Sociability and the timing of first marriage

By

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ABSTRACT

This paper investigates, both theoretically and empirically, the effect of sociability on the age of marriage. Theoretically, a more sociable individual has higher chances of finding a suitable partner for marriage early in life, and hence is expected to marry earlier than an otherwise similar unsociable individual. On the other hand, a more sociable individual can afford to be more selective in choosing a mate and therefore will tend to postpone marriage until the most suitable partner is found. Using a survival model applied to Israeli data, we show that the first effect is dominant for relatively less sociable individuals, whereas the second effect is dominant for relatively more sociable individuals. Hence, people with intermediate levels of sociability will tend to marry earlier. In an era of increasing individualism and decreasing sociability, these results have important implications for marriage rates, fertility, housing markets and financial markets.

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INTRODUCTION

The pioneering work of Becker (1973, 1974) on the theory of marriage sets the foundations of empirical and theoretical research in that area. Following Becker, the marriage market literature can be summarised in the following questions: "Why marring?" or what are the economic gains from marriage and their division influence on the decisions to marry and stay married; "Who marry whom?" and does it determined by competition in the marriage market or is it the complementary marital traits which leads to assortative mating; "Why divorce?" or why in any given moment in time part of the population is single and why individuals enter into imperfect unions which end with divorce.

Many researchers have investigated the factors affecting the age of marriage, factors such as education, employment status, wage rate, social norms, and more. Education is generally assumed to have a negative effect on the age of marriage. Having a stable career may encourage the individual to get married; however, a well paid skilled employment may reduce one's benefits from marriage and therefore delays marriage.[1] Wage rate affects the gains from marriage and therefore affects marriage age, but the influence is different for men and for women. Becker (1973) and Keeley (1977) suggest that if both spouses are working and the male's wage rate exceeds the female's wage rate, an increase in the difference between male and female wage rates, increases the specialization benefits from marriage and hence decreases the age of marriage of both spouses. On the other hand, Bergstrom and

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[1] Anderson, Hill, and Butler (1987) find that skilled employment of both husbands and wives, especially professional employment, delays marriage relative to unskilled employment and unemployment. Oppenheimer (1988) finds that as long as men's economic role in the family remains of considerable importance, the age of marriage for both sexes will be heavily depended on the timing of young men's entry into relatively stable occupational careers.

Bagnoli (1993) argues that since it takes time to establish economic success, men may postpone marriage until their high incomes are revealed, making them desirable mates.[2] Social norms also play an important role on the marriage market.[3]

Despite the emerging literature on the age of marriage, to the best of our knowledge, there have not been any economic studies examining the relationship between the level of sociability and the age of marriage. The factor which is the closest to sociability is risk preference. Schmidt (2008) finds that highly risk-tolerant women are more likely to delay marriage. Schmidt argues that the individuals who are more risk tolerant have higher reservation value of an acceptable marriage partner, and therefore are less likely to find an acceptable mate and have, *ceteris paribus*, an older age at first marriage. This argument is relevant in job search models as well: individuals who are more risk tolerant will have a higher reservation wage and therefore a longer expected duration of unemployment.[4] Spivey (2010) also finds that a more risk-averse individual marries sooner than a more risk loving counterpart.

This paper sheds light on the effect of sociability on the timing of first marriage. Intuition would say that a more sociable individual (which has more social relationships in

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[2] Zhang (1995) and Danziger and Neuman (1999) results support Becker-Keeley theory. Danziger and Neuman (1999) find evidence also for Bergstrom and Bagnoli (1993) theory in a traditional society characterized with non-working wives.

[3] Yabiku (2006) finds that when the neighbourhood have attitudes favouring later marriage, marriage rates decrease. However, Balestrino and Ciardi (2008) argue that since the welfare state has replaced the family caring, social norms have lost their strength, such that individuals can afford the luxury of searching their preferred partners at length without feeling at odds with their social duties.

[4] See Feinberg (1977) and Pissarides (1974).

general) will have better chances of finding a suitable mate for marriage early in life, comparing to an unsociable individual. However, experience shows that sometimes it is the sociable individuals that postpone marriage or choose to engage in extramarital relationships.

We suggest the following explanation. Sociability affects the probability of marriage early in life in two opposite directions: (i) a sociable individual has the objective opportunity of marring sooner comparing to an unsociable individual, because the social individual has higher chances of finding a mate in the first place, (ii) however, since it is easy for the sociable individual to find a suitable mate, the sociable individual may be more selective in the process and postpone marriage until he (or she) finds the best match. Hence, it could be the case that an unsociable individual will marry sooner than a selective sociable counterpart.

This second effect would be weaker, the larger the cost of staying alone (after years of searching for a mate), due to (i) Economic costs of not sharing on household costs when living alone, (ii) Social costs - since being married is still a common trait, the expectations of society increases and therefore single individuals pay a social price, although in recent years divorce rates are increasing and the age of first marriage increases, (iii) Fertility costs – as time passes fertility decreases and the chances of having children is less likely for single individuals. For all of those reasons it could be that the compromise of the unsociable individuals will urge them into marriage early in life, just from the fear of remaining alone. This pressure to find a mate and marry increases with time, especially for women, because women's fertility period is shorter and hence their risk of remaining single is relatively high. Therefore, as time passes, we expect women to compromise even more on the reservation quality (or fitness) of their mate.

Theoretically, marriage and divorce issues are generally studied using search and matching models (SM)[5], taken from the job-search literature[6]. However, the economics of search is assumed to begin earlier, with Stigler (1961, 1962), suggesting the basic one-sided search model. McCall (1970) and Mortensen (1970) developed it into a sequential job search model, characterizing the job search decision in terms of the reservation wage, which is the lowest wage the worker is willing to accept[7].

Most of the search models, of either kind (one-sided or bilateral), assume a constant reservation wage/quality, allowing simplifying the setup in a stationary form. While this assumption allows elegant calculations and results, it is inconsistent with economic experiments in the labour market[8], since a worker will obviously compromise on available job offers if he or she is searching a job for quite a long time (because of wage loss, the need to professionally stay inform, and the loss of professional and social relationship). The marriage market is similar in that sense, since, as time passes, the individual pays a price for remaining single. Moreover, the marriage market is in some way more complex than the labour market. The gains are not so clear as net income, a matching could be of different

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[5] See Burdett and Coles (1997,1999), Shimer and Smith (2000), and Mortensen (1988). See also Weiss (2008), and Browning et al. (forthcoming) for a review of this literature.

[6] Gale and Shapley (1962) presented the algorithm solving the stable matching problem. This algorithm was extended into the labour market in search and matching models. See Mortensen (1982a,1982b), Diamond (1982a,1982b), Pissarides (1984,1985), and Burdett and Wright (1998). See also Rogerson et al. (2005) for a review of this literature.

[7] See also Mortensen (1977), Gronau (1971), and Lippman and McCall (1976).

[8] See Braunstein and Schotter (1981) and Cox and Oaxaca (1989).

types (not only the traditional marriage) and even a search may be obscure and involved with other activities[9] .

The matching model became popular over the last decade, since it allows both sides to accept or reject an offer, simultaneously. This advantage is important especially when studying the "who marry whom" question (the way men and women sort each other into marriage) and it is also suitable to the study of divorce (the continuous search when individuals are married). However, since we focus on the timing of first marriage (we do not model divorce or assortative marriage), we find the one-sided sequential search model to be the best framework for our study.

The rest of the paper is organized as follows. The next section presents the theoretical model, investigating the relationship between social relationship and the probability of marriage in early age. Afterwards we present the empirical model, studying the effect of social networks on the probability of being married, in Israeli data, using a survival function. The last section discusses the results and concludes with suggestions to future research.

THEORETICAL MODEL

The question we study is the relationship between sociability and the timing of first marriage. We suggest two opposite forces affecting the timing of marriage of both men and women:

(i) *Direct effect* – sociable individuals sample more partners at each time period, therefore their probabilities of finding a suitable mate for marriage in early years are higher compared to unsociable individuals. Hence we expect a sociable individual to find a mate sooner than an unsociable individual.

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[9] See Oppenheimer (1988) for further understanding of the similarities and differences between job-search theory and marriage markets.

(ii) *Indirect effect* – the chances of sociable individuals to find a suitable mate are high, even in later years, hence sociable individuals may be more selective in choosing a mate and will not be urged to marry early in life. Hence we expect a sociable individual, to find a mate later in life, compared to an unsociable individual.

Assumptions

We construct a sequential one-sided search model[10] with a finite time horizon[11], following the studies of Gronau (1971), Lippman and McCall (1976) and Cox and Oaxaca (1989) in order to study theoretically the relationship between sociability and the timing of first marriage. The aim of the model is to investigate the relationship between sociability and the probability of marriage in early years, presenting the two opposing forces affecting on marriage decision and studying the overall effect of sociability on the time of first marriage.

In each time period the individual is engaged in a search for a suitable mate for marriage. We assume no turnovers (neither divorce nor learning[12]), hence if the individual accepts an offer, the search is over. If the individual does not find a suitable mate, the search continues into the next time period. If the individual reaches the end of the search horizon

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[10] In a sequential search, in each time period the individual may accept an offer or reject and continue the search to the next time period.

[11] An infinite time horizon search model, by its stationary nature, provides simple and elegant mathematical results, and is therefore more common in the search literature. It has been derived numerous times in the economic literature since the basic search model of Stigler (1961). However, the infinite horizon model lacks the compromising nature of individuals when reaching the end of the horizon, and hence may affect the model qualitative results.

[12] Adding divorce in the model will probably affect the quantitative results since it may affect the individual's utility from marriage, however, the qualitative result should not be affected.

unmarried, the individual incurs staying alone costs (that include social, economics, and fertility costs). The sociability level is measured by the individual's probability of finding any mate in each time period. To simplify the exposition we assume that this probability is fixed with time[13]. Since the horizon is finite, as time passes, the individual become less selective on choosing a mate because of the high cost of staying alone in the end of the search horizon.

We specify a search horizon of T periods. In each time period, there is a probability s (the sociability level) that an individual will find a mate. If the individual finds a mate this mate has unique characteristics which would result with a utility u for the individual if the individual decides on marring this mate. u is a random variable with a density function $f(u)$. It is assumed a fixed distribution of mates' utilities. The minimal level of u is zero and the maximal level of u is $\bar{u}$. It is also assumed that there is no discount factor, no search costs, but there exists a cost, C, at the end of the last period (cost of remaining single)[14]. In each time period, the individual decides on a reservation utility level, u_t, that is the minimal individual's utility for which the individual will stop the search and get married.

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[13] In fact, the probability of finding a mate is supposed to decrease with time, since with age, the available mate population for each individual is smaller (it is also reasonable to assume that it would decrease faster for women comparing to men). Still, for simplification reasons, we assume that the sociability level is constant. Assuming otherwise would make the qualitative results even stronger, since as time passes, an individual will compromise even more, if the probability of finding a mate decreases.

[14] A discount factor and search costs would not affect the qualitative results, and therefore for simplification reasons we left them out of the model. However, C, the cost of remaining single, is the main reason for compromising on mate's utility, and hence it is an important variable in our model.

Model

Let M_t be the conditional probability for marriage in period t, which is obtained by multiplying the probability of finding some mate (the sociability level), s, by the probability that the mate's utility is above the reservation level, u_t. That is

$$(1) \qquad M_t = s \int_{u_t}^{\bar{u}} f(u)du.$$

If the individual finds a suitable mate in period t for which $u \geq u_t$, then the individual marries the mate and receives utility u. If the individual do not marry a mate in period t, with probability $1-M_t$, then the individual continues the search in period $t+1$ receiving an expected utility, E_{t+1}. Hence, the time-period expected utility from a search in period t, E_t, is

$$(2) \qquad E_t = s \int_{u_t}^{\bar{u}} uf(u)du + (1-M_t)E_{t+1}.$$

Using (1), we arrange E_t as

$$(3) \qquad E_t = E_{t+1} + s \int_{u_t}^{\bar{u}} (u - E_{t+1})f(u)du.$$

Maximizing the expected utility in period t, E_t, with respect to u_t, provides the reservation utility[15]

$$(4) \qquad u_t^* = \begin{cases} E_{t+1}, & E_{t+1} > 0 \\ 0, & E_{t+1} \leq 0. \end{cases}$$

Since there is no negative utility of mates (the minimal utility is zero), as long as the expected utility is negative (which would be for at least the last period, but could continue backward to several periods), the individual compromises on any mate the individual finds

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[15] Since $dE_t/du_t = -sf(u_t)(u_t - E_{t+1}) = 0$, it follows that $u_t^* = E_{t+1}$, except for negative E_{t+1}.

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and therefore determines the reservation utility as zero. However, if the expected utility is positive the reservation utility is equal to the expected utility in the next period. Hence, for all t:

$$(5) \qquad E_t^* = E_{t+1}^* + s \int_{E_{t+1}^*}^{\bar{u}} (u - E_{t+1}^*) f(u) du.$$

The optimal sequence of reservation utilities can be derived by backward recursion as follows. At the end of the search horizon, there is no further search and hence if the individual has not found a mate, the individual incurs the cost C

$$(6) \qquad E_{T+1}^* = -C.$$

Since the expected utility at $T+1$ is negative, the reservation utility at period T is zero. Hence,

$$(7) \qquad E_T^* = -C + s \int_0^{\bar{u}} (u + C) f(u) du.$$

We can see that $E_T^* > E_{T+1}^*$, and since $s \int_{E_{t+1}^*}^{\bar{u}} (u - E_{t+1}^*) f(u) du > 0$ (which is positive no matter whether E_{t+1}^* is zero or positive), we then see by (3), that $E_t^* > E_{t+1}^*$ for all t, since we always add a positive component to E_{t+1}^*. Hence, as time passes an individual's expected utility from a search decreases and also the periodic reservation utility decreases. The intuition is that when the individual is closer to the end of the horizon, the individual compromises more on the mate's utility.

Proposition 1: *The periodic expected utility, E_t^*, is increasing with sociability level, s.*

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This proposition is intuitive since the larger the probability of finding a mate, the larger is the periodic expected utility from a search. The proof is made by induction. First we prove the proposition for *t=T:*

$$(8) \qquad \frac{dE_T^*}{ds} = \int_0^{\bar{u}} (u + C) f(u) du > 0.$$

Then we assume that $dE_{t+1}^* / ds > 0$ and prove that $dE_t^* / ds > 0$.

by (5)

$$(9) \qquad \frac{dE_t^*}{ds} = \frac{dE_{t+1}^*}{ds} \left(1 - s \int_{E_{t+1}^*}^{\bar{u}} f(u) du \right) + \int_{E_{t+1}^*}^{\bar{u}} (u - E_{t+1}^*) f(u) du > 0.$$

For all t. Since, by assumption, $dE_{t+1}^* / ds > 0$, and since the first parentheses is one minus a probability, dE_t^* / ds is positive for all t. ∎

The reservation utility, u_t^*, is therefore, also increasing with *s* as long as E_t is positive, since $u_t^* = E_{t+1}^*$.

By (1) and (4), the probability of marriage is

$$(10) \qquad M_t^* = s \int_{E_{t+1}^*}^{\bar{u}} f(u) du.$$

Hence,

$$(11) \qquad \frac{dM_t^*}{ds} = \int_{E_{t+1}^*}^{\bar{u}} f(u) du - s f(E_{t+1}^*) \frac{dE_{t+1}^*}{ds}.$$

We can see that the derivative is composed of two parts:

(i) A positive part, $\int_{E_{t+1}^*}^{\bar{u}} f(u)du$ – a higher s directly increases the chances of finding a

mate and therefore increases the probability of marriage.

(ii) A negative part $-sf(E_{t+1}^*)\dfrac{dE_{t+1}^*}{ds}$ - a higher s increases the individual's reservation

utility (since the individual is more selective) and hence, indirectly decreases the

individual's chances of finding a mate and therefore decreases the probability of

marriage.

Theorem: *Assuming a uniform distribution of utilities and two periods t=1,2, the relationship*

between the probability of marriage in period 1, M*₁, and the sociability level, s, is an

inverse U-shaped.

First, we solve the model for two periods, t=1,2 assuming a uniform distribution of utilities[16],

and obtain

$$(12) \qquad E_2^* = -C + s\int_0^{\bar{u}} (u+C)f(u)du = -C(1-s) + s\frac{\bar{u}}{2}.$$

If $E_2^* \leq 0$ then $M_1^* = M_2^* = s$. The meaning of such case is that the cost, C, is so high

such that the individual is compromising on any mate the individual finds in period 1 and 2.

In such case obviously the relationship between s and M_t^* has only the positive part since the

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[16] We assume that each individual's rank of utilities depends on his or her own subjective

preferences (that means that a higher utility corresponds to a more similar mate, and not

necessarily to higher level of education or higher salary), therefore a uniform distribution is

the most appropriate one under this assumption. If one would consider an objective rank of

mates' utilities, a normal distribution would be more appropriate.

individual is always compromising. Investigate further into a three or more periods would probably obtain a positive expected utility for which the solution is more interesting. Alternatively, we may assume that $E_2^*>0$, and hence

$$(13) \qquad M_1^* = s \int_{-C(1-s)+s\frac{\bar{u}}{2}}^{\bar{u}} f(u)du = s\left[1+C(1-s)-s\frac{\bar{u}}{2}\right].$$

Then, we find the first and second derivatives of M_1^* with respect to the sociability index s:

$$(14) \qquad \frac{dM_1^*}{ds} = \left[1+C(1-s)-s\frac{\bar{u}}{2}\right]-s\left(C+\frac{\bar{u}}{2}\right).$$

We can see the two opposing influences on the probability of marriage in the first period:

(i) The positive part, $\left[1+C(1-s)-s\frac{\bar{u}}{2}\right]$

(ii) The negative part, $-s\left(C+\frac{\bar{u}}{2}\right)$.

We can easily see that for $s=0$, dM_1^*/ds is positive and for $s=1$, dM_1^*/ds may be negative. The second derivative is obtain by

$$(15) \qquad \frac{d^2M_1^*}{ds^2} = -\left(2C+\bar{u}\right)<0.$$

Hence the probability of marriage in period 1 first increases with sociability level and then may decrease, as can be seen in figure 1.[17] ∎

The marriage probability of an unsociable individual, who can hardly find any mate, would be low. Similarly, the marriage probability of a very selective sociable agent, who

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[17] The graphs are based on different values of C and $\bar{u}$. The relative difference between C and $\bar{u}$ determines the relative proportion of the increasing part and the decreasing part of the graph. The qualitative results are the same as long as both parts exist.

delays marriage in order to find the most suitable mate, would also be low. It follows that the highest probability of marriage would characterize the intermediate sociability level.

If we compare two different individuals with different sociability levels, s_1 and s_2, where $s_1 < s_2$, their probabilities of marriage would depend on the location of s_1 and s_2 on the graph. More precisely, if the both individuals are relatively unsociable (s_1 and s_2 are on the increasing part of the graph), they are both very compromising and then direct effect would be dominant. Hence the individual who has the higher chance of finding a mate (the more sociable one) will have a higher probability of marriage. However, if both individuals are relatively sociable (s_1 and s_2 are on the decreasing part of the graph), they both have high chances of finding a mate and therefore the indirect effect would be dominant. Hence the one who is more selective (which has a higher sociable level) has the lower marriage probability.

From (13) we can derive two comparative static results, one with respect to the maximal level of utility $\bar{u}$, and another with respect to the staying alone costs, C.

Proposition 2: *As the maximal utility $\bar{u}$ increases, the probability of marriage in period 1,*

M_1* decreases, and this effect become stronger as s increases. (16) $\qquad \dfrac{dM^*_1}{d\bar{u}} = \dfrac{-s^2}{2} < 0.$

That is, the probability of marriage in a particular age decreases as the maximal utility increases. Further:

$$(17) \qquad \frac{d^2 M^*_1}{d\bar{u}\,ds} = -s < 0. \quad \blacksquare$$

That means that a more sociable individual tends to postpone marriage more than a less sociable individual, as $\bar{u}$ increases. The intuition is that the magnitude of $\bar{u}$ has a stronger effect on more sociable individuals who aim to higher utility levels. This is demonstrated quite clearly in figure 1.

Proposition 3: *As the cost of staying alone, C, increases, the probability of marriage in period 1, M_1* increases, and this effect is larger for intermediate levels of s.*

$$(18) \qquad \frac{dM^*_1}{dC} = s(1-s) > 0.$$

That is, the probability of marriage in early age increases as the cost of remaining single increases. This is quite intuitive. Further:

$$(19) \quad \frac{d^2M^*_1}{dCds} = 1 - 2s$$

$$(20) \quad \frac{d^3M^*_1}{dCds^2} = -2 < 0. \ \blacksquare$$

This means that an individual with an intermediate level of sociability tends to rush into marriage more than individuals with high level or low level of sociability, when the cost of remaining single is higher. The intuition is that as the cost of staying single, *C*, increases, an unsociable individual will tend to hasten marriage, but unfortunately he or she has not many choices to choose from. On the other hand, a sociable individual will not be so affected by these costs, since he or she is quite sure in their ability to find a mate. It happens that the main influence would be on the intermediate level of sociability. This is also illustrated very clearly in figure 1.

EMPIRICAL MODEL

Data

The data for this research were taken from the Israeli Social Surveys for the years 2002-2007. These surveys are conducted by the Central Bureau of Statistics, and are based on intensive one-on-one interviews. The questionnaire is exceedingly comprehensive, including hundreds of questions. It collects personal and socioeconomic details and covers various facets of life, such as self-defined national and religious identities, education, employment status, employment history, income, housing, health status and illnesses, habits of computer and internet use, relations with family and friends, and engaging in volunteer activities and leisure activities.

We limit the sample to Jewish households. The reason is that our index of social networks is based on questions regarding the frequency of meeting with friends. The questionnaire also included similar questions about meeting with family members. Israeli Arabs tend to live at villages with their extended families and thus the distinction between "friends" and "family members" may not be clear. We also limit the sample to single individuals or those who married for the first time in the year prior to the survey. This is because we only have information of social ties for the time of the survey, while the individual's decision to get married may be influenced by social ties from earlier periods. We minimize the impact of this problem by eliminated individuals who got married in earlier periods, for whom the information on current social ties may not be accurate. In addition, we eliminate people with children, because children affect the social ties of their parents (Heizler and Kimhi, 2011), in a way that is unrelated to the social ties that affect the marriage decision.[18] Finally, we limit the sample to individuals up to 35 years of age, because around this age unmarried women begin hearing the biological clock ticking, and thus we assume

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[18] Only 4% of the under-35 sample who were single or married in the previous year had children.

that individuals who want to get married will do it up to age 35.[19] Overall, the sample we used under these constraints included 7,039 individuals, of which 3,995 are males and 3,044 are females.

Our key explanatory variable is the level of social networks, which we measured by the frequency of contacts. Frequency of contact is a possible proxy to social networks (see Kanas et al, 2011).[20] We used two questions from the questionnaire: (i) *"Do you have friends that you meet with or talk to on the phone (including fax and email)?"* and (ii) *"(If you have friends) how often do you meet these friends, or talk to them on the phone?"* The respondents answered the latter question on a 1 to 4 scale: (1) daily, almost daily, (2) once or twice a week, (3) once or twice a month, or (4) less than once a month. We created the variable "*level of social networks*" which includes three categories: High level - meets with friends daily, or almost daily; Intermediate level - meets with friends between once or twice a week to once or twice a month; and Low level - does not have any friends or have friends but meets them once or twice a month or less. As we can see in table 1, bout 70% of the sample individuals are in the high level of social networks and less than 3% are in the low level.

Table 1 also shows additional explanatory variables that we use, and their descriptive statistics. Respondents were asked to self-define their religious identity. About 4.5% of the sample are ultra-orthodox ("haredim"), about 7.5% are religious, and about 10.5% are traditional religious.[21] This defines a scale of religiosity, with the ultra-orthodox being the

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[19] Our results did not change qualitatively when we increased the age to 40.

[20] Another possible proxy is the size of the social networks (e.g. Allen, 2000), but we do not have this information. It should be noted that these proxies are positively correlated.

[21] While "haredim" and "traditional religious" are definitely religious, the Social Survey questionnaire uses "religious" as a distinct category, meaning "religious but not haredim and not traditional religious". We keep this terminology here.

most religious while "others" are the least. About 15% of the sample individuals are new immigrants.[22] The rest includes immigrants and natives. Because of the differences in the immigrants cultural backgrounds which might affect the age of marriage, we distinguish between "Sepharadi" (oriental Jew) – an individual who immigrated from Asia or Africa before 1990 or his/her father was born there and "Ashkenazi" – an individual who immigrated from America or Europe before 1990 or his/her father was born there. About 27% of our sample individuals are defined as Sepharadi and about 17% are defined Ashkenazi. The others (the about 40%), were born in Israel to Israeli-born fathers.

Females are more educated than males in the sample. 12.5% of the males and 10.5% of the females have a post-secondary, non-academic, degree. Between 11.5% (males) and 16.5% (females) of the sample have a B.A. degree. Between 2% (males) and 3% (females) of the sample have an M.A. or Ph.D. degree. Between 19% (males) and 10.5% (females) of the sample have been in a regular military service during the last year. About 73% of the sample declared that their health is very good.

Empirical methodology

We examine the roles of the level of social networks and other explanatory variables in the determination of the age of marriage using the Cox proportional hazard model (Cox 1972). The model considers the time from age 18 until first marriage as the dependent variable.[23] The two basic concepts of duration models are the hazard function and the survival function. The hazard function $h(t,Z)$ is defined as the probability of leaving a given

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[22] 1990 marks the beginning of the massive immigration wave from the former USSR to Israel. Hence, we define "new immigrants" as those who immigrated since 1990.

[23] The minimum legal age to get marriage in Israel is 17, but all the individuals in our data got marriage on age 18 or over.

state at duration t conditional upon staying there up to that point given a vector Z of covariates. In our case, leaving the state is getting married. The hazard rate into marriage at time t is expressed as follows:

$$(21) \quad h(t,z) = h_0(t)\exp(B'Z),$$

where $h_0(t)$ is an unspecified time-dependent function (baseline hazard faced by everyone at time t), Z is vector of covariates and B is a vector of unknown coefficients. The model is semiparametric in the sense that the baseline hazard does not have to be specified for the estimation. The term "proportional hazard" stems from the fact that the ratio of hazards of two different individuals is independent of time. Note also that for two individuals that differ only in the level of a binary explanatory variable z_k, the ratio of hazards becomes $\exp(b_k)$. This is denoted as the hazard ratio.

The survival function reveals the probability of surviving (remaining) in a specific state. The survival function is defined as the probability that a spell lasts at least T periods. This type of spell, where we do not observe the end of the spell, is called right-censored.[24] In our case, this is the spell of remaining unmarried.[25] The likelihood function of the model is constructed such that the hazard function applies to individuals with a complete spell (those who got married) while the survival function applies to individuals with a right-censored spell (those who remained single).

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[24] Note that censoring is individual-specific, since not all individuals started the spell at the same time, while the data is observed at the same time.

[25] Using the Cox proportional hazard model for estimating the timing of marriage and divorce is very common. See for example, Anderson et al. (1987), Lehrer (2008), Gutiérrez-Domènech (2008), and Spivey (2010).

Results

The estimation results of the Cox proportional hazard model are presented in Table 2 separately for males and females. We report the coefficient and the hazard ratio of each variable.

We begin by presenting the coefficients of the variables describing social networks. As the theoretical model predicted, males having a high level of social networks as well as those having a low level of social networks, have lower hazard rates compared to males with an intermediate level of social networks. This result means that there is an inverse U-shaped relationship between the conditional probability of marriage and the level of social networks. It should be noted that having a high level of social networks decreases the conditional probability of marriage less than having a low level of social networks. Specifically, males with a high level of social networks face hazard rates that are 70% of the hazard rates faced by males with an intermediate level of social networks. Males with low level of social networks face hazard rates that are 52% of the hazard rates faced by males with an intermediate level of social networks. Among the females, an inverse U-shaped relationship between the conditional probability of marriage and the level of social networks is also obtained. However, the coefficient of having a low level of social networks is not statistically significantly.[26] These results are presented in figure 2. The numbers were normalized, such that the low level receives a hazard ratio of 1, and the intermediate and high level of sociability receives values relative to the low level. Note that the values denote hazard ratios rather than probabilities, and that male hazard ratio of 1 is not comparable to female hazard ratio of 1.

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[26] Because of the small number of observations with a low level of social networks, we also estimated the model while excluding this category of social networks (Appendix 1), and the results have not changed qualitatively.

Let us now discuss the coefficients of the other explanatory variables. We find that as the individual belongs to a more religious group, the hazard shifts up and increases the conditional probability of marriage significantly, for both males and females. For example, the most religious males, the ultra-orthodox, face hazard rates that are more than nine times higher than the hazard rate faced by non-religious males. This finding is in line with Gutiérrez-Domènech (2008) who found that religious individuals are more likely to get married. It should be noted that when the ultra-orthodox, the most religious people who tend to get married with match making, were taken out from the analysis, our results did not change qualitatively (see Appendix 2).

Compared to individuals who were born in Israel as well as their fathers, being "Sepharadi" (oriental Jew) shifts the hazard down and decreases the conditional probability of marriage, for both males and females. This effect becomes insignificant when we omit the ultra-orthodox (see, Appendix 2). Being a new immigrant shifts the hazard up and increases the conditional probability of marriage, but only for females. This latter effect is not significant for males. Being "Ashkenazi" does not affect the probability of marriage compared to native Israelis.

Among females, having a post secondary degree increases the hazard rate compared to less educated people. Females with higher levels of education are not significantly different from the less educated. It means that education initially increases the conditional probability of marriage and subsequently decreases it. For males, the effect of education on the age of marriage is not significant.[27] This result could follow from the fact that high education on one hand induces the individual to delay the marriage, but on the other hand

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[27] We tried, alternatively, to distinguish between students and graduates or to shift students for advanced degrees to the category of "M.A.\Ph.D degree", but the results have not changed.

studying at a university increases the individual's chances of meeting potential spouses. The positive effect may cancel the negative effect.

We include the military service only in the males' regression because for females it is highly correlated with religious group and may be dependent on the age at marriage rather than causing it.[28] Military service at the previous year increases the hazard rate of males, but the effect is only marginally significant. As expected, good health increases the hazard rate and the conditional probability of marriage, for males and females alike.

As aforesaid, the literature offers two opposing hypotheses on the relation between wage and age at marriage. Becker (1973) and Keeley (1977) proposed that the relation between men's earnings and the age at marriage will be negative because the benefit of marriage decreases with wage, while Bergstrom and Bagnoli (1993) suggested the opposite. We did not find significant effect of wage on the age at marriage. We also did not find significant effect of employment status on the age at marriage. These results can be due to the fact that about 33% from our sample individuals are currently in school. Thus, their current employment status and wage are not representative of their future employment status and wage. The literature indicates that type of locality (rural or urban, the size of the locality) can affect age of marriage (see for example, Gutiérrez-Domènech, 2008). The sample includes information only on current locality of residence, but not on previous, thus we could not examine its effect. We also did not find significant effects of internet-using habits and car ownership on the age of marriage.

DISCUSSION

This paper investigated, both theoretically and empirically, the relationship between sociability level and the age of marriage. To the best of our knowledge, this is first attempt to

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[28] In Israel, married and religious females are exempted from military service.

examine this relationship. In the theoretical model, we presented two opposing factors affecting the relationship between sociability and the age of marriage: (1) a direct effect - a sociable individual has more chances of finding a suitable partner for marriage early in life, and hence he (or she) is expected to marry earlier than an otherwise similar unsociable individual, (2) an indirect effect - a sociable individual is more selective in choosing a mate and therefore will tend to postpone marriage until he (or she) finds the most suitable partner. Since the two effects work in opposite directions, it is not clear, in advance, which effect would be dominant and under what conditions.

We developed a one-sided search model, with a finite time horizon. Solving the model for two periods, under the assumption of uniform distributions of utilities, yielded an inverse U-shaped relationship between the sociability level and the probability of marriage in the first period. That is, individuals with an intermediate level of sociability will tend to marry at young ages, compared to individuals with either low or high level of sociability (see figure 1). The explanation for this result is as follows: Unsociable individuals have a hard time finding a mate, and therefore will take more time to find a suitable mate for marriage. Thus, the direct effect will be dominant for them, so that an increase in their sociability level will increase their chances of finding a mate and getting married. Sociable individuals, on the other hand, who have many social relationships, can find a mate easily, and therefore can be more selective and tend to delay the age of marriage until they find the most suitable mate. Therefore, the indirect effect will be dominant for them. An increase in their sociability level will increase their selectivity and thus they will further postpone marriage. The result is that individuals who marry at early ages would be those who are sociable enough to find a mate quickly, but not too complacent to delay marriage.

The empirical model estimated the probability of being married as a function of the sociability variable, which is the "level of social networks", and other explanatory variables,

using a survival model. Our main finding is as predicted by the theoretical model. Namely, the relationship between the level of sociability and the age of marriage is inverse U-shaped. This can easily be seen in figure 2, where the normalized hazard ratios (from table 2) of those with intermediate and high sociability levels are presented relative to those with low sociability levels, for both males and females.[29] It can also be seen that the marriage probability of men with a high level of sociability is higher than the marriage probability of men with a low level of sociability, while the opposite is true for females. It could be that women are in general more willing to compromise when choosing a mate, because their time horizon is shorter than the time horizon of men, and hence it is only the very sociable women who can afford to be selective in choosing a mate. Another explanation is related to the fact that the gaps between the ordinal sociability levels are different for males and females. If, for example, the gaps between women's low and intermediate sociability levels are smaller than the respective gaps between men's sociability levels, the effect of an increase in sociability on the probability of marriage would be smaller for women.

In general, a theoretical model and empirical results cannot be fully congruent, since a theoretical model requires the use of simplifying assumptions, while the empirical results cannot fully grasp all possible cases. However, as in our case, if the empirical results support an important theoretical theorem, we can say that the theoretical model serves a good predictor and that the empirical results reflect the model predictions well. Indeed, the main hypothesis in our paper, that is an inverse U shape relationship between sociability and the timing of first marriage, was obtain both theoretically and empirically. However, it is

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[29] It should be noted that the difference in the probability of marriage between females with intermediate levels of sociability and females with low levels of sociability is not statistically significant.

important to understand the limitations of our predictions and to suggest future extensions for this paper.

In the theoretical model we assumed no divorce, no second marriage, and also no other forms of marital relationship. Future research may use a search model with turnovers in order to study the influence of these factors in a marriage cycle. We also assumed that sociability level is constant over time; the relationship between sociability level and age or marital status is also needed to be further investigated. Finally, we used a one-sided model, for simplification reasons. However, once we presented the main idea in a simple format, a future research may use a two-sided search model to investigate the same relationship.

This paper contributes to the understanding of marriage decision and its timing. However, the examination of the age of marriage is relevant not only at the micro-economic level, but also at the macro-economic level. The age of marriage affects fertility decisions and therefore the rate of population growth. The consumption of family is different from singles' consumption. In addition, the age of marriage affects the demand for new housing, which subsequently affects financial markets.

REFERRENCES

Allen, W.D. (2000). "Social networks and self-employment," *Journal of Socio-Economics* 29, 487–501.

Anderson, K.H., Hil, M.A., Butler, J.S. (1987). "Age at marriage in Malaysia: A hazard model of marriage timing," *Journal of Development Economics* 26(2), 223-234.

Balestrino, A., and Ciardi, C. 2008. "Social norms, cognitive dissonance and the timing of marriage," *Journal of Socio Economics* 37, 2399–2410.

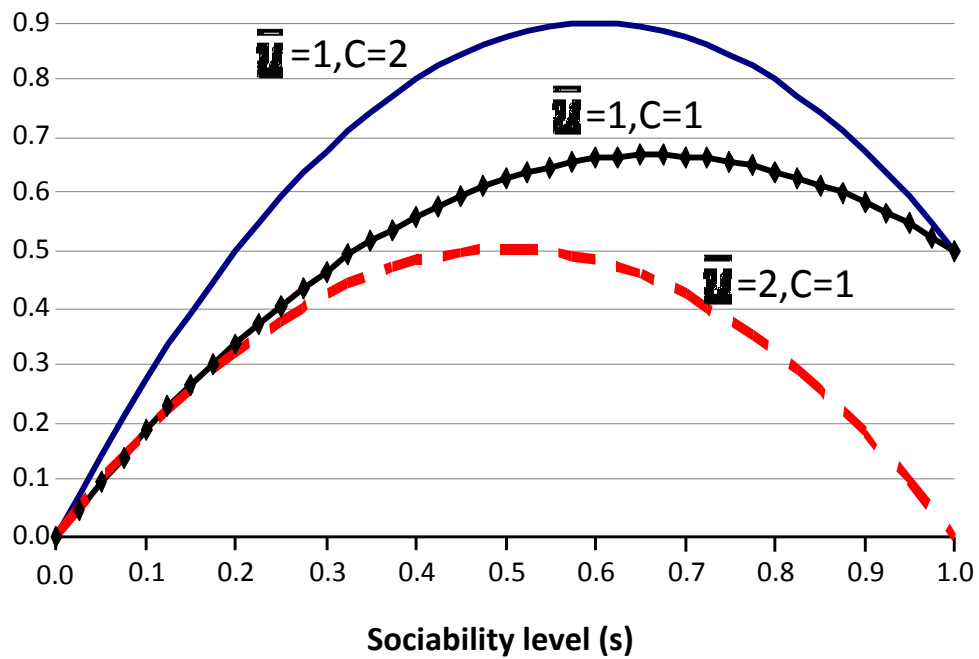Becker, G.S. 1973. "A Theory of Marriage: Part I," *Journal of Political Economy* 81(4), 813-846.

Becker, G.S. 1974. "A Theory of Marriage: Part II," *Journal of Political Economy* 82(2), S11-S26.

Bergstrom, T.C., and Bagnoli, M. 1993. "Courtship as a Waiting Game," *Journal of Political Economy* 101(1), 185-202.

Browning, M., Chiappori, P.A., and Weiss, Y. Family Economics. Cambridge University Press (forthcoming).

Burdett, K., and Coles, M.G. 1997. "Marriage and Class," *Quarterly Journal of Economics* 112(1), 141–168.

Burdett, K., and Coles, M.G. 1999. "Long-Term Partnership Formation: Marriage and Employment." *Economic Journal* 109(456), F307–334.

Burdett, K., and Wright, R. 1998. "Two-Sided Search with Nontransferable Utility," *Review of Economic Dynamics* 1, 220-245,

Braunstein, Y.M., and Schotter, A. 1981. "Economic Search: An Experimental Study," *Economic Inquiry* 19(1), 1-25.

Cox, D.R, (1972). "Regression Models and Life-Tables," *Journal of the Royal Statistical Society*, Series B (Methodological) 34(2), 187-220.

Cox, J.C., and Oaxaca, R.L. 1989. "Laboratory Experiments with a Finite-Horizon Job-Search Model," *Journal of Risk and Uncertainty* 2, 301-330.

Danziger, L., and Neuman, S. 1999. "On the age at marriage: theory and evidence from Jews and Moslems in Israel," *Journal of Economic Behaviour & Organization* 40, 179–193.

Diamond, P.A. 1982a. "Aggregate Demand Management in Search Equilibrium." *Journal of Political Economy* 90(5), 881–894.

Diamond, P.A. 1982b. "Wage Determination and Efficiency in Search Equilibrium." *Review of Economic Studies* 49(2), 217–227.

Feinberg, R.M. 1977. "Risk Aversion, Risk, and the Duration of Unemployment," *Review of Economics and Statistics* 59, 264–271.

Gale, D., and Shapley, L.S. 1962. "College Admissions and the Stability of Marriage." *American Mathematical Monthly* 69(1), 9-15.

Gronau, R. 1971. "Information and Frictional Unemployment," *American Economic Review* 61(3), 290-301.

Gutiérrez-Domènech, M. (2008). "The impact of the labour market on the timing of marriage and births in Spain," *Journal of Population Economics* 21(1), 83-110.

Heizler, O., Kimhi, A. (2011). "Does Family Composition Affect Social Networks?," Mimeo.

Kanas, A., Chiswick, B.R., Lippe, T., F., Tubergen (2011). "Social Contacts and the Economic Performance of Immigrants: A Panel Study of Immigrants in Germany," *International Migration Review*, forthcoming.

Keeley, M.C. 1977. "The Economics of Family Formation," *Economic Inquiry* 15(2), 238-250.

Lippman, S.A., and McCall, J. 1976. "The Economic of Job Search: a survey," *Economic Inquiry* 14, 155–189.

McCall, J.J. 1970. "Economics of Information and Job Search," *Quarterly Journal of Economics* 84(1), 113-126.

Mortensen, D.T. 1970. "Job Search, the Duration of Unemployment, and the Phillips Curve," *American Economic Review* 60(5), 847-862.

Mortensen, D.T. 1977. "Unemployment Insurance and Job Search Decisions." *Industrial and Labor Relations Review* 30(4), 505–517.

Mortensen, D.T. 1982a. "The Matching Process as a Noncooperative Bargaining Game," in The Economics of Information and Uncertainty. John J. McCall, ed. Chicago: University of Chicago Press, 233–254.

Mortensen, D.T. 1982b. "Property Rights and Efficiency in Mating, Racing, and Related Games." *American Economic Review* 72(5), 968–979.

Mortensen, D.T. 1988. "Matching: Finding a Partner for Life or Otherwise," *American Journal of Sociology* 94, S215-S240.

Oppenheimer, V.K. 1988. "A Theory of Marriage Timing," *American Journal of Sociology* 94, 563-591.

Pissarides, C.A. 1984. "Search Intensity, Job Advertising, and Efficiency," *Journal of Labor Economics* 2(1), 128–143.

Pissarides, C.A. 1985. "Short-Run Equilibrium Dynamics of Unemployment Vacancies, and Real Wages," *American Economic Review* 75(4), 676–690.

Pissarides, C.A. 1974. "Risk, Job Search, and Income Distribution," *Journal of Political Economy* 82, 1255–1267.

Rogerson, R., Shimer, R., and Wright, R. 2005. "Search-Theoretic Models of the Labor Market: A Survey," *Journal of Economic Literature* 43, 959–988.

Shimer, R., and Smith, L. 2000. "Assortative Matching and Search," *Econometrica* 68(2), 343-369.

Schmidt, L. 2008. "A Risk Preferences and the Timing of Marriage and Childbearing," *Demography* 45(2), 439–460.

Spivey, C. 2010. "Desperation or Desire? The Role of Risk Aversion in Marriage," *Economic Inquiry* 48(2), 499–516.

Stigler, G.J. 1961. "The Economics of Information," *Journal of Political Economy* 69(3), 213-225.

Stigler, G.J. 1962. "Information in the Labor Market," *Journal of Political Economy* 70(5), 94-105.

Weiss, Y. 2008. "Marriage and Divorce" in The New Palgrave Dictionary of Economics, eds. Steven N. Durlauf and Lawrence E. Blume. New York: Palgrave McMillan.

Yabiku, S.T. 2006. "Neighbors and Neighborhoods: Effects on Marriage Timing," *Population Research and Policy Review* 25(4), 305-327.

Zhang, J. 1995. "Do men with higher wages marry earlier or later?" *Economics Letters* 49, 193-196.

Figure 1 – The theoretical Probability of Marriage in Period 1

$\overline{u}=1, C=2$

$\overline{u}=1, C=1$

$\overline{u}=2, C=1$

Sociability level (s)

Figure 2 – Empirical Hazard Ratios of Marriage in Period 1

Males

Females

	Males				Females		
Low	1.00			Low	1.00		
Intermediate		1.93		Intermediate		1.41	
High			1.35	High			0.63

Sociability level (s)

Sociability level (s)
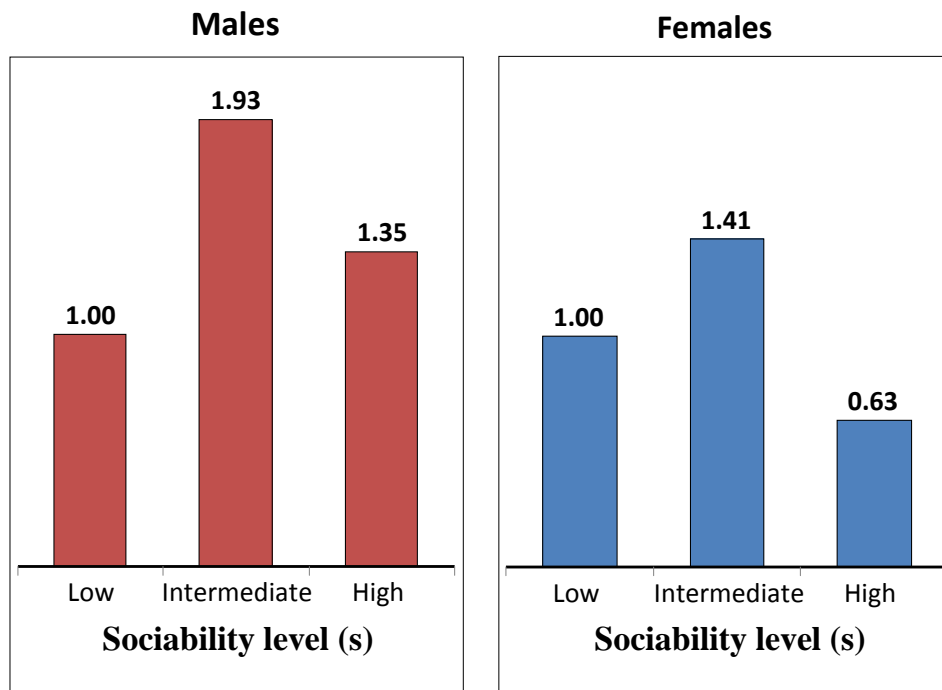
Table 1. Descriptive statistics

Variable	Male	Female
Social networks (%)		
High level	69.79	72.11
Intermediate level	27.48	25.36
Low level	2.73	2.53
Religious group (%)		
Ultra-orthodox	4.38	4.37
Religious	7.33	7.62
Traditional-religious	11.06	9.92
Non-religious	78.37	78.09
Ethnic group (%)		
New immigrants (1990+)	14.82	14.03
Sepharadi (Oriental Jew)	28.29	26.87
Ashkenazi	17.52	17.15
Other	39.37	41.95
Education (%)		
High school or below	73.84	69.74
Post Secondary degree	12.59	10.68
B.A. degree	11.39	16.72
M.A.\Ph.D. degree	2.18	2.86
Military service (regular army and compulsory army) (%)	18.77	10.48
Good health (%)	73.92	72.01
Number of observations	3,995	3,044

Table 2. Cox Proportional Hazard Model of Marriage by Gender

Explanatory variables	Males			Females		
	Coef.	Hazard Ratio	Z.	Coef.	Hazard Ratio	Z.
Social networks						
High level	-0.354***	0.701	-3.10	-0.804***	0.447	-6.51
Low level	-0.655**	0.519	-1.98	-0.344	0.708	-1.08
(the intermediate level is						
omitted)						
Religious group						
Ultra-orthodox	2.220***	9.215	12.70	2.133***	8.442	11.01
Religious	0.953***	2.595	5.22	1.259***	3.523	6.94
Traditional-religious	0.467**	1.595	2.51	0.487**	1.628	2.36
Ethnic group						
New immigrants	-0.069	0.933	-0.37	0.446**	1.562	2.38
Sepharadi (Oriental Jew)	-0.480***	0.618	-3.46	-0.348**	0.705	-2.25
Ashkenazi	-0.044	0.956	-0.30	0.018	1.018	0.11
Education (%)						
Post Secondary degree	0.131	1.140	0.82	0.375**	1.455	2.34
B.A. degree	0.102	1.107	0.72	0.032	1.033	0.22
M.A.\Ph.D. degree	-0.189	0.827	-0.75	-0.299	0.741	-1.08
Military service	0.444*	1.55	1.81	-	-	-
Good health	0.499***	1.64	3.55	0.401***	1.493	2.71
Log likelihood	-2266.343			-1875.440		
LR χ^2 (p-value)	156.92 (0.0000)			196.70 (0.0000)		
Number of observations	3,995			3,044		

Note: ***, **,* denote significance at 1%, 5% and 10%, respectively.

Appendix 1. Cox Proportional Hazard Model of Marriage by Gender with two levels of social Networks

Explanatory variables	Males			Females		
	Coef.	Hazard Ratio	Z.	Coef.	Hazard Ratio	Z.
Social networks High level	-0.300***	0.740	-2.67	-0.776***	0.459	-6.38
Religious group Ultra-orthodox Religious Traditional-religious	2.222*** 0.945*** 0.467**	9.263 2.573 1.596	12.73 5.16 2.51	2.126*** 1.258*** 0.464**	8.386 3.519 1.159	10.95 6.94 2.26
Ethnic group New immigrants Sepharadi (Oriental Jew) Ashkenazi	-0.728 -0489*** -0.043	0.929 0.612 0.957	-0.39 -3.52 -0.29	0.434** -0.351** 0.022	1.543 0.703 1.022	2.32 -2.28 0.13
Education (%) Post Secondary degree B.A. degree M.A.\Ph.D. degree	0.161 0.142 -0.154	1.174 1.153 0.856	1.01 1.00 -0.61	0.389** 0.054 -0.273	1.476 1.055 0.760	2.43 0.36 -0.99
Military service	0.462*	1.588	1.89	-	-	-
Good health	0.520***	1.683	3.71	0.405***	1.500	2.74
Log likelihood	-2268.692			-1876.075		
LR χ^2 (p-value)	152.23 (0.0000)			195.43 (0.0000)		
Number of observations	3,995			3,044		

Note: ***, **,* denote significance at 1%, 5% and 10%, respectively.

Appendix 2. Cox Proportional Hazard Model of Marriage by Gender, without Ultra-orthodox

Explanatory variables	Males			Females		
	Coef.	Hazard Ratio	Z.	Coef.	Hazard Ratio	Z.
Social networks						
High level	-0.463***	0.629	-3.78	-0.790 ***	0.453	-5.91
Low level	-0.842**	0.430	-2.28	-0.252	0.776	-0.78
(the intermediate level is omitted)						
Religious group						
Religious	0.921***	2.512	5.01	1.297***	3.660	7.14
Traditional-religious	0.401**	1.493	2.14	0.426**	1.531	2.05
Ethnic group						
New immigrants	-0.082	1.085	0.488	0.507***	1.661	2.61
Sepharadi (Oriental Jew)	-0.219	0.803	-1.47	-0.198	0.820	-1.20
Ashkenazi	-0.075	0.927	-0.45	0.047	1.048	0.26
Education (%)						
Post Secondary degree	0.023	1.023	0.14	0.167	1.182	0.89
B.A. degree	0.054	1.056	0.37	0.079	0.923	-0.50
M.A.\Ph.D. degree	-0.218	0.803	-0.81	-0.407	0.665	-1.46
Military service	0.727***	2.07	2.90	-	-	-
Good health	0.393***	1.64	3.55	0.346**	1.414	2.28
Log likelihood	-1953.2073			-1638.0657		
LR χ^2 (p-value)	58.64 (0.0000)			96.04 (0.0000)		
Number of observations	3,820			2,911		

Note: ***, **,* denote significance at 1%, 5% and 10%, respectively.