

SEARCH COSTS AND THE PROBABILITY OF DISSOLUTION

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In an economic analysis of marital dissolution, Becker, Landes, and Michael (1977) assert that an increase in the cost of finding a suitable mate increases the probability of dissolution. In contrast to their assertion, based on a model of search with belated information, I show that an increase in search costs decreases the probability of dissolution, if the distribution of marriage offers possesses a monotonically increasing hazard rate property. The analysis implies that a lower minimum acceptable offer need not lead to lower marital stability.

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I. INTRODUCTION

This paper takes a search-theoretic approach to analyze marital dissolution in marriage markets when some information about the quality of a match is revealed to the searcher only after the marriage has occurred. This *ex post* learning is referred to as *belated information* in the search literature (Lippman and McCall, 1981). The central theme of this study is that the stability of a match depends not only on the quality of premarital matching but also on postmarital socialization (Oppenheimer, 1988), which is shaped by opportunities for further search.

In this type of search models one of the most important comparative-static results is the relationship between search costs and turnover. In a seminal work Wilde (1979) suggested that there is no systematic relationship between search costs and the probability of a quit. The most thorough analysis of the relation-

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ship between search costs and the probability of dissolution has been provided by Becker, Landes, and Michael (1977) [hereafter referred to as BLM]. In this influential study, they assert that an increase in the cost of finding a suitable mate increases the probability of dissolution. The argument is that, as individuals with high search costs are expected to search less before marrying and thus to settle for a less-suitable match, they are expected to have a higher probability of dissolution (Michael, 1979).

In this paper I develop a simple model of search with belated information. The model explicitly allows for the possibility of divorce and remarriage by assuming that, if the marriage turns out to be uncongenial, divorce occurs and search resumes.¹ The theoretical results of the model are strikingly different from those of the BLM model. Specifically, I show that an increase in search costs decreases the probability of dissolution, if the distribution of marriage offers possesses a monotonically increasing hazard rate property.² This is an important and general result, not restricted to the relationship between search costs and marital dissolution. The analysis implies that a lower minimum acceptable offer need not lead to lower marital stability.³

Section 2 develops a simple model of search with belated information and studies the impact of search costs on the probability of dissolution. An intuitive interpretation of the monotone-hazard-rate condition is also given. Section 3 discusses several determinants of search costs and marital dissolution in detail. The concluding section contains some suggestions for future research.

II. THE BASIC MODEL

In this section I consider the search problem of an unwed individual searching for a mate in the marriage market.⁴ The following assumptions are made in order to keep the model simple.

First, suppose that a potential mate can be characterized by two types of characteristics: the search characteristic, which is observed before marriage and the experience characteristic, which can be observed only by getting married.

¹ To simplify the analysis the remarriage market is assumed to be identical to the first-marriage market. Indeed, it is conceivable that divorced women are in general at a greater disadvantage in the remarriage market than do divorced men mainly because divorced women usually retain custody of children from their first marriage (Cohen, 1987). Becker, Landes, and Michael (1977) predict that "an increase in the cost of search would tend to increase the probability of dissolution even when the distribution of offers and the minimum acceptable offer were the same in both the remarriage and first-marriage markets" (p. 1154).

² Similarly, an increase in offer availability increases the probability of dissolution, if the monotone-hazard-rate condition holds.

³ On the other hand, the BLM model predicts that a reduction of the minimum acceptable offer always raises the probability of dissolution.

⁴ The model is based on the seminal work of Lippman and McCall (1981), McKenna (1979), and Wilde (1979).

Second, denote the search characteristic by the random variable W and the value of the experience characteristic by the random variable Y . W is called the marital wage (Keeley, 1977) and Y the congeniality of a match. Thus, a marriage offer is composed of a pair (w, y) , where w is the marital wage and y the congeniality which becomes known to the searcher exactly one period after she has accepted the offer.⁵ The searcher is risk neutral. We term the sum of the marital wage and congeniality of a match the reward rate: $u = w + y$.

Third, the searcher obtains at most one offer each period at a search cost c . There may be some uncertainty as to whether she receives an offer in a particular period. Specifically, I assume that each period, with probability q ($0 < q < 1$), she gets an offer. With probability $(1 - q)$, she receives no offer. The probability of getting an offer is exogenous in this model and indicates offer availability in the market.

Fourth, denote the distribution function of the nonnegative random variable W by F and the corresponding continuous and strictly positive density function by f . To simplify the analysis, assume that $\text{Cov}(W, Y) = 0$ and $P(Y = \alpha) = P(Y = -\alpha) = 1/2$, where α is a positive number.⁶ If $Y = \alpha$, then the marriage is said to be congenial. If $Y = -\alpha$, the marriage is said to be uncongenial.

Finally, the searcher seeks to maximize the expected present value of rewards, net of search costs, over an infinite horizon and the discount factor is β ($0 < \beta < 1$).

Given the assumptions, the decision process is as follows. The searcher samples from a distribution of marriage offers, paying c and receiving one offer with probability q each period. By incurring search costs she can get an offer (w, y) , but only w is observable. Thus, initially search is over the distribution of offers $F(w)$. If an offer is rejected, search continues anew next period. If an offer is acceptable, marriage occurs and y (and thus the reward rate u) is revealed after one period. If the reward rate is not acceptable, divorce occurs and search resumes. She stays married forever if the reward rate is acceptable.

Let $V(w)$ be the maximum expected rewards when a particular offer w has just been received. Denote the value of search by S . Then,

$$V(w) = \max\{S, M(w)\} \quad (1)$$

where

$$M(w) \equiv E(w + Y) + \beta E \max\left(S, \frac{w + Y}{1 - \beta}\right) \quad (2)$$

⁵ In general the congeniality becomes known to the searcher N periods after she has accepted the offer, where N is a geometric random variable with parameter p (Lippman and McCall, 1981).

⁶ If the two random variables are correlated, a sufficient condition, such as first-order stochastic dominance, is needed to ensure the reservation wage property (McKenna, 1979; Wilde, 1979). The main results in this paper hold when Y is a continuous random variable (Kim, 1995).

$$= w + \frac{\beta}{2} \left\{ \max \left(S, \frac{w + \alpha}{1 - \beta} \right) + \max \left(S, \frac{w - \alpha}{1 - \beta} \right) \right\}$$

and

$$S = -c + \beta \left[(1 - q)S + q \int_0^{\infty} V(w) dF(w) \right]. \quad (3)$$

$M(w)$ is the return to accepting the offer for one period and then, after evaluating the experience characteristic, deciding optimally whether to divorce or to stay married forever. As $M(w)$ is continuous and strictly increasing in w , there exists a unique solution of $S = M(w)$. At this w , which I denote w^* , the searcher is indifferent between getting married and continuing search. There are two reservation levels in this type of search models, $w^* < w^{**}$:

$$w^* = (1 - \beta)S - \frac{\beta}{2 - \beta} \alpha, \quad (4)$$

and

$$w^{**} = (1 - \beta)S + \alpha \quad (5)$$

w^* is the minimum acceptable offer and w^{**} is the smallest offer at which no divorce occurs after acceptance. For a formal derivation of equations (4) and (5), see the Appendix or Lippman and McCall (1981).

Lemma 1. The value of search decreases as the cost of search increases.

Lemma 1 is an intuitive and well-known result in the search literature, and the proof is relegated to the Appendix. Notice that an increase in search costs reduces the value of search in the remarriage market as well in the first-marriage market. The next two Lemmas immediately follow from Lemma 1.

Lemma 2. An increase in search costs leads to a lower minimum acceptable offer.

Proof. From (4) and Lemma 1, $\frac{\partial w^*}{\partial c} = (1 - \beta) \frac{\partial S}{\partial c} < 0$.

Lemma 3. The searcher becomes less choosy in evaluating the experience characteristic of her spouse as the cost of search increases.

Proof. From (5) and Lemma 1, $\frac{\partial w^{**}}{\partial c} = (1 - \beta) \frac{\partial S}{\partial c} < 0$.

The probability of dissolution conditional on marriage (D) is

$$P(w + Y \leq (1 - \beta)S | w \geq w^*) = \frac{P(w^* \leq w \leq w^{**})}{2P(w \geq w^*)} = \frac{F(w^{**}) - F(w^*)}{2[1 - F(w^*)]} \quad (6)$$

We are now in a position to state and prove one of the main propositions in this paper.

Proposition 1. A change in search costs has an ambiguous effect on the probability of dissolution (Wilde, 1979). If the hazard function of the offer distribution is monotonically increasing, then an increase in search costs decreases the probability of dissolution.

Proof. From (6),

$$\frac{\partial D}{\partial c} = \frac{-f(w^*)[1 - F(w^{**})]\frac{\partial w^*}{\partial c} + f(w^{**})[1 - F(w^*)]\frac{\partial w^{**}}{\partial c}}{2[1 - F(w^*)]^2} \quad (7)$$

Consider the numerator. From Lemmas 2 and 3,

$$\frac{\partial w^*}{\partial c} = \frac{\partial w^{**}}{\partial c} = (1 - \beta) \frac{\partial S}{\partial c}.$$

Then the numerator can be rewritten as

$$\begin{aligned} & (1 - \beta) \frac{\partial S}{\partial c} \left[\frac{f(w^{**})}{1 - F(w^{**})} - \frac{f(w^*)}{1 - F(w^*)} \right] [1 - F(w^*)][1 - F(w^{**})] \\ &= (1 - \beta) \frac{\partial S}{\partial c} [h(w^{**}) - h(w^*)][1 - F(w^*)][1 - F(w^{**})] \end{aligned}$$

where $h(t) = \frac{f(t)}{1 - F(t)}.$

Note that $\partial S / \partial c < 0$ from Lemma 1. It is obvious that the sign of $\partial D / \partial c$ depends on the shape of the hazard function. If the hazard function is monotonically increasing, $h(w^{**}) > h(w^*)$. Then $\partial D / \partial c < 0$.

The interpretation of the monotone-hazard-rate condition is particularly simple when there are only two possible levels of congeniality rather than a continuum.⁷ As the cost of search decreases, w^* and w^{**} increase by the same magnitude. This has two effects on the (*ex ante*) probability of divorce. The first effect is that it deters divorces previously occurred since some offers are not accepted in

⁷ I owe the interpretation to Jonathan L. Burke.

the first place as w^* rises. $f(w^*)/[1 - F(w^*)]$ is the proportion of marriages not dissolved after a decrease in the cost of search, among marriages formed and possibly dissolved before the decrease in the cost of search. The second effect is that it induces new divorces since some marriages are now dissolved after the congeniality of the marriage is revealed as w^{**} rises. $f(w^{**})/[1 - F(w^{**})]$ is the proportion of marriages (possibly) dissolved after a decrease in the cost of search, among marriages formed and never dissolved before the decrease in the cost of search. If the second effect dominates the first effect, the probability of divorce increases as the cost of search decreases. The monotone-hazard-rate condition ensures that this is indeed the case. Thus, if the hazard rate of the offer distribution is monotonically increasing, then the probability of divorce increases as the cost of search decreases.

III. DISCUSSION

BLM (1977) consider several determinants of search costs. In particular, they consider age at first marriage, premarital pregnancy, and rare traits. In this section I explore the association between the first two factors and marital dissolution in detail.

It has been well documented that age at first marriage is one of the most powerful predictors of marital dissolution (Bianchi and Spain, 1986; Martin and Bumpass, 1989). The younger the age at first marriage, the greater is the risk of divorce (even net of such relevant correlates of divorce as education and premarital pregnancy). BLM (1977) and Michael (1979) interpret this relationship as evidence for the positive association between search costs and the probability of dissolution. This interpretation may not be appropriate for a number of reasons.

First, there are numerous and varied factors besides search costs that determine age at (first) marriage. For example, Martin and Bumpass (1989) suggest the degree of emotional maturity, competence for marital roles, and educational and economic resources available.

Second, search theory predicts that the prolonged length of time spent searching for a mate should lead to a later age at marriage. However, a later age at marriage does not necessarily imply a long and thorough search in the marriage market. There are important differences between searching in marriage markets and labor markets. In labor markets, by definition, the unemployed are those who are looking for a job. However, in the case of marriage markets, it is hard to determine whether one is on the market at all (Cohen, 1987) or whether searching for a marital partner is actually occurring (Oppenheimer, 1988).

Third, recent empirical work unanimously shows that cohabitation has been linked to delay in marriage, but higher divorce rates (Teachman and Polonko, 1990). As Bumpass and Sweet (1989) point out, this evidence is surprising since "the termination of less propitious matches before marriage and the later age at marriage associated with cohabitation would lead to greater marital stability for

those who cohabit and marry" (p. 621). The evidence provides a powerful counterexample to the prediction that an increase in the minimum acceptable offer always reduces the probability of dissolution.

Next, I discuss the association between premarital pregnancy and marital dissolution. BLM (1977) argue that premarital pregnancy increases the probability of dissolution because it increases the cost of finding a suitable mate. According to BLM, women who become premaritally pregnant have an incentive to marry hastily because they want to legitimate their children, and because they become less valuable to other potential mates (p. 1151).

However, there are several factors which may make them less likely than others to dissolve their "shotgun" marriages (Moore and Waite, 1981). Research has found repeatedly that childless women have a higher probability of dissolution than women with children born in their marriages (Balakrishnan et al., 1987). Based on the NSFH (1987-88 National Survey of Families and Households) data, DeMaris and Rao (1992) have found that, compared to childless couples, having a premarital pregnancy reduces the risk of dissolution by 54 percent for males and 45 percent for females. Teachman and Polonko (1990) also report similar results.

It is conceivable that women are less highly valued in the remarriage market following a divorce than they were prior to their first marriage (Cohen, 1987). This is especially relevant to the divorced women with custody of a child or children. Moreover, the presence of children raises search costs in the remarriage market because "they raise the shadow price of the mother's time" (BLM, p. 1176). There is no reason to expect that women who become premaritally pregnant, and thus enter "shotgun" marriages, would find a better partner in the remarriage market after divorce than their current spouse. The above reasoning, coupled with BLM's argument, suggests that the net effect of premarital pregnancy on subsequent marital stability is theoretically ambiguous.

IV. CONCLUDING REMARKS

Our theoretical analysis shows that the impact of a change in search costs on the expected probability of dissolution depends on the shape of the distribution of marriage offers. Specifically, if the offer distribution possesses a monotonically increasing hazard rate property, an increase in search costs decreases the expected probability of dissolution.

We note that the monotone-hazard-rate condition is a fairly mild condition satisfied by many familiar distributions in economics, including uniform, normal, logistic, and under some restrictions on the parameters, Weibull, gamma, or beta. Indeed, as a referee points out, whether the distribution of marriage offers actually satisfies the monotone-hazard-rate condition is an empirical question.

The analysis of this paper is a partial equilibrium one in the sense that only individual searcher's decision about divorce has been discussed. An equilibrium search model should be developed to jointly analyze the divorce behavior of both

marriage partners.

Recent empirical findings on the relationship between cohabitation and marital stability pose a challenging question to labor and demographic economists. I think the economics of cohabitation should be shortly developed to explain why cohabitation is associated with a higher risk of divorce.

Appendix

(1) Derivation of w^* and w^{**}

Before determining w^* , consider the following cases.

If $\frac{w+\alpha}{1-\beta} \leq S$, $M(w) = W + \beta S \leq (1-\beta)S - \alpha + \beta S = S - \alpha < S$.

This implies that $V(w) = S$. On the other hand,

If $\frac{w+\alpha}{1-\beta} \geq S$, $M(w) = \frac{w}{1-\beta} \geq S + \frac{\alpha}{1-\beta} > S$.

This implies that $V(w) = M(w)$. Then it has to be that

$$(1-\beta)S - \alpha < w^* < (1-\beta)S + \alpha.$$

Note that on this interval, $M(w) = w + \frac{\beta}{2} \left(\frac{w+\alpha}{1-\beta} + S \right)$.

Equating S with $M(w)$ yields

$$w^* = (1-\beta)S - \frac{\beta}{2-\beta} \alpha.$$

On the other hand, w^{**} is defined by

$$w^{**} = (1-\beta)S + \alpha.$$

The distribution of Y is bounded from below by assumption. It is then possible that for some w , $w - \alpha \geq (1-\beta)S$. The implication is that for sufficiently high offers the searcher accepts the offer and then never gets divorced. w^{**} is the minimum of such offers.

(2) Proof of Lemma 1

Form the equations in the model, we get

$$\begin{aligned} S = & -c + \beta(1-q)S + \beta q F(w^*)S + \frac{\beta^2 q}{2} [F(w^{**}) - F(w^*)] \left(S + \frac{\alpha}{1-\beta} \right) \\ & + \frac{\beta(2-\beta)q}{2(1-\beta)} \int_{w^*}^{w^{**}} w dF(w) + \frac{\beta q}{1-\beta} \int_{w^{**}}^{\infty} w dF(w) \end{aligned}$$

Then applying the envelope theorem,

$$\frac{\partial S}{\partial c} = \frac{-2}{2 - 2\beta(1 - q) - 2\beta qF(w^*) - \beta^2 q[F(w^{**}) - F(w^*)]}.$$

The denominator is positive:

$$\begin{aligned} & 2(1 - \beta) + \beta q(2 - 2F(w^*) - \beta[F(w^{**}) - F(w^*)]) \\ & > 2(1 - \beta) + \beta q(2F(w^{**}) - 2F(w^*) - \beta[F(w^{**}) - F(w^*)]) \\ & = 2(1 - \beta) + \beta q(2 - \beta)[F(w^{**}) - F(w^*)] > 0. \end{aligned}$$

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