

and

$$c_{2j}^D = \beta^{-1}[A + (1-\theta)]\bar{y}_{ij} - z.$$

When these consumption values are plugged into the welfare functions

[13] When the maximization steps outlined earlier in the paper are repeated, average savings at the end of period 1 are $\frac{1}{2}\sum_{k=i,j} s_k^M = A \cdot \bar{y}_{ij}$, where $A = [\theta - \beta^{-1}(1-\theta)B]/(1 + \beta^{-1}B)$ and $B = 1 + (bz^2/2\Delta)$.

for marriage and no marriage as of period 1, expressions (2) and (3), respectively, an increase in $\bar{y}_i$ affects the probability of divorce as follows:

$$\left|\frac{dF(\hat{\nu})}{d\bar{y}_i}\right|_{\bar{y}_i=\bar{y}_{ij}} = F'(\hat{\nu}) \cdot (1 - 2\psi\bar{y}_{ij}) \cdot \left\{\beta^{-1}\chi(1-\theta) + \frac{-(\delta/2) + \delta P(\hat{\nu})\chi(1-\theta)}{1+\beta[1-\delta P(\hat{\nu})]}\right\} \gtreqless 0. \quad (20)$$

Note that as $\chi \to 0$, expression (20) collapses to expression (18). The first term inside the braces is the period 2 direct effect of how a change in individual i's expected income affects the probability of staying married, namely, $\partial\hat{\nu}/\partial\bar{y}_i$. In this case, a rise in i's expected resources will raise the net economic benefits to divorce in period 2 and hence should raise the probability of divorce.

The second term of expression (20)—the fraction—is the effect of a rise in i's expected resources on the probability of divorce that works indirectly through the decision to get married. Its first term indicates that as long as initial love has some persistence, then marriages with larger differences in mean incomes between partners should have more love and hence be less likely to end in divorce. Its second term captures the effect that the incomplete sharing of expected resources in the case of divorce raises the economic returns to marriage for the better-off individual. Hence, they can settle for a smaller amount of initial love since they still retain the option to divorce. The derivative is decreasing as either δ or θ is increasing or χ is decreasing. Which effect dominates is considered in the following proposition.

PROPOSITION 5. An increase in the gap between a couple's individual mean incomes will raise, lower, or have no effect on the probability of divorce if the fraction of income that is earned early in life, θ, satisfies $\theta < \theta'$, $\theta > \theta'$, or $\theta = \theta'$, respectively, where $\theta'(\delta, \beta, \chi) = 1 - \{\delta/[2(1 + \beta^{-1})\chi]\}$.

If initial love is sufficiently temporary and expected future resources are relatively similar whether one stays married or divorces, there will be a zero impact from larger expected income differences on the probability of divorce. Such an impact can also be obtained, more generally, as long as $\delta \approx 2(1 + \beta^{-1})\chi(1 - \theta)$; namely, love's persistence, δ, is proportional to the amount of unshared lifetime resources in the case of divorce, $\chi(1 - \theta)$.[14] Note that even if love is permanent, $\delta = 1$, the impact on the duration of marriage from an increase in the gap between

[14] Note that $\theta^* \gtreqless \theta'$ as

$$\frac{\sqrt{1+\beta}}{\beta\sqrt{\delta}+\sqrt{1+\beta}} + \frac{\delta}{2(1+\beta^{-1})\chi} \gtreqless 1.$$

the couple's individual mean incomes could be zero as long as the expected amount of unshared expected lifetime resources is sufficiently large. Also, as in proposition 4, there can also be a negative impact of larger expected income differences on the probability of divorce if love is permanent and expected future resources are relatively similar whether one stays married or divorces. In contrast to proposition 4, however, there can be a positive impact from larger expected income differences on the probability of divorce if love is temporary or expected future resources are relatively dissimilar whether one stays married or divorces.

III. Empirical Results

In this section I test the broad implications of the theory using data on first marriages from the National Longitudinal Survey of Youth (NLSY) for the years 1978–94. Since potential pairings of individuals are not observed in the data set, I test only the model's implications for couples that actually do get married: propositions 2–5. The following subsections provide the paper's estimation strategy, data, and empirical findings.

A. Econometric Strategy

I investigate the impact of joint spousal economic characteristics (**E**)—income correlations (CORR), their relative volatilities (VGAP), and mean differences (MGAP)—on the duration of marriages and hence on the probability of divorce and the duration of marriage. Of course, the duration of a marriage will likely depend on a number of other observed individual as well as joint noneconomic characteristics. Hence, the empirical specification for marital durations will also include individual characteristics (**I**) as well as joint noneconomic characteristics (**J**).

It is critical to note that the model's predictions concerning the likelihood of divorce and the temporal persistence of love depend on the fact that these joint economic characteristics are substituted for love at the time of marriage. Accordingly, these expected income characteristics for each marriage should be based on information assumed to be known at the beginning of each marriage. Unfortunately, however, these joint economic characteristics (**E**) are measured only throughout the marriage. As such, using simple measures of these characteristics in a duration model may induce an endogeneity bias to the results. To overcome this potential bias, I generate predicted values for these economic characteristics, denoted $\hat{\mathbf{E}}$, based only on data known at the beginning of the marriage. To implement this approach I use marital occupation pairs of spouses from the beginning of a marriage to predict the joint economic characteristics (**E**) under the identifying restriction that they affect the probability of divorce only through their impact on remaining lifetime income characteristics. The details of this identifying structure, and other econometric issues, are discussed in subsections *C* and *D* below.

When a Cox proportional hazard model is adopted, the hazard function for the *i*th marriage is related to the hazard rate according to $\lambda(t_i, X_i) = \lambda(t_i, 0)\exp[\boldsymbol{\gamma}'(X_i)]$, where the vector $\boldsymbol{\gamma}$ contains the parameters to be estimated.[15] To test the theory's predictions, $\boldsymbol{\gamma}'X_i$ is specified as[16]

$$\boldsymbol{\gamma}'X_i = \gamma_1 \cdot \widehat{\mathrm{CORR}}_i + \gamma_2 \cdot \widehat{\mathrm{MGAP}}_i + \gamma_3 \cdot \widehat{\mathrm{VGAP}}_i + \gamma_4 \cdot \mathbf{I}_i + \gamma_5 \cdot \mathbf{J}_i. \quad (21)$$

According to the theory as summarized by propositions 2–5, the estimates of γ_1, γ_2, and γ_3 should be negative if love is permanent and future income (both shared and unshared) is relatively unimportant in income considerations. In contrast, if love is temporary or future income is important in permanent income considerations, then γ_1 and γ_3 should be positive; if love is temporary, then γ_2 should be positive if unshared expected lifetime resources in the case of divorce are large. It is also possible for γ_2 to be zero, namely, if love's persistence is proportional to the amount of unshared expected lifetime resources in the case of divorce. Importantly, if these resources are small as a consequence of more equitable divorce agreements, then γ_2 equal to zero would be direct evidence that love is temporary.[17]

B. The Data

The unit of observation is a marriage. The key datum for the dependent variable in this empirical study is whether a marriage ends in divorce (DIV = 1) or not. For each marriage, the maximum duration observed of a given couple's marriage is denoted MAXDUR, which is equal to the uncensored duration of the marriage if it ends in divorce and is otherwise equal to the censored duration of the marriage in 1994 when the sample ends. The data set contains demographic, income, and mar-

[15] The proportional hazard model is a partial likelihood function approach to estimate the parameters $\boldsymbol{\gamma}$, without estimating the baseline hazard $\lambda(t_i, 0)$, which contains the individual heterogeneity. Similar findings were also obtained from exponential, Weibull, and log-logistic specifications of the hazard function.

[16] I also allowed for time-dependent covariates for each individual characteristic in the hazard model (not shown). None were statistically significant at below the .1 level.

[17] The amount of remaining income uncertainty might be quite large given that the data set focuses on young respondents. That is why the evidence for $\widehat{\mathrm{MGAP}}$ is important for establishing the possibility that love is temporary.

ital information for both respondents.[18] It also contains a reduced set of this information for their spouses. After missing data, respondents who became widowed or were never married, and so forth are removed, the sample is approximately 1,200 observations (first marriages).[19]

For general demographic information used as explanatory variables, I include a number of variables used in prior studies: a dummy variable for whether the spouses attended a two- or four-year college at the beginning of the marriage (EDM = 1 for the male and EDW = 1 for the female), whether there were no dependents in the household at the beginning of the marriage (NOKIDS = 1), a dummy variable for whether a spouse was 25 years of age or older when first married (AGEM = 1 for the male and AGEF = 1 for the female), the race of the respondent (WHITE = 1), whether the respondent was raised Catholic (CATHOLIC = 1), and whether the respondent's parents are divorced at the beginning of the respondent's marriage (PARDIV = 1).[20] The NLSY also provides each partner's reported occupation at the time of the marriage: MMAROCC is the vector of 10 dummy variables for the male partner's marital occupation, and FMAROCC is that for females.[21]

From the data, I calculate for each marriage the mean, variance, and correlation of the partners' incomes. On the basis of income data from the respondent and his or her spouse, the partners' observed income correlation (CORR_i) was calculated. Moreover, the mean income gap (MGAP) was measured as the absolute value of the difference of the means as suggested by the definition of z in Section II*D*4. The income variance gap (VGAP) is measured as the ratio of the higher value in the marriage to the lower value in the marriage, as suggested by the definition of Φ.[22]

[18] The income data were converted to real by dividing by the 1994-based, chain-weighted gross domestic product deflator.

[19] I consider data for only first marriages, though I empirically explore second marriages below at the end of Sec. III*D* and the results in col. 5 of table 4.

[20] The results are similar if I use the number of children at the beginning of marriage as opposed to a dummy variable to distinguish between zero and the presence of children. Also, similar results were obtained both when age was measured continuously and when multiple age dummies were used: under 21, between 21 and under 25, and then over 25 when first married did not affect the result.

[21] The NLSY reports each partner's current occupation, which is then classified into 10 groupings. The listed occupations in the NLSY (with occupational classification codes in parentheses) are [1] professional, technical, and kindred (001–195); [2] managers, officials, and proprietors (201–45); [3] sales workers (260–85); [4] clerical and kindred (301–95); [5] craftsmen, foremen, and kindred (401–575); [6] operatives and kindred (601–715); [7] laborers, except farm (740–85); [8] farmers, farm managers, farm laborers, and foremen (801–24); [9] service workers, except private household (901–65); and [10] private household (980–84). In a few instances, the respondent's occupation for the year of the marriage was not reported, so the occupation for the prior year was used.

[22] Explicitly, $\text{MGAP} = |\bar{y}_i - \bar{y}_j|$ and $\text{VGAP} = \max(\sigma_i^2/\sigma_j^2, \sigma_j^2/\sigma_i^2)$. Other approaches to empirically defining the disparity of means and variances across partners were used, such as the absolute value of the difference or the absolute value of the difference scaled by

TABLE 1
SAMPLE STATISTICS

Series	Mean (1)	Standard Error (2)	Median (3)	Correlations: CORR (4)	MGAP (5)	VGAP (6)
DIV	.292	.455	.000	.093	−.043	.057
MAXDUR	9.815	4.158	10.000	−.118	.061	−.087
WHITE	.671	.470	1.000	−.128	.139	.026
AGEM	.310	.463	.000	−.069	.119	−.014
AGEF	.133	.339	.000	−.049	.041	.065
EDM	.277	.448	.000	−.009	.169	−.026
EDW	.259	.438	.000	−.036	−.033	−.026
NOKIDS	.761	.427	1.000	−.095	.081	−.048
CATHOLIC	.380	.486	.000	.032	.045	−.007
PARDIV	.150	.357	.000	.003	.034	−.018
CORR	.216	.524	.301	1.000		
MGAP	12.692	11.689	10.125	−.129	1.000	
VGAP	19.021	22.532	3.033	.049	.073	1.000

NOTE.—See the text for a data description. The number of observations is 1,207. Cols. 4–6 are the correlations of the variable listed at the top of the column with the variable listed in the row. The variables are whether the respondent was white (WHITE), the partners' ages when married (AGEF = 1 for the female and AGEM = 1 for the male if 25 or older), whether the partners attended a two- or four-year college (EDF = 1 for the female and EDM = 1 for the male), whether the respondent's parents divorced (PARDIV = 1), and whether the respondent was raised Catholic (CATHOLIC = 1). CORR is the correlation of the partner's income, MGAP is the absolute value of the mean gap in their income, and VGAP is the ratio of the partners' highest to lowest volatilities.

Table 1 present statistics for the data for the marriages and marital economic characteristics used in this study. Columns 1–3 report the mean, standard deviation, and median. About 30 percent of first marriages failed by 1994, whereas only 15 percent of the respondents' parents divorced. The sample is over 65 percent white, over 35 percent Catholic, and quite young when first married. These latter two features are likely driven by the fact that the survey pertains to young people. Finally, approximately 30 percent of the male and female spouses have attended a two- or four-year college at some point by the time of their marriage, and approximately 80 percent of these first marriages begin without dependents. The average correlation is around .2, the average mean income gap is approximately $12,000, and the average ratio of the highest to the lowest income variances is approximately 19.[23]

Columns 4–6 report the correlation coefficients between the data and the three key observed economic characteristics, **E**. In general, the unconditional correlations between divorce and the predicted income characteristics for correlation and volatility are positive and relatively

the sum of the two partners' variables. The findings of this paper *do not* depend on the method chosen to measure these disparities.

[23] While the predicted correlation is low, this is consistent with the finding of Dynarski and Gruber (1997). They find that a wife's labor income does not appreciably affect the smoothness of the head's labor income. However, if the correlation between the head's and wife's incomes is less than one, marriage will still provide a consumption-insurance benefit.

large, and the mean gap has a negative, though smaller, correlation with divorce. As well, spouses with larger gaps in their mean incomes tend to have more negatively correlated incomes and smaller gaps in their income variances. The remaining correlations between the income variables and the other characteristics are directly related to the empirical results in table 2 below.

C. *Construction of Economic Characteristics at the Start of a Marriage*

To ensure that the marital income characteristics are based on available information at the time of the beginning of the marriage, the predicted income characteristics for the marriage will be projected from those characteristics observed at the beginning of a couple's marriage. Consider first the predicted income correlation for each ith marriage. After calculation of the partners' observed income correlation (CORR_i), the predicted income correlation variable ($\widehat{\mathrm{CORR}}_i$) was obtained from the fitted value of the following linear regression:

$$\mathrm{CORR}_i = A(\mathbf{I}_i, \mathbf{J}_i, \mathbf{Z}_i) + u_i, \tag{22}$$

where A represents the linear coefficients to be estimated. The fitted values from this regression, $\widehat{\mathrm{CORR}}_i$, are therefore the predicted correlation of the partners' incomes based on information at the beginning of the marriage. Similarly, the predicted gaps in mean incomes ($\widehat{\mathrm{MGAP}}$) and volatilities ($\widehat{\mathrm{VGAP}}$) were constructed. Hence, for each marriage, there is a vector of observed and predicted joint economic characteristics, $\mathbf{E}$ and $\hat{\mathbf{E}}$.

The explanatory variables in regression (22) warrant discussion. The vector $\mathbf{I}$ represents a constant as well as the following available individual characteristics: AGEM_i, AGEW_i, EDM_i, EDW_i, $\mathrm{CATHOLIC}_i$, PARDIV_i, NOKIDS_i, $\mathrm{MMAROCC}_i$, and $\mathrm{FMAROCC}_i$. The vector $\mathbf{J}$ represents the available noneconomic cross-spouse characteristics that are independent of $\mathbf{I}$, namely, those components of $\mathrm{AGEM}_i \times \mathrm{AGEW}_i \times \mathrm{EDM}_i \times \mathrm{EDW}_i$.

Essential to using these generated economic characteristics in our duration estimation, however, is that we identify some variables ($\mathbf{Z}$) that can predict the observed joint economic characteristics ($\mathbf{E}$) but do not directly affect the duration of marriage. The term $\mathbf{Z}$ represents the critical joint marital occupation variables that are linearly independent of $\mathbf{I}$ and $\mathbf{J}$ and can predict the joint economic characteristics ($\mathbf{E}$) but are assumed not to directly affect the duration of marriage, namely,

$\text{MMAROCC}_i \times \text{FMAROCC}_i$.[24] The identifying assumption that occupational pairings of spouses affect the probability of divorce only though their impact on the economic characteristics of remaining lifetime income is critical for using the model to interpret the marriage duration results presented below.

There are two major reasons why cross-marital occupation variables at the time of marriage are used to identify the joint economic characteristics. First, these combined occupation dummy variables, MMAROCC × WMAROCC, would be expected to be important predictors of a marriage's joint economic characteristics, **E**, throughout the marriage as long as incomes are subject to occupation-specific shocks. Indeed, this point is demonstrated in table 2; namely, these joint marital occupation dummy variables have significant explanatory power in predicting the joint economic characteristics.

Second, it is not likely that joint marital occupation variables will have a significant remaining effect on the duration specification, equation (21), outside of their effect on the key joint economic characteristics for two key reasons. First, the duration equation itself includes each partner's individual marital occupation dummy variable in $\mathbf{I}_i$. Second, the duration equation already contains variables in $\mathbf{I}_i$ and $\mathbf{J}_i$ individual as well as joint noneconomic characteristics that are likely to be important determinants of the observed heterogeneity in both marital duration and joint economic characteristics. Hence, it is unlikely that the key findings below are due to the omission of variables, such as those in **Z**, from the duration specification. However, to guard further against the remote possibility that these cross-spouse industry variables embody relevant unobserved cross-spouse heterogeneity that is relevant for marital duration independent of their influence on the joint economic characteristics, in table 4 below I provide a number of modifications to the basic specification to test this identification's sturdiness.

The estimates of equation (22) for the joint economic characteristics (**E**) are presented in table 2. To conserve space, I report p-values for F-tests for the significance of a number of relevant variables in the specification (22). In particular, p-value (CROSS OCC [59]) tests whether the coefficients on the linearly independent marital occupation interaction terms in **Z** are jointly equal to zero. This p-value statistic for the significance of the cross-spouse occupation variables will be useful for

[24] Note that out of a possible 16 (2^4) combinations of interactions of the sex-specific age and education dummy variables in **J**, 11 are linearly independent of the individual age and education dummy variables in **I**. Out of a possible 10 × 10 combinations of male and female marital occupations, 59 both are observed in the sample and are linearly independent of the individual marital occupation variables MMAROCC and FMAROCC in **I**.

TABLE 2
Economic Variables Projected on Initial Marital Characteristics
(N=1,207; 98 Regressors)

Explanatory Variable	Dependent Variable CORR (1)	MGAP (2)	VGAP (3)
Constant	.186	8.359***	.250
	(.403)	(1.052)	(.173)
AGEM	−.103**	.532	.030
	(.052)	(.965)	(.125)
AGEW	−.178**	−1.941	1.722
	(.081)	(1.413)	(1.331)
EDM	−.035	1.845	.001
	(.054)	(1.239)	(.097)
EDW	−.022	−2.483***	−.022
	(.048)	(.961)	(.096)
WHITE	−.123***	3.107***	.101
		(.677)	(.070)
NOKIDS	−.098***	.560	−.173
	(.037)	(.793)	(.168)
CATHOLIC	−.005	1.736**	.010
	(.032)	(.708)	(.056)
PARDIV	.002	1.567*	−.066
	(.041)	(.890)	(.054)
R^2	.123	.177	.274
p-value (OCC [18])	.001	.006	.001
p-value (AGE [12])	.007	.036	.685
p-value (ED [12])	.031	.001	.641
p-value (CROSS OCC [59])	.001	.001	.001
p-value (CROSS AGE and ED [9])	.029	.131	.482

Note.—Standard errors, robust to possible heteroskedasticity of unknown form, are reported in parentheses. p-value (OCC [18]) tests whether the coefficients on MMAROCC and FMAROCC in **I** are jointly equal to zero; p-value (AGE [12]) tests whether the coefficients on all the age variables in **I** and **J** are jointly equal to zero; p-value (ED [12]) tests whether the coefficients on all the education variables in **I** and **J** are jointly equal to zero; p-value (CROSS AGE and ED [9]) tests whether the coefficients on the linearly independent age and education interactions terms in **J** are jointly equal to zero; and p-value (CROSS OCC [59]) tests whether the coefficients on the linearly independent interaction terms in MMAROCC and FMAROCC in **Z** are jointly equal to zero. The number of restrictions for each test is reported in brackets.

* Statistically significant (two-tailed test) at the .10 level.
** Statistically significant (two-tailed test) at the .05 level.
*** Statistically significant (two-tailed test) at the .01 level.

identifying the independent role of the predicted income characteristics on the duration of marriage.

Column 1 of table 2 presents the regression results when the couple's actual labor income correlation ($CORR_i$) is the dependent variable. Typically, couples in which the respondent is white, who are older when married, and who start their marriage without children have more negatively correlated labor incomes. The p-value results from the F-statistic also reveal that one can reject the hypothesis that the individual and cross-marital occupational dummy variables are jointly equal to zero at or below the .001 level of statistical significance.

Column 2 of table 2 reports the empirical results for equation (22) when MGAP_i is the dependent variable. Marriages in which the respondent is white, is Catholic, and has divorced parents and in which the female spouse has not attended college are associated with larger mean income gaps. In addition, the reported p-value reveals that one can reject the hypothesis that the coefficients on the individual and cross-spouse marital occupational variables are jointly equal to zero at or below the .01 level of statistical significance. Column 3 presents the results for the case in which the partners' gap in the variances of their individual incomes, VGAP_i, is the dependent variable. Here, only the coefficients on the variables for the individual and cross-spouse occupation dummies are significantly different from zero at or below the .01 level. The R^2 is .274, which is two times higher than for the CORR_i equation (col. 1) and about one-half higher than for the MGAP equation (col. 2).[25]

D. *Empirical Estimates*

The use of generated economic characteristics, $\hat{\mathbf{E}}$, also introduces additional econometric wrinkles into the estimation procedure. First, as these regressors in the duration equation have been generated from an earlier estimation step, the standard errors in the duration equation (i.e., the second step) must be corrected for the sampling error inherited from the imputed regressors. To correct these standard errors, I followed Murphy and Topel (1985) by calculating the analytical and numerical first derivatives of the likelihood functions from the ordinary least squares regressions of the predictions equations (22) and the duration model implied by equation (21), calculating the cross partials of the joint likelihood functions, and then inverting the joint matrix to obtain the standard errors for the duration equation.[26]

In addition, while the use of the generated regressors was predicated on the belief that using data throughout the marriage for the economic characteristics would be subject to endogeneity bias, such a bias can be examined using a Hausman test. Under the null hypothesis that there is no endogeneity bias, including the observed economic characteristics $\mathbf{E}$ rather than the generated ones $\hat{\mathbf{E}}$ should produce estimates of the

[25] Fortunately, the regression results for MGAP are no weaker than those for CORR, since one potential finding is that $\widehat{\mathrm{MGAP}}$ is insignificant in determining marital durations. Of course, a poorly measured $\widehat{\mathrm{MGAP}}$ is one way to obtain this finding.

[26] Two things should be noted. First, since both steps of the regression use the same data sample, the full covariance matrix must be evaluated. See Murphy and Topel (1985, sec. 5.1) for the formulas for the relevant matrix calculations. Second, the results for the first step would also be affected but are not reported again since they are not the focal point of inquiry in this study. The size of the full estimated covariance matrix is 332×332, where 332 reflects the 98 coefficients in each of the three equations for constructing $\hat{\mathbf{E}}$ and the 38 coefficients in the duration equation.

impact of the economic characteristics on the duration of marriage, which should be the same. The rows in tables 3 and 4 labeled "Hausman" present results from such a test.[27]

Table 3 presents estimation results of equation (21). To conserve space, rather than report the estimated coefficients on the individual marital occupation dummy variables and the interacted gender-specific age and education dummy variables, I simply report at the bottom of the table the p-values from the χ^2 test of the null hypothesis that the individual industry, age and education, and cross-spouse age and education variables are zero.

In general, the null hypothesis that the estimates of γ_1 and γ_3 are zero can be rejected in favor of the alternative that they are greater than zero. Furthermore, in every case the estimates of γ_2 are statistically indistinguishable from zero. The former result is consistent with propositions 2 and 3 when the fraction of income risk in the future is relatively large, though it cannot by itself distinguish the absolute persistence of love. As proposition 5 suggests, however, there are two interpretations of the latter result. One interpretation is that love is very temporary and that the amount of unshared expected future income in the case of divorce is small. An alternative interpretation is that the persistence of love is proportional to the level of unshared expected future income in the case of divorce. In this latter interpretation, the absolute persistence of love cannot be determined. Regardless, the results clearly indicate the importance of a good match of economic characteristics for the longer expected duration of a marriage. By implication, the evidence supports the view that a good deal of initial love is not a sufficient substitute for marrying a good economic match in order for a marriage to be expected to last longer.

For example, column 1 of table 3 provides estimates of the baseline specification (21) when only $\widehat{\mathrm{CORR}}$ is included in $\hat{\mathbf{E}}$ in the regression. It is striking that the more positively related the spouses' incomes are, the more likely that the marriage will end in divorce as the hazard rate rises. The coefficient on γ_1 is positive and statistically different from zero at below the .01 level of significance. Columns 2 and 3 provide estimates of the baseline specification (21) when just $\widehat{\mathrm{MGAP}}$ and $\widehat{\mathrm{VGAP}}$, respectively, are included as covariates in the hazard function. While the coefficient on $\widehat{\mathrm{MGAP}}$ is not statistically different from zero, the coefficient on $\widehat{\mathrm{VGAP}}$ is statistically significant at or below the .01 level, and the sign of the coefficient is once again positive. This suggests that partners with a greater difference in their predicted income vola-

[27] Each model is reestimated—generally not shown except in col. 4 of table 3—using the observed characteristic(s), $\mathbf{E}$, rather than the generated one(s), $\hat{\mathbf{E}}$. The standard Hausman test is then constructed for the equality of the coefficients on economic characteristics γ_1, γ_2, or γ_3 across the two estimated specifications.

TABLE 3
ESTIMATION RESULTS FOR THE DIVORCE HAZARD RATE (λ) (N=1,207)

Explanatory Variable	Regression (1)	(2)	(3)	(4)	(5)
$\widehat{\text{CORR}}$	1.306***				.922**
	(.417)				(.470)
CORR				.347***	
				(.107)	
$\widehat{\text{MGAP}}$		−.023			−.009
		(.024)			(.026)
MGAP				−.003	
				(.005)	
$\widehat{\text{VGAP}} \cdot 100$			.109***		.075***
			(.017)		(.022)
VGAP · 100				.037***	
				(.013)	
AGEM	.104	−.017	−.028	−.014	.085
	(.187)	(.156)		(.157)	(.204)
AGEW	.138	−.087	−.229	−.137	−.053
	(.333)	(.309)	(.205)	(.306)	(.257)
EDM	−.173	−.185	−.201	−.223	−.153
	(.173)	(.177)	(.181)	(.173)	(.182)
EDW	−.243	−.325**	−.253	−.297**	−.250
	(.178)	(.158)	(.146)	(.147)	(.158)
WHITE	−.021	−.107	−.212**	−.147	−.068
	(.123)	(.129)	(.090)	(.105)	(.128)
CATHOLIC	−.115	−.066	−.088	−.087	−.086
	(.114)	(.125)	(.112)	(.110)	(.130)
PARDIV	.260*	.276*	.252*	.244*	.279*
	(.140)	(.144)	(.135)	(.135)	(.153)
NOKIDS	−.128	−.253**	−.193**	−.220**	−.112
	(.124)	(.124)	(.096)	(.113)	(.148)
Regressors	36	36	36	38	38
EXITS	353	353	353	353	353
Log likelihood	−2,383.37	−2,387.87	−2,383.87	−2,38.87	−2,381.22
p-value (OCC [18])	.139	.002	.022	.005	.013
p-value (AGE [12])	.339	.696	.607	.581	.567
p-value (ED [12])	.080	.178	.243	.031	.217
p-value (CROSS AGE and ED [9])	.608	.779	.587	.623	.607
p-value (Hausman [a])	.019	.441	.001	…	.002

NOTE.—See tables 1 and 2. Estimates are obtained from a proportional hazard model. Cols. 1–3 and 5 report the estimation results for the full sample using the two-step estimation procedure in which the predicted joint economic characteristics from table 2 are used. The standard errors for these cases are corrected for generated regressor bias following Murphy and Topel (1985). The results in col. 4 pertain to the one-step estimator in which the realized joint economic characteristics are used as explanatory variables. EXITS is the number of uncensored data observations, namely those that end in divorce. *p*-value (Hausman) is taken from a Hausman specification test of whether the joint economic characteristics, CORR, MGAP, and VGAP are endogenous.

* Statistically significant (two-tailed test) at the .10 level.

** Statistically significant (two-tailed test) at the .05 level.

*** Statistically significant (two-tailed test) at the .01 level.

[a] The number of restrictions tested is 1 for cols. 1–3 and 3 for col. 5.

TABLE 4
ADDITIONAL ESTIMATION RESULTS FOR THE DIVORCE HAZARD RATE (λ)

VARIABLE	REGRESSION (1)	(2)	(3)	(4)	(5)	(6)
$\widehat{\text{CORR}}$	.687**	.949**	.829*	1.521**	1.055**	.934*
	(.349)	(.475)	(.498)	(.694)	(.495)	
$\widehat{\text{MGAP}}$	−.009	−.008	−.021	−.008	−.004	.004
	(.015)	(.026)	(.025)	(.033)	(.045)	(.022)
$\widehat{\text{VGAP}} \cdot 100$	.114***	.072***	.091***	.076***	.069***	.098***
	(.016)	(.022)	(.019)	(.023)	(.025)	(.019)
SECOND						.257*
						(.153)
JOINT		−.052				
		(.164)				
AGEM	.056	.088	.068	−.218	.219	−.009
	(.184)	(.207)	(.210)	(.208)	(.194)	(.159)
AGEW	−.297	−.039	−.169	−.071	.183	−.164
		(.249)	(.239)	(.265)	(.175)	(.215)
EDM	−.164	−.152	−.144	−.193	−.044	−.198
	(.198)	(.166)	(.185)	(.183)	(.218)	(.173)
EDW	−.311*	−.243	−.274*	−.515**	−.357*	−.247*
	(.176)	(.179)	(.149)	(.232)	(.184)	(.149)
WHITE	−.116	−.069	−.044	.004	−.107	−.150**
	(.121)	(.127)	(.139)	(.153)	(.135)	(.089)
CATHOLIC	−.070	−.090	−.079	.193	−.101	−.062
	(.125)	(.128)	(.121)	(.192)	(.134)	(.123)
PARDIV	.305**	.276*	.299**	−.239	.241	.242*
	(.155)	(.148)	(.150)	(.174)	(.165)	(.139)
NOKIDS	−.125	−.112	−.099	−.129	−.052	−.086
	(.127)	(.140)	(.135)	(.426)	(.130)	
Observations	1,207	1,207	1,207	966	966	1,332
Regressors	20	39	43	38	38	39
EXITS	353	353	353	291	296	397
Log likelihood	−2,396.72	−2,381.17	−2,372.57	−1,896.02	−1,926.99	−2,723.94
p-value (OCC [18])	…	.013	.021	.072	.003	.078
p-value (AGE [12])	.570	.571	.583	.563	.545	.637
p-value (ED [12])	.156	.221	.216	.065	.039	.337
p-value (CROSS AGE and ED [9])	.641	.608	.681	.462	.206	.525
p-value (Hausman [3])	.001	.006	.001	.048	.001	.001

NOTE.—See table 3. The standard errors for these cases are corrected for generated regressor bias following Murphy and Topel (1985). The estimation results all use the two-step estimation procedure in which the predicted joint economic characteristics from table 2 are used. The results in col. 1 pertain to the case in which the individual marital occupation dummy variables are excluded from the specification. The results in col. 2 include both the individual marital occupations and a dummy variable (JOINT) that takes the value one if both spouses have the same marital occupations. The results in col. 3 include both the individual marital occupations and five dummy variables for the joint marital occupations that were significant at below the .1 level on the basis of a Lagrange multiplier test when they were individually included in the specification. The results in col. 4 pertain to the subsample in which the bottom quintile of actual income correlations are removed from the sample. The results in col. 5 pertain to the subsample in which the top quintile of mean income gaps (MGAPs) are removed from the sample. The results in col. 6 pertain to the expanded sample that includes second marriages.

* Statistically significant (two-tailed test) at the .10 level.

** Statistically significant (two-tailed test) at the .05 level.

*** Statistically significant (two-tailed test) at the .01 level.

tilities will have an increased chance of divorce, whereas those with a greater mean difference will not. The estimates in columns 1–3 also suggest that those respondents whose parents have divorced have a higher chance of divorce themselves, whereas the results in columns 2 and 3 suggest that starting a marriage without children lowers the probability of divorce.

In column 5 of table 3, estimates are provided in which all three economic variables are included simultaneously. Again, the coefficients on $\widehat{\text{CORR}}$ and $\widehat{\text{VGAP}}$ are positive and statistically different from zero at or below the .05 level of statistical significance. Moreover, the coefficient on $\widehat{\text{MGAP}}$ remains statistically indistinguishable from zero at conventional levels. Interestingly, the results in table 2 provide evidence that the predicted level of mean incomes has a much better fitting regression than the predicted income correlation as measured by its R^2. It is likely, therefore, that the finding that γ_2 is insignificantly different from zero is not due to $\widehat{\text{MGAP}}$'s poor measurement, but rather to $\widehat{\text{MGAP}}$'s inability to contribute to the explanation of a marriage's duration.

To better aid the reader in understanding the role of the predicted economic characteristics, column 4 presents estimates of the duration model using the observed joint economic characteristics, **E**, rather than predicted ones, $\hat{\mathbf{E}}$. Note that a similar pattern of coefficients and statistical significance is found whether the observed or predicted characteristics are used. However, the estimated coefficients in column 5 using the predicted characteristics are much larger in magnitude, as are their estimated standard errors. With the exception of the results in column 2—where the estimated coefficient is insignificantly different from zero—the p-value for the Hausman test rejects the equality of the coefficients. This finding places additional importance on having created the key economic characteristics from data known at the beginning of the marriage.

Table 4 provides additional empirical results that demonstrate the robustness of the findings. In particular, the results in columns 1–3 investigate the extent to which the findings are affected by including $\mathbf{Z}_i$ only in the economic characteristics prediction equation (22) but not in the duration equation (21), while allowing individual marital occupations in both equations. Column 1 presents results from the baseline specification, where **I** excludes the 18 individual marital occupation variables from the duration equation. The results for $\widehat{\text{CORR}}$, $\widehat{\text{MGAP}}$, and $\widehat{\text{VGAP}}$ are little changed. A second modification, presented in column 2, explores whether partners with the same marital occupation marry because of some common interest or "love," which may independently affect the duration of marriage.[28] To this end, I reestimate the marriage duration equation and include an additional dummy variable for whether spouses have the identical marital occupation (JOINT = 1). The results indicate, however, that JOINT is not statistically significant, and the overall results are unchanged.

Another modification, presented in column 3, is to see whether including a number of cross-spouse marital occupations into the marital duration specification affects the key results. This was undertaken in the following steps. First, I conducted individual Lagrange multiplier tests—not shown—to see which of the possible 78 observed combinations of cross-spouse occupation dummies might potentially be omitted from the baseline specification (21) on the basis of a .1 significance threshold. I found that five such variables passed this criterion. I then reestimated the baseline specification by including these five potentially omitted joint marital occupation variables in the duration model.[29] The results, presented in column 3, indicate that such a modification does not change the estimated pattern of the response of the duration of marriage to the predicted joint economic characteristics, $\hat{\mathbf{E}}$. The findings in columns 1–3, therefore, suggest some robustness from using joint cross-marital occupation codes to identify the impact of joint economic characteristics on marital duration.

The results in columns 4 and 5 of table 4 are presented to ensure further that our baseline sample and specification are not unduly influenced by households that may display reverse causality with respect to economic characteristics and marital success.[30] For example, suppose that households have some private information that one of the partners will be very successful in market activity and that one partner specializes in home production. We would expect that couples like this would display a larger gap in mean observed incomes and more negatively correlated observed incomes. The results in columns 4 and 5 remove marriages whose partners have the bottom quintile of observed mean income correlations, CORR_i, and the top quintile of observed mean income differences, MGAP_i, respectively, in the sample.[31] The results for

[28] Though not reported, spouses with identical marital occupations have significantly higher actual as well as predicted income correlations, though reduced mean and variance differences.

[29] Of course, with a size of 10 percent for false rejections, five out of 78 rejections of the null are quite unremarkable. These marital combinations are (male–female): 1–7, 2–6, 5–2, 6–4, and 6–8. See n. 21 for the occupational numberings.

[30] Of course, this is exactly the reason why the predicted values of CORR, MGAP, and VGAP, rather than their actual values, are included in the specification of the hazard rate, eq. (21).

[31] The findings are also unchanged if I remove the top quintile of actual income variance differentials, VGAP, in the samples or impose a minimum average earnings restriction for each partner.

γ_1, γ_2, and γ_3, reported in columns 4 and 5, however, are unaffected by the removal of these households.

As a final investigation, I included second marriages in the data set, reestimated the projection equations (not shown) and proportional hazard model equation, and included a dummy variable for second marriages (SECOND) in both equations.[32] One would think, however, that second marriages for the respondent might involve some learning, which would lead them to make better matches during second marriages. The results, reported in column 6 of table 4, indicate, however, that the inclusion of these additional marriages leaves the baseline estimation results unchanged.

IV. Conclusion

This paper presents strong evidence that joint economic characteristics from the beginning of a marriage are significant explanatory factors in a marriage's probability of survival. The evidence uncovered is that more positively correlated incomes between partners and a bigger gap in their income volatilities are associated with marriages of decreased duration, though bigger mean income gaps do not affect a marriage's duration. This pattern of results is consistent with the view that spouses who are good economic matches for one another are associated with longer-lasting marriages and that initial love is not a reliable substitute for this essential ingredient.

A potential shortcoming of this model is that love is purely determined by exogenous factors.[33] Rather, if partners could invest in love to raise its future stock, then they may find that better economic matches would lead to a higher return on the investment in love. In turn, as a result, partners with better economic characteristics would accumulate a greater stock of love, which would make these marriages last longer. However, such considerations do not alter the basic finding that beneficial economic characteristics lead to an increase in the survival of marriages and that initial love cannot simply be substituted in its place.

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[32] Note that these 125 second marriages come from the 353 out of 1,207 first marriages that ended in divorce, though any dependence is not modeled.

[33] See Mulligan (1997) and Becker and Murphy (1998), among others, for a more general treatment of the economic and welfare effects of endogenizing love.

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