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Affection, Speed Dating and Heart Breaking

Discussion Paper

SP II 2013–309

August 2013

Research Area
Markets and Choice

Research Unit
Economics of Change

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Abstract

Affection, Speed Dating and Heart Breaking*

This paper explores the role of unilateral and idiosyncratic affection rents ('love') from being married with a specific individual in a matching model with individuals with heterogenous matching frequencies. We show that individuals suffer in expectation from being matched with individuals with high matching frequency. High-frequency daters have high reservation utilities for entering into a marriage. This makes them turn down many offers and makes them appear as 'heart-breakers'.

Dieses Paper untersucht ein Matching-Modell, in dem Heiratsentscheidungen auf der Basis von gegenseitiger Zuneigung ("emotionalen Renten") getroffen werden. Die Rolle von Einkommen und sozialem Status wird in der Analyse bewusst ausgeblendet. Es zeigt sich: Personen, die häufiger als andere Personen auf neue mögliche Partner treffen (sogenannte "Speed Dater"), neigen dazu, auch dann weiterzusuchen, wenn die Zuneigung zu einem gerade aktuellen Partner bereits sehr hoch ist. Speed Dater wirken deshalb oft als "Herzensbrecher", obgleich ihr Verhalten nur aus ihrer Optimierungssituation entspringt, in der sie ihre Entscheidung treffen. Die Existenz solcher "Speed Dater" verschlechtert zudem die Situation für Personen, die eher selten auf mögliche neue Partner treffen.

Keywords: marriage, affection rent, love, matching, non-hierarchical heterogeneity

JEL classification: J12

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I thank Salmai Qari for comments. The usual caveat applies.

1 Introduction

In this paper we analyze the role of heterogeneity in dating frequencies in a matching framework in which emotional affection and emotional rents from spending one's life with one's significant other is the main motivation for marriage. We identify a negative externality which individuals with a high-frequency of matching cause other individuals that results from their different behavior in terms of their decision of whether or not to propose. Intuitively, such high-frequency daters can afford to be picky, and will be picky in equilibrium due to the fact that they choose from a larger set of possible patterns in a short amount of time. Rejecting a partner is less costly for high-frequency daters than it is for people who only meet very few partners in the same period of time. Therefore, they are more likely not to propose in a given match, hence causing matches that are futile for the partners involved.

As a consequence, high-frequency daters exhibit a tendency for a particular social behavior in equilibrium. They are 'heartbreakers' in the sense that they are more often proposed to than they themselves propose and eventually turn down a potentially large number of offers. As male persons, they meet one partner after the other in fairly short time intervals, only to turn them down after meeting them. Typical labels awarded to them are those of 'womanizers', 'playboys' or 'Casanovas' if they are male. Female persons who behave similarly are given labels that receive similarly low social approval.

These labels have a connotation that hints at emotional aspects of partnership and at moral categories. Our matching theory can explain the 'heart breaker' phenomenon as well as the social disapproval of such behavior. This theory does not resort to differences in the moral standards different individuals may have but explains the differences in behavior as an outcome of differences in constraints, and it explains the social perspective of this phenomenon as an outcome of externalities in search markets and of differences in matching frequencies. Empirically, one should expect considerable heterogeneity in this frequency due to a number of reasons. Some individuals are more afraid of being rejected when approaching a partner than others. Some persons may live in remote areas where they meet very few others, compared to inhabitants of metropolitan areas.[1] Job design and leisure activities also matter. And some persons may use institutions designed to increase the frequency by which they meet potential partners.[2]

The matching problem we consider is based on heterogeneity of match quality in terms of emotional affection, or the quality of the match-specific fit with respect to lifestyle and preferences.[3] Unlike heterogeneity along an objective, match-unspecific and vertically ordered characteristic such as income or status that dominates the marriage matching literature[4], we consider match quality of a person that is match-specific, non-transferable, and that cannot be ordered objectively: when person A meets person B, A may feel more or less of an affection for B, and B may feel more or less of an affection for A. Affection need not be mutual or reciprocal, and affection is idiosyncratic to the respective match. Examples of strong mutual feelings as well as asymmetric feelings make up for a large share of romantic literature. It is this type of non-vertical heterogeneity which we consider. More generally, we allow for independent, unidirectional and match-specific subjective benefits from partnership.[5]

[1] Gautier, Svarer and Teulings (2010) take the lower search frictions in cities as the starting point of their theoretical and empirical analysis of differences in migration patterns between rural and urban areas for singles and for married couples.

[2] Sports and dance clubs, 'speed dating services' which provide an institutional set-up which guarantees participants the opportunity to communicate with a certain number of potential partners in a very short time interval and internet partnership platforms are the most obvious and straightforward examples for this type of institution.

[3] Hitsch, Hortaçsu and Ariely (2010a) analyse internet dating services and find evidence for preferences for similarity along a number of characteristics.

[4] A selection of important contributions includes Mortensen (1982), Burdett and Coles (1997, 1999), MacNamara and Collins (1990), Bloch and Ryder (2000) and Smith (2006). See also Hitsch, Hortaçsu and Ariely (2010b) for an empirical account.

[5] To illustrate the non-vertical nature of this heterogeneity, such affection need not be grounded in objective characteristics that are considered desirable attributes more universally, such as wealth, social status or outstanding beauty. Edward the VIIIth, King of Britain, for instance, is known for his deep devotion to Wallis Simpson who was clearly

The assumption of idiosyncratic, match specific and potentially asymmetric benefits from marriage is a significant departure from the standard assumption of marriage matching models. Marriage matching models typically assume that individuals differ along one or several objectively ranked dimensions - *pizazz* in the language of Burdett and Coles (1997). Income or wealth are natural examples for pizazz. In these models pizazz is not a property that is 'in the eyes' of the matched partner and it does not change from one match to the other; it is a generally acknowledged and match independent invariant quality property of the individual. Such a ranking has important implications. When persons of different pizazz level are matched, in these models individuals like to be married with a partner with more pizazz. The decision whether to marry is always unidirectional: the high-pizazz partner is decisive, matching partners with less pizazz in a given match always aspire to attain an 'upward marriage', but the option is limited by the decision of the partner with more pizazz. In the equilibrium the decision outcome for a given match follows directly from the pizazz levels of the potential partners. There is a mutual, and also social, understanding, making it easier for the 'low pizazz' partner to understand and accept the reasons why the matched partner is not satisfied with their pizazz. A rejected partner is not left with a broken heart upon being rejected, not least because there exist no such emotions in the model. Actually, being matched with a partner of much higher pizazz or one with much lower pizazz is considered equally bad. Disappointment only arises because the current match is not sufficiently similar in pizazz.

The 'pizazz' model is rich, has a number of surprising properties and can explain a number of phenomena. But there is also a lot missing in such a model: passion, marriage for love, jealousy, unfaithfulness and many other elements that are important determinants in the marriage market - issues that

not of comparable social status, had been married before and can hardly be described as extremely good-looking. Nevertheless, Edward's utility from being together with her was sufficiently high for him to be willing to give up his kingdom for her. And rumors are that Wallis Simpson did not reciprocate the feelings he had for her to a similar extent.

make for a good novel or movie. In our framework, we disregard 'pizazz' completely, but we allow for match specific emotions such as partner specific affection, emotional attachment or love. Fernández, Guner and Knowles (2005), Anderberg and Zhu (2010) and Konrad and Lommerud (2010) and Hofmann and Qari (2011) have addressed this 'non-vertical' heterogeneity in matching market models.[6] A framework that allows for idiosyncratic preferences of varying levels of intercorrelation in male-female matches and considers their implications in the context of a Gale-Shapley matching mechanism is studied by Boudreau and Knoblauch (2010). Given the finite life-span of individuals, the mating market has strong elements of non-stationarity, leading to interesting dynamics by which the willingness to accept a given match quality over time, as in Alpern and Reyniers (1999, 2005). Our analysis resorts on assumptions that make the matching problem stationary, but introduces and focuses on heterogeneity of matching frequency. Smith (2002) studies a matching market for objects in which these objects can be traded between different matching partners repeatedly, allowing for idiosyncratic valuations of the objects and draws some conclusions from the analysis for a process of entering and leaving in temporary partnerships. Similarly, Booth and Coles (2010) consider 'romantic matching' and focus on the incentives for educational investment in a matching model in which these romantic reasons are the driving force for marriage decisions. Our research focuses on the impact of heterogeneity in dating frequencies for players' reservation utilities and their willingness to propose.

In the next section we describe the formal structure and characterize the Markov perfect equilibrium in the matching model. In section 3 we provide the comparative static properties of this equilibrium and interpret these results. Section 4 concludes.

[6]Huang, Jin and Xu (2012) acknowledge these dimensions and try to quantify their importance. Hess (2004) acknowledges the role of emotional benefits ('love') for the persistence of marriage.

2 The formal framework

Consider the following standard matching framework. There is a continuum I of individuals. Each individual who is currently in this set is matched with another individual as the outcome of a stochastic process. Suppose the two individuals i and j are matched at time t. At t, each decides whether or not to propose. If i and j mutually propose, they marry, leave the set I and stay together forever; no further decisions are to be made by them. They have a life as a couple for an infinite time horizon, giving them a constant flow utility $u_i(ij)$ and $u_j(ji)$ at each instant of time, the present value of which can be calculated using the discount rate $r > 0$ that is assumed to be exogenous, constant over time, and the same for all individuals. Individuals who marry are replaced by new elements of I which are clones of the individuals who leave the set. If either i or j does not propose, the marriage does not take place. In this case they stay as singles until the next marriage opportunity with another individual comes up. We assume I to be sufficiently large (or the matching process to be appropriately designed) to rule out any subsequent meeting of i and j. Until the next match, players receive a single's flow of utility, which is normalized to zero.

The matching takes place as a Poisson process. We do not look at the precise microeconomic underpinnings of this process, but we allow for differences in the Poisson process for different individuals. More precisely, some individuals are high-frequency daters. If Δ refers to an arbitrarily small time interval, their probability to meet at least one additional partner in this interval is $\eta\Delta$. The other part of the population are low-frequency daters, described by a matching probability $\lambda\Delta$, with $\eta > \lambda > 0$. We refer to these types as H-types and L-types and use subscripts H and L to indicate that variables refer to them, and we assume that a player's type as well as the size of the coefficients η and λ are exogenously given. Also, individuals do not change their type over time.

For any given match, we denote the exogenous and time invariant probability by which an H-type is matched with another H-type as $q_H \in (0, 1)$ and with an L-type with probability $1-q_H$. Similarly, an L-type is matched with an H-type with probability $q_L \in (0,1)$ and with an L-type with probability $1-q_L$. We do not describe the microfoundations of the matching process underlying these probabilities.[7]

Consider now the decision whether to propose. When individual i meets individual j, i learns about the flow of affection rent i would have spending his or her life with j, denoted as $u_i(ij)$. We assume that $u_i(ij)$ is a random draw from a uniform distribution with support $[0,1]$. Similarly, j meets i and immediately learns about $u_j(ji) \in [0,1]$. As discussed, $u_i(ij)$ may be the result of emotional attachment, sympathy or other aspects which explain why i likes being together with j. We do not assume that these benefits are mutually symmetric. Hence, $u_i(ij)$ and $u_j(ji)$ from a marriage between the two individuals i and j will typically be of different size. This assumption describes that affection need not be reciprocated; the intensity by which one person would like to be together with another person need not be symmetric for the same couple. Also, these utility flows are match specific: affection rents $u_i(ij)$ and $u_k(kj)$ from being together with j can be very different for two individuals i and k.

We search for stationary Markov perfect equilibrium (MPE). Decisions are made only at those points in time when unmarried players are matched. At those points of time the matched players must choose independently and have two local strategies: propose, or not propose. If and only if both players propose, they marry. Otherwise, they both stay unmarried and have to wait for the next match with new partners before making the next decision. The local strategy of a player i when matched with player j at time t could be a function of the whole history of the game up to that point and of t itself, and

[7] These assumptions are compatible with many possible microfoundations, as the matching problem has a sufficiently large number of degrees of freedom (shares of H-types and L-types, specific assumptions about correlation in the matching process). In particular, we do not require $q_L = 1-q_H$. For stationarity we adopt the standard assumption about replacement of marrying individuals who leave the set I. For a discussion of some of these issues, see Burdett and Coles (1999).

this may lead to other equilibria. We focus on Markov strategies, for which the local strategy of a player i is only a function of the state variables of the system that are payoff relevant for the player. As the composition of I and the matching process are invariant over time, the only state variables affecting the decisions of a player i are his or her marital status (being unmarried), the player's own matching frequency parameter, the frequency of types, and the players' affection rents $u_i(ij)$ and analogously for player j in this match.

We can now characterize the stationary MPE that has the highest marriage frequency as follows.

Proposition 1 *(i) An MPE in stationary strategies exists that is characterized by threshold strategies as follows: In any given match between i and j, low-frequency types i propose if $u_i(ij) \geq l$ and high-frequency types i propose if $u_i(ij) \geq h$, with l and h determined by the system of equations*

$$h = \frac{(1-h)^2}{2r}\eta(q_H(1-h) + (1-q_H)(1-l)) \tag{1}$$

$$l = \frac{(1-l)^2}{2r}\lambda(q_L(1-h) + (1-q_L)(1-l)). \tag{2}$$

The solution to (1) and (2) exists, has $h > l$ and is unique. (ii) In the equilibrium that is characterized by this solution, both low- and high-frequency types have a higher expected utility from being matched with a low-frequency type than being matched with a high-frequency type in this equilibrium.

Proof. To show (i), let us assume that this equilibrium exists and is characterized by threshold levels h and l for H-types and for L-types as in the proposition: individuals propose if and only if their match-specific affection rent is at least as high as the threshold level that applies. Let i be an H-type. We need to confirm that this equilibrium behavior is optimal for i, given that all other individuals follow this pattern. Consider individual i's local strategy choice: i is indifferent about whether to propose if the present value of staying unmarried in this time period, denoted as V_H, is equal to the expected present value of proposing. The individual prefers to propose (not propose) if the expected present value of proposing is higher (lower). Indifference can be approximated, in line with standard optimization considerations and using the assumption about uniform distribution of u_i, by

$$V_H = \frac{1}{1+r\Delta}\left[(1-p_H)V_H + p_H\frac{1}{r}\int_h^1 \frac{x}{1-h}dx\right] + o(\Delta) \tag{3}$$

with

$$p_H = \eta\Delta(1-h)(q_H(1-h)+(1-q_H)(1-l)). \tag{4}$$

Here, $r > 0$ is a discount rate defined further above. The probability p_H in (4) is the probability by which the unmarried H-type individual i is matched (at least) once in the time period Δ with another individual j in a sufficiently suitable match; that is a match for which i and j are both sufficiently affected by each other to find a marriage desirable. Consider (4) in detail: for small Δ, we can disregard the possibility of more than one match occurring in this time interval. Accordingly, the factor $\eta\Delta$ approximates the probability with which a match with some other individual j occurs for an H-type in that period. With probability $(1-h)$ individual i has sufficiently strong affection for j to propose. This is the case if $u_i(ij) \geq h$ for individual i. However, this is not enough for the marriage to take place: individual j must also be willing to propose. Recall that, as i is an H-type, the next individual j whom i is matched with is an H-type with probability q_H and an L-type with probability $1-q_H$. Moreover, using equilibrium behavior by all other players, the equilibrium probability that j feels sufficient affection for i to propose and chooses to propose is $(1-h)$ if j is an H-type and $(1-l)$ if j is an L-type. So, with probability p_H, the individual i marries and receives the utility flow u forever, where the expected u, conditional on $u \geq h$, is

$$\int_h^1 \frac{u}{1-h}du = \frac{1+h}{2}. \tag{5}$$

This flow is converted into a present value given a discount rate r by the factor $1/r$. Finally, the arbitrage condition uses the assumption that the utility flow of unmarried persons is normalized to zero. It further assumes that the match occurred at the end of the time interval Δ, which is accounted for by the term $o(\Delta)$, which is a second-order magnitude when Δ becomes infinitesimally short.

Marrying a person that yields a constant flow $u = h$ from being married with this person for an infinite time horizon yields a present value of h/r, given that the discount rate is r. To be indifferent between marrying this person and continuing to search, the continuation value must be $V_H = h/r$. Making use of this identity and dividing through by Δ, the condition (3) can be rewritten as

$$\frac{h}{\Delta r} = \frac{1}{1 + r\Delta} \left[(1 - p_H) \frac{h}{\Delta r} + p_H \frac{1}{\Delta r} \frac{1 + h}{2} \right] + o(\Delta). \tag{6}$$

Here, the discount factor $1/(1 + r\Delta)$ accounts for the fact that we consider the payoff outcome that emerges during a time interval of small, but positive length Δ, and $o(\Delta)$ accounts for payoff components that are of second order and approach zero if $\Delta \to 0$. Rearranging terms in (6) by collecting all terms containing p_H and $o(\Delta)$ on the right-hand side, inserting p_H from (4), simplifying and taking limits as regards $\Delta \to 0$ yields

$$h = \eta(1 - h)^2 (q_H(1 - h) + (1 - q_H)(1 - l)) \frac{1}{2r}). \tag{7}$$

Both sides of this equation are functions of $h \in [0, 1]$. The left-hand side is a linear function with positive slope 1 starting at $h = 0$ and reaching 1 for $h = 1$. The right-hand side starts at $\eta(q_H + (1 - q_H)(1 - l)) \frac{1}{2r}$ and is monotonically decreasing in h, reaching zero for $h = 1$. Accordingly, these two functions cross exactly once for any given l. We denote the $h-$coordinate of this intersection by $h(l)$ as in (1).

Similarly, the indifference condition for an L-type individual is

$$l = \lambda(1 - l)^2 (q_L(1 - h) + (1 - q_L)(1 - l)) \frac{1}{2r}). \tag{8}$$

This also defines a unique threshold level as a function of h, denoted as $l(h)$ in (2).

Overall, this defines the optimal threshold choice of a $H-$type ($L-$type) as a function of l (of h) as

$$h^*(h,l) = \begin{cases} 0 & \text{if} \quad h(l) < 0 \\ h(l) & \text{if} \quad h(l) \in [0,1] \\ 1 & \text{if} \quad h(l) > 1 \end{cases} \tag{9}$$

and

$$l^*(h,l) = \begin{cases} 0 & \text{if} \quad l(h) < 0 \\ l(h) & \text{if} \quad l(h) \in [0,1] \\ 1 & \text{if} \quad l(h) > 1 \end{cases} . \tag{10}$$

This establishes a continuous self-mapping on a compact set

$$\Phi(h,l) : [0,1] \times [0,1] \to [0,1] \times [0,1], \tag{11}$$

and this mapping has (at least) one fixed point (h,l) by Brouwer's fixed point theorem.

The fixed point of $\Phi(h,l)$ constitutes the thresholds h and l in the MPE. It is also clear from this that player i of type H (of type L) strictly prefers to propose if $u_i(ij) > h$ (if $u_i(ij) > h$) and not to propose if the reverse inequality holds strictly. This confirms that behavior described by the equilibrium behavior is i's optimal local reply to equilibrium behavior by all other players and anticipated equilibrium behavior in potential future matches and establishes that the fixed point of $\Phi(h,l)$ characterizes an MPE in stationary strategies.

We next show that a solution for (1) and (2) has $h > l$. A proof is by contradiction. Suppose that, for some $(q_H, q_L, \eta, \lambda)$ the condition $l \geq h$ holds. From (1) and (2) we have

$$\frac{\eta}{\lambda} = \frac{\frac{h}{(1-h)^2}}{\frac{l}{(1-l)^2}} \frac{q_L(1-h) + (1-q_L)(1-l)}{q_H(1-h) + (1-q_H)(1-l)} > 1. \tag{12}$$

Condition (12) implies that

$$\frac{q_L(1-h) + (1-q_L)(1-l)}{q_H(1-h) + (1-q_H)(1-l)} > \frac{\frac{l}{(1-l)^2}}{\frac{h}{(1-h)^2}}. \tag{13}$$

For $l \geq h$, for all possible values of q_H and q_L, the left-hand side is maximal if $q_L = 1$ and $q_H = 0$, which reduces the left-hand side to

$$\frac{(1-h)}{(1-l)}.$$

Replacing $\frac{q_L(1-h)+(1-q_L)(1-l)}{q_H(1-h)+(1-q_H)(1-l)}$ with this maximum in (12) leads to

$$\frac{\frac{h}{(1-h)^2}}{\frac{l}{(1-l)^2}}\frac{(1-h)}{(1-l)} = \frac{\frac{h}{(1-h)}}{\frac{l}{(1-l)}} > 1.$$

The last inequality can be transformed into $h > l$. This, in turn, contradicts the assumption $l \geq h$, and this contradiction completes the proof of $h > l$.

We turn now to uniqueness of the solution for (1) and (2). Consider the slope of $h(l)$ and $l(h)$. From (1) and (2) we obtain

$$\frac{dh(l)}{dl} = \frac{-(1-q_H)\eta\frac{(1-h)^2}{2r}}{(q_H(1-h)+(1-q_H)(1-l))\eta\frac{2(1-h)}{2r} + q_H\eta\frac{(1-h)^2}{2r} + 1} \tag{14}$$

and

$$\frac{dl(h)}{dh} = \frac{-q_L\lambda\frac{(1-l)^2}{2r}}{(q_L(1-h)+(1-q_L)(1-l))\lambda\frac{2(1-l)}{2r} + \frac{(1-l)^2}{2r}\lambda(1-q_L) + 1}. \tag{15}$$

The condition $h > l$ implies $\frac{dh(l)}{dl} \in (-1, 0)$ and $\frac{dl(h)}{dh} \in (-1, 0)$. This slope restriction, in turn, implies that $h(l)$ and $l(h)$ can intersect only once.

Turn now to property (ii). Recall that $h > l$ in the equilibrium. Consider an individual i who is matched with an individual j. Then, for $u_i(ij)$ smaller than the threshold (h or l , depending on i's type) i does not propose, and the decision of j whether to propose is not decisive. But for all $u_i(ij)$ exceeding the threshold, i proposes and has a rent that exceeds V_i by some margin if j proposes. For $h > l$, the probability that j proposes is higher if j is an $L-$type than if j is an $H-$type. ■

Proposition 1 establishes the existence of an MPE in stationary strategies and characterizes this equilibrium. The equilibrium is of a simple nature: it is characterized by threshold values of affection rents for high-frequency daters and low-frequency daters. Partners propose if their affection rent is at least as high as a threshold that depends on the individual's dating type, and a marriage takes place if both partners have affection rents in this match that are at least as high as their respective threshold rents. Conditions (1) and (2) characterize a unique set of thresholds and provide an underpinning for high-frequency daters to have a higher threshold than low-frequency daters. Given these different thresholds, the probability that a low-frequency dater is rejected by a high-frequency dater is higher than the probability that a high-frequency dater is rejected by a low-frequency dater.

Uniqueness of a solution to (1) and (2) is an important property. It does not imply, however, that the equilibrium described in Proposition 1 is the only MPE. For instance, lack of coordination in the simultaneous choices of whether to propose can support an MPE in which all players never propose. To see this, suppose that all players assume that all other players never propose. In this case each player who is matched with another player is indifferent about whether to propose, and one of the optimal choices is not to propose. These types of 'trivial' equilibria are, however, sensitive to a number of refinements. In what follows we therefore focus on the MPE that is characterized in Proposition 1.

3 Comparative statics

We can now answer a number of comparative static questions for the MPE that is described by the solution of (1) and (2). We find

Proposition 2 *A player of type H (of type L) benefits from an increase in η (an increase in λ) and from a decrease in λ (a decrease in η).*

Proof. The properties can be shown by analyzing the equilibrium conditions (1) and (2). Their slopes have been characterized in part (i) in the proof of Proposition 1. The slope restrictions of the functions $h(l)$ and $l(h)$ imply that

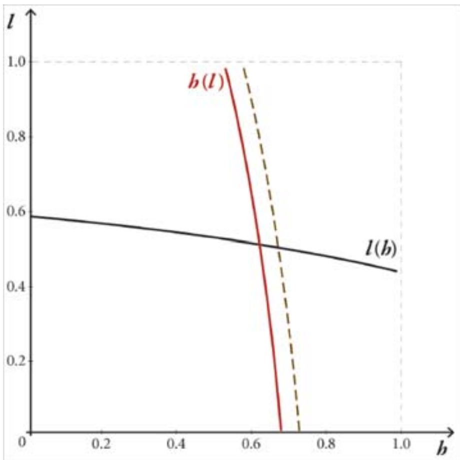

Figure 1: The solid curves represent $l(h)$ and $h(l)$ for values $\lambda = 1, \eta = 2$ and $q = 1/2$. Their slopes are in the range $(0, -1)$, implying that they intersect only once. The dashed line reveals how l and h at the intersection change if one of the two curves shifts.

$h(l)$ intersects $l(h)$ only once, and that $h(l)$ intersects $l(h)$ from the upper left to the lower right. The solid lines in Figure 1 illustrate these qualitative properties and map these curves for parameter values $\lambda = 1$, $\eta = 2$, $q = 1/2$ and $r = 0.1$. A change in η leaves $l(h)$ unaffected. However, an increase in η shifts $h(l)$ to the upper-right. This follows from the first derivative of (1) with respect to η. This change is illustrated in Figure 1 by the dashed line. This shift changes the point of intersection in line with Proposition 2: the threshold l is lowered and the threshold h is increased. As $V_H = h/r$ and $V_L = l/r$, these thresholds are proportional to individuals' continuation values V_H and V_L. This completes the argument for an increase in η. The argument for a reduction in η or a change in λ is fully analogous. ■

In conclusion, an increase in the frequency of matches for any of the two groups increases their own reservation utility but decreases the reservation utility of members of the respective other group. In particular, the low-frequency daters suffer from the existence of the high-frequency daters for any given λ, as long as they may interact with them, i.e., as long as $q_L > 0$. The introduction of high-frequency dating, hence, reduces match quality and life satisfaction of those who do not want to, or cannot, participate in this dating mechanism but still may accidentally be matched with speed daters from time to time. This hints at an important externality of matching mechanisms that works only for some segments of the population. It may also explain why - given this equilibrium behavior - social prejudices and a general negative attitude towards high-frequency daters may have developed.

We can also use the properties of the functions $h(l)$ and $l(h)$ to derive comparative static properties as regards the propensities by which the different types are matched with each other. As discussed previously, the microfoundation of the matching process has enough parameters (shares of $H-$types and L-types, matching frequencies, possible positive or negative correlation of matches of individuals of the same type) to consider variations of q_H and q_L independently.

Proposition 3 *A player of type L (of type H) has a lower (higher) expected payoff if q_L is higher. A player of type H (of type L) has a lower (higher) expected payoff if q_H is higher.*

Proof. An increase in q_L has no direct influence on $h(l)$. However, for a given h, an analysis of (2) shows

$$\frac{dl}{dq_L} = \frac{\frac{(1-l)^2}{2r}\lambda(l-h)}{\frac{2(1-l)}{2r}\lambda(q_L(1-h)+(1-q_L)(1-l))+\frac{(1-l)^2}{2r}\lambda(1-q_L)+1} < 0. \quad (16)$$

This implies that $dq_L > 0$ induces a shift of $l(h)$ in Figure 1 to the left, causing the coordinates at which $h(l)$ and $l(h)$ intersect to have a lower l and a higher h.

We can make an analogous argument for an increase in q_H. This increase leaves $l(h)$ unchanged, but it shifts $h(l)$ inward/downward, in analogy to (16). This leads to a new equilibrium with lower h and higher l. ■

Intuitively, recall that high-frequency daters have higher thresholds: $h > l$. If a player i is matched with a high-frequency dater, the likelihood that this high-frequency dater does not propose to i is higher than the likelihood by which a low-frequency dater does not propose to i. Accordingly, for any given rule by which i does or does not propose, the likelihood that a given match leads to a marriage is lower if the matched person j is a high-frequency dater. For a given match frequency, it is therefore bad news for a player if the probability for being matched with a H-type is increased. Waiting for a better match in the future becomes less attractive for an individual i of type L if q_L is higher and makes i propose to less attractive matches. This, in turn, is good news for H-types, as their probability of being proposed to in a given match goes up, and this makes them more selective. The same logic applies for $H-$types and an increase in their probability q_H of being matched with $H-$types.

4 Discussion and conclusions

The previous sections assumed that matched partners could observe the affection rent they had from being married with a matched partner at the time when they make the marriage decision. Alternatively, they may have to base their decision to propose on an expected value of $u_i(ij)$ prior to the marriage, rather than on a precise value. If divorce is not an option, then this does not make a difference for the analysis.

If a divorce option comes into play, then players have the option to return to the matching market if the marriage does not deliver a sufficient affection rent. We would expect that some of the qualitative results about differences between high-frequency daters and low-frequency daters can be sustained, as the first-order effects point in a similar direction. Suppose, for instance, that high-frequency daters' expected equilibrium continuation payoff as unmarried individuals is indeed higher than that of low-frequency daters. Then a divorce and the return to the matching market is more attractive for high-frequency daters. This, in turn, should induce them to leave a given marriage more easily if it turns out that the true realization of $u_i(ij)$ is low. If the precision of i's information on $u_i(ij)$ is very high at the point of marriage, divorce is a very rare event and the results of the main section should hold true unchanged.[8]

Note that these considerations about marriage with a divorce option can also be applied to pre-marital dating behavior. If the benefit of becoming married to a given matched partner cannot be immediately assessed in a new match (but needs a 'trial period' for her to find out whether the matched male is 'Mr. Right' and for him to find out whether the matched woman is 'Miss Perfect'), then each match that is potentially sufficiently suitable leads to a trial period. We can interpret a period in which two persons were matched and had dated each other as a kind of 'trial marriage' in which the two persons narrow down the $u_i(ij)$ and $u_j(ji)$ which they would likely have from marrying the partner they are matched with. What holds for a real marriage with a divorce option holds similarly for such a period of 'trial marriage'; the role of accumulated affection rents during the trial period, however, is less pronounced than in a marriage, given that the trial period is short. Their higher continuation value in the state in which they are neither married nor in a 'trial marriage' relationship is one reason why we may expect that high-frequency daters who date a low-frequency dater may be more likely to exit first. This behavior can contribute to the bad reputation of high-frequency daters as emotionally instable, irresponsible or emotionally unable to enter into a relationship. These considerations and a formal analysis of them, however, are left for future research.

Summarizing, participants in matching markets for marriage partners are heterogeneous along many dimensions. Much emphasis has been placed in the past on matching markets in which individuals are sorted along a quality

[8]If the precision of information on $u_i(ij)$ is sufficiently low, then another effect becomes relevant. Marriage has an option value: people may marry to find out more about their affection rent. Within a certain range, they propose even to partners which give them an expected affection rent that is lower than their reservation level of actual affection rent, because of the possibility that they are positively surprised by the match in the future. This option value is also different for daters with high and low matching frequency.

dimension ('pizazz') which provides an objective rank order or even a cardinal quality scale. Here we focus on matching markets in which this hierarchical dimension is fully absent. Potential partners are not better or worse in an objective sense. Instead, a player has some subjective and idiosyncratic benefit from marrying a particular matched partner. We called this benefit an 'affection rent'. This rent need not be mutual or symmetric. In this framework matched players marry if both partners' idiosyncratic marriage rent is sufficiently large.

We suggest this model as a decision framework for understanding marriage in matching markets because we think that it catches an important element in marriage markets wherein some individuals unilaterally or mutually feel affection for each other, but need not have similar or even stronger feelings of affection if meeting a more wealthy or more good-looking person. We show that heterogeneity along this 'non-hierarchical dimension' interacts with heterogeneity in the probability of being matched with new partners. We characterize a Markov perfect equilibrium in stationary strategies. The equilibrium shows that 'high-frequency daters' have a negative externality for 'low-frequency daters': their higher fall-back utilities as players participating in the matching process make them more reluctant to propose, thus, causing them to propose less frequently. As a result, if people of different matching frequency meet, the high-frequency dater is more likely to disappoint the low-frequency dater.

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