Class, Gender and Marriage

Gillian Hamilton & Aloysius Siow[1]
University of Toronto
Department of Economics
150 St. George St.
Toronto, ON M5S 3G7
Canada
hamiltng@chass.utoronto.ca & siow@chass.utoronto.ca

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Abstract

This paper estimates the contributions of differential fecundity, social heterogeneity, assortative matching and search frictions to aggregate marriage behavior in 18th century Quebec. The reduced form estimates show that a simple random matching model of the marriage market, in which there are gains to assortative matching and women may leave the marriage market at a higher rate than men, can explain these data. The structural estimates provide the first estimates of the impact of differential fecundity on the welfare of men and women. The estimates suggest that 18th century Quebec women fared slightly better than men.

1 Introduction

Women are fecund for a shorter period of their lives than men. Since Trivers (1972), researchers have been investigating the implications of differential fecundity for marriage market behavior and other gender roles.[1] While there are some suggestive empirical tests of the theory, there is no study on the quantitative significance of differential fecundity in determining overall marital behavior in a society.[2] The welfare consequence of the theory for men and women is unclear. Differential fecundity makes fecund (young) women relatively scarce in the marriage market and hence they are expected to capture scarcity rents. On the other hand, because they are fecund throughout their lives, older men are more 'attractive' as spouses than older women. Thus, in terms of expected lifetime discounted utility, whether men fare better than women is theoretically ambiguous. In this paper, we offer the first estimates of the quantitative effects of differential fecundity on marriage market behavior and welfare.

We employ a reconstituted family data set from 17th and 18th century New France gathered painstakingly by demographers at the University of Montreal.[3] The data set consists of linked information from all of the birth, marriage, and death parish registers in the Quebec region. It provides the vital life histories of everyone known to have been born in the colony. It is the richest vital record data set available for exploring the demographic experiences of seventeenth and eighteenth century North Americans.[4] We

[1]See Betzig (1997) for work outside economics. Economic articles include Akerlof, Yellin and Katz (1996), Bergstrom and Bagnoli (1993), Edlund (1998), Siow (1998), Willis (1999), Siow and Zhu (1998).

[2]See discussion and references in Betzig (1997) and Siow (1998).

[3]The project, Registre de la Population du Québec Ancien, operates under the auspices of the Programme de Recherche en Démographie Historique—PRDH. It is ongoing. A number of papers describe aspects of this program: Charbonneau et al. (1993), Desjardins (1993), Desjardins, Beauchamp, and Légaré (1977), Landry and Légaré (1987), Légaré (1988), Légaré and Desjardins (1980), Légaré, LaRose, and Roy (1975), Légaré, Lavoie, and Charbonneau (1972), Nault, Desjardins, and Légaré (1990), Nault and Desjardins (1988, 1989), Roy and Charbonneau (1978).

[4]Little work has been done on 17th or early 18th century American demographic behavior, principally because of poor data sources. See Haines (1996) and Wells (1992) for a description of the state of research on colonial American demography. There is a considerable literature on New France's demographic experiences. See the citations in the previous footnote and also: Bates (1986), Bouchard and dePourbaix (1987), Choquette (1997), Cliché (1988), Henripin (1954), Henripin and Peron (1972), Paquette and Bates

make use of this historic data set in part because of an advantage over modern data. Most modern data sets do not provide entire life histories of both male and female marital behavior.

The paper has two parts. First, we estimate a *just identified* reduced form model of the marriage market in 18th century Quebec to study the quantitative significance of differential fecundity, assortative matching and search frictions in determining marital behavior in this society. The estimates of the reduced form model show that a simple random matching model of the marriage market, in which women may leave the marriage market at a higher rate than men, can match the aggregate marital experiences of 18th century Quebec.[5] Second, we also estimate a structural model that considers agents' behavior in the marriage market. Based on the structural estimates, holding social status constant, 18th century Quebec women fared marginally better than men in terms of lifetime discounted consumption.

Our model also allows us to rationalize a number of regularities in both current and past marriage markets that previously have been studied separately. The regularities include: positive assortative matching by social attributes;[6] more never married men than never married women;[7] a higher average age of first marriage for wealthier or higher social status individuals than for less wealthy or lower status individuals;[8] a lower average age of first marriage for women than men;[9] and a systematic redistribution of resources between spouses that depends on the characteristics of the couple and marriage market conditions.[10] No current theory of the marriage market rationalizes all of these regularities.[11]

(1986), Pelletier et al. (1997).

[5]Our companion paper, Hamilton and Siow (1999), studies the individual data underlying the aggregate data presented here.

[6]E.g. Abdelrahman (1994); Botticini and Siow (1999); Jaffee and Chacon-Puignau (1995); Mare (1991); Qian and Preston (1993); Sanchez-Andres and Mesa (1994).

[7]E.g. Haines (1996); United Nations (1992).

[8]E.g. Bergstrom and Schoeni (1996); Boonstra (1998); De Silva (1997); Dobson et al. (1998); Islam et al. (1998); Nguyen (1997); Vella and Collins (1990); Zhang (1995). Voland and Dunbar (1997) present contrary evidence.

[9]United Nations (1990).

[10]E.g. Chiappori, Fortin and Lacroix (1998), Hamilton (1999), Lundberg, Pollak and Wales (1997), Seitz (1999), Strauss and Thomas (1995), Zhang and Chan (1999).

[11]Partial explanations are available. Becker explains assortative matching in marriage and marital transfers based on marriage market conditions (Becker, 1991). Bergstrom and Bagnoli (1993) provides a model of gender differences in ages of first marriage. Siow (1998) provides a model of gender differences in ages of first marriage and marriage rates.

We also provide a new interpretation of women's lower average age of first marriage. A standard argument is that women feel the need to marry earlier because they face menopause.[12] Thus, they have lower reservation match values. This argument is incomplete. Impending menopause will lower women's reservation match value (ceteris paribus), but it also makes women relatively scarce in the marriage market. This improves their chances of meeting a mate and allows them to be more discriminating (thus raising their reservation match values). Thus, whether differential fecundity lowers women's average age of first marriage (relative to men) is ambiguous. Our structural estimates show that 18th century Quebec women were more discriminating than men in the marriage market, but because the chances of meeting a spouse were higher for eligible women, they tended to spend less time searching and married at a younger age.

Our theoretical model builds on models of marriage markets that analyze the roles of wealth, assortative matching and intra household transfers in marriage markets.[13] It also adds to the literature on search frictions in the marriage market, first introduced by Mortensen (1985).[14]

Our empirical analysis is complementary to other recent empirical equilibrium random matching models of marriage (Aiyagari, Greenwood and Güner (forthcoming), Seitz (1999) and Wong (1997)).[15] The common theme in these papers is the use of equilibrium random matching models to rationalize different regularities in the marriage market. Wong estimates the determinants of inter-racial marriages. Aiyagari et al. calibrate a model of marriage, divorce, work and parental investments.[16] Their focus is on the determinants of single parenthood, the distribution of income and policy simulations. Empirically, Seitz's paper is the most ambitious. Using micro data, Seitz estimates a non-stationary model of marriage, divorce and work for young adults. Through differential fecundity, our model predicts observed gender differences in mar-

[12]Social norms is also often invoked in empirical models of the marriage market (e.g. Fossett and Kiecolt (1991), Rao (1993), Seitz (1999), South and Lloyd (1992)). Differential fecundity and labor market interaction models include Bergstrom and Bagnoli (1993), and Siow (1998).

[13]This field was started by Gary Becker (his work is summarized in Becker (1991)). Recent surveys include Bergstrom (1997), Lundberg and Pollak (1996) and Weiss (1997).

[14]Also see Burdett and Cole (1997), Shimer and Smith (forthcoming).

[15]Other empirical analyses include Becker, Landes and Michael (1977), Chiappori, Fortin and Lacroix (1998), Grossbard-Shechtman (1993), Brien, Lillard and Stern (forthcoming).

[16]Calibration models of the family are appearing rapidly. Also see Greenwood et al. (1999); Regalia and Rios-Rull (1999).

ital behavior which are either absent or unexplained in the other papers. On the other hand, we ignore fertility, divorce, work behavior and lone parenthood.[17] Some of these abstractions are, of course, appropriate for the period at hand. Divorce was not an option in the Catholic colony of New France. Furthermore, abstracting from these factors greatly aids our objective of providing the first quantitative effects of differential fecundity on behavior and welfare. Extending our model to deal with the idiosyncracies of modern marriage is left for future research.

2 Historic context

The French began settling New France as a Catholic colony in the early seventeenth century. The colony did not appear to have been a very attractive destination. Hostilities between the Iroquois and French were on-going, the region was relatively unestablished compared to colonial America, and it was cold for several months of the year. The pace of migration was very slow (Moogk (1978)). In addition, most immigrants were male until the King of France actively addressed the gender imbalance in the 1660s (Landry, 1992). After about 1680 the population grew primarily through natural increase.[18]

Because land was abundant and labor scarce, contemporaries described New France as a good destination for peasants but less so for the upper class:

> "this country [New France] is not yet fit for people of rank who are extremely rich, because such people would not find in it all the luxuries they enjoy in France. ...The people best fitted for this country are those who can work with their own hands...as men's wages are very high here."[19]

While the wealthiest residents of France were unlikely to have left for the colony, some traditional class distinctions appear to have been maintained

[17]For papers on the differential experience of men and women in the workplace, see Altonji and Blank (1999) for the modern experience, and Goldin (1990, 1997) for the historical experience.

[18]The population of the colony was about 3,000 in 1666; 9,700 in 1681; 10,300 in 1688 and just over 20,000 in 1716. Sources: Census of Canada, 1871, Vol.4; Dechêne (1992: 315); Harris (1987); Dickinson and Young (1993: 67-70).

[19]Pierre Boucher. *True and Genuine Description of New France Commonly Called Canada* (Paris: 1664), cited in Thorner (1997:70).

in New France. In the highest social class was the nobility. French royalty conferred noble title, which was inherited through the male line. The nobility did not have the same stature as their French counterparts, but they were afforded privileges not enjoyed by the typical resident. For example, the King of France offered some nobility large land grants, called seigneuries.[20] In addition, a substantial portion of those that did not inherit title served as officers in the military and were given (lucrative) officers' commissions. The nobility comprised a very small portion of the population, roughly one or two percent.

A second tier in the social strata consisted of the bourgeiosie. 'Bourgeois' was often a self-appointed title taken by men with relatively high status occupations, such as large-scale merchants or crown appointed officials (a complete list appears in the data appendix). These were positions of privilege and wealth. The bourgeoisie constituted a similarly small portion of the population.

The vast majority of the population was in the third and last social strata. Most were *habitant*–people who farmed for a living.

Apart from differences in occupation and privilege, there was also some geographic distinction between 'high' and 'low' status individuals. Most of the upper echelon lived in the cities. One consequence of this segregation is that high status people lived relatively unhealthy lives, because the cities were notoriously unsanitary. Life was already fairly short at this time: 27 percent of boys and 21 percent of girls died before they reached the age of 15.[21] Average life span for those who lived past age 15 was 58.[22] The wealthy class had higher infant and childhood mortality rates, and their average life span, conditional on living past age 15, was lower than that found in the general population.[23] Unsanitary conditions were not the only factor affecting the life span of the higher class. They also tended to wet-nurse their children, which may have contributed to their higher infant and

[20]Not all seigneurs were member of the nobility (Harris, 1966). The aristocracy also qualified for pensions and some received fur-trade licences. For more information on the nobility, see Gadoury (1991), Dechêne (1992), or Greer (1997: 51).

[21]Summary statistics from the NB sample are discussed here (defined in section 3.3). The other samples are qualitatively similar.

[22]In addition, the maternal mortality rate was 9 percent. In spite of the risks, families were large. Adults in their first marriage had an average of 8.2 children.

[23]Today, in contrast, life expectancy is positively correlated with wealth. Thus wealth had different effects on 18th century Quebeckers compared with their current descendents.

child mortality rates.

3 A statistical framework

3.1 Model

We begin with a statistical model of the marriage market that can reproduce the observed aggregate behavior of our data set. We consider the steady state of a non-linear Markov model. Figure 1 provides a flow chart. In every period, new individuals enter the marriage market. Individuals may leave the market in three ways. First, two single individuals who meet in the marriage market leave temporarily if they marry. Second, individuals may die. Third, women exogenously leave the market at a higher rate than men. Married individuals may return to the marriage market when their spouses die. Widows may return to the marriage market at a lower rate than widowers.

To address heterogeneity within the marriage market, we assume that there are two types of individuals: high status (h) and low status (l). Equal numbers of males and females are born each period. We normalize the number of new entrants of each gender to 1, a_h fraction of these adults, equally divided between men and women, are high status and the rest are low status.

Individuals are potentially infinitely lived. Each h individual who is alive in the current period will live in the next period with probability p_h. Each l individual who is alive in the current period will live in the next period with probability p_l.[24] A person may re-enter the marriage market when his or her spouse dies.

In order to accommodate the fact that there are more unmarried men than women, we assume that women leave the marriage market at a faster rate than men. Each woman in a current period will remain in the marriage market in the next period with probability η. Married women will also "leave" the marriage market at a rate of $1-\eta$. Married women who leave will not re-enter the marriage market when they are widowed.[25] This is the

[24] ¿From a purely descriptive view point, it is unnecessary to interpret these probabilities exclusively as survival probabilities. p_h and p_l are the per period probabilities that individuals from different social classes will remain in the marriage market.

[25] Marriages do not end when a women 'leaves' the marriage market–the exit rate determines whether she will re-enter the market if she is widowed.

only distinction between men and women.

We assume that there is random matching in the marriage market. Each individual may meet at most one other individual of the opposite sex per period. When an eligible man of status s and a woman of status S meet, they will fail to marry with probability $\lambda(S,s)$.[26] With probability $\overline{\lambda(S,s)}$, an Ss pair that meets will marry (for any variable α, $\overline{\alpha}$ is $1-\alpha$). When they do not marry, they may return to the marriage market in the next period.

Following the custom in 18th century Quebec, we assume that there is no divorce. A marriage ends when a spouse dies. Individuals who remain in the market may remarry after the death of a spouse. Participants in the marriage market do not distinguish between never married individuals and reentrants.

The statistical marriage market model is determined by the eight parameters: a_h, p_h, p_l, η, $\lambda(H,h)$, $\lambda(H,l)$, $\lambda(L,h)$ and $\lambda(L,l)$. We construct steady state quantities generated by these parameters.

Let n_s be the steady state stock of eligible s type males. Let N_S be the steady state stock of eligible S type females. Since females exit the market at a higher rate then men, assume $n = n_h + n_l > N = N_l + N_h$. We assume a simple matching rule where every eligible woman is able to find an eligible male. With random matching in the marriage market, the probability of a woman meeting a man of type s, and the probability of a man meeting a women of type S, is (respectively):

$$Q(s) = \frac{n_s}{n} \qquad (1)$$
$$q(S) = \frac{N_S}{n}$$

Let π_{Ss} be the equilibrium number of married Ss couples. In steady state,

$$\pi_{Ss} = p_S p_s\{\pi_{Ss} + n_s q(S)(1-\lambda(S,s))\} \qquad (2)$$

The first term within brackets is the number of existing Ss marriages in the previous period. The second term within the brackets is the number of new Ss marriages formed in the previous period.

[26] We use upper case letters for women, small case letters for men. Note, however, that there is no theoretic distinction between men and women of a given status (apart from the higher exit rate for women, which is not status dependent).

Let Π_{Ss} be the number of fecund married women of type S in an Ss marriage. In steady state,

$$\Pi_{Ss} = \eta p_S p_s \{\Pi_{Ss} + N_S Q(s)(1 - \lambda(S, s))\} \tag{3}$$

The steady state number of eligible men of status s in each period is determined by:

$$n_s = a_s + \sum_{S'} p_s \overline{p}_{S'} \{\pi_{S's} + n_s q(S')(1 - \lambda(S', s))\} + p_s n_s \{1 - \sum_{S'} q(S')(1 - \lambda(S', s))\} \tag{4}$$

The first term in this expression is the number of new entrants (a_s is the fraction of type s born in each period). The second term is the entry from new widowers. The third term is the contribution of unsuccessful searchers from the previous period. Similarly, after adjusting for the extra attrition of women from the market, the steady state number of eligible women of status S in each period is:

$$N_S = a_S + \sum_{s'} \eta p_S \overline{p}_{s'} \{\Pi_{Ss'} + N_S Q(s')(1 - \lambda(S, s'))\} + \eta p_S N_S \{1 - \sum_{s'} Q(s')(1 - \lambda(S, s'))\} \tag{5}$$

Equations (1) to (5) provide a complete description of the steady state of this marriage market.

3.2 Empirical methodology

In estimating the statistical (reduced form) model, we do not observe all the quantities in equations (1) to (5), such as the match probabilities, $q(S)$ and $Q(s)$. We observe π_{Ss} (the number of marriages) and other statistics which are functions of the above quantities, such as the probability of not marrying throughout an individual's lifetime and the average age at marriage. We use these statistics to recover the reduced form parameters ($\lambda(S, s)$, a_h, p_h, p_l, and η). The variables we can observe are described below.

Let z_s be the probability that an eligible man will not marry in the current period. Let Z_S be the probability that an eligible woman will not marry in the current period. Then:

$$z_s = 1 - \sum_{S'} q(S') + \sum_{S'} q(S')\lambda(S', s)$$
$$Z_S = \sum_{s'} Q(s')\lambda(S, s')$$

Thus the likelihood that a man (woman) of type s (S) will never marry, y_s (Y_S), is:

$$y_s = z_s - \frac{p_s z_s \overline{z_s}}{1 - p_s z_s}$$
$$Y_S = Z_S - \frac{\eta p_S Z_S \overline{Z_S}}{1 - \eta p_S Z_S}$$

After entering the marriage market, a type s individual will live for an average of l_s periods:

$$l_s = \frac{1}{1 - p_s}$$

The average ages of first marriage of type s males and females are (in terms of periods):

$$ma_s = \frac{1 - z_s}{(1 - p_s z_s)}$$
$$MA_S = \frac{1 - Z_S}{(1 - \eta p_S Z_S)}$$

We assume that all individuals enter the marriage market at age 17.[27] Let one period in the model be of length δ years. Hence to express MA_S (or l_s) in years, the following conversion must be made: $(17 + \delta MA_S)$. δ is estimated along with the rest of the model.

Given data on π_{Hl}/π_{Ll}, y_h, y_l, Y_h, Y_l, l_h, l_l, MA_l and a_h, we can estimate the parameters $\lambda(H, h)$, $\lambda(H, l)$, $\lambda(L, h)$, $\lambda(L, l)$, a_h, p_h, p_l, η, and δ. The model is *just identified*. To illustrate the effectiveness of the model we also report estimates for the other marriage ages (those for men and high status women) and the ratios of the number of other social combinations of marriages relative to the number of low-low marriages (e.g., π_{Hh}/π_{Ll} and π_{Lh}/π_{Ll}).

[27] The results are not particularly sensitive to using 16 as the starting age.

3.3 Data

The data consist of reconstituted family data elicited from New France's birth, marriage, and death (Catholic) parish records, linked by demographers at the University of Montreal. Reconstituting the native-born population has been particularly successful, in part because Catholic parishes were established early in the colony's history, and few records have been lost through neglect or disaster. In addition, the colony's early immigrants were exclusively Catholic (by government decree). In some cases, the parish records have been supplemented by census and notary records. These sources provide extra information on family composition, literacy (ability to sign one's name), and occupation or status. There are omissions, but because of extensive cross-checking the gaps are believed to represent a small minority of the native-born population. Charbonneau et al. (1993) estimate that 20,680 non-aboriginal people were born in the Quebec area before 1700, 19,580 of which are documented in this data set. Marriage and death information is known in about 85 percent of cases (Charbonneau et al. (1993: 62)). More detail about the data set is presented in the data appendix.

While these parish data capture the vast majority of the native-born population, the records on immigrants are naturally much spottier and systematically over-represent immigrants who married or died in the province. This is not expected to be a major source of bias because most births and marriages occur after 1680, by which time the flow of immigrants had slowed and the population was growing primarily through natural increase. Compared to colonial America, New France was a relatively closed society.[28]

The birth records provide information on individuals' gender, birth date, place of birth, and, in some cases, the father's occupation or social status. Marriage records include the date and place of the union, whether each party signed (or marked) the marriage record, possibly the occupation or social status of the groom and the bride and groom's fathers. Death registers record the date and place of death.

Linking all of these registers produces a record of each person's vital life history: for those whose birth and death was recorded in the colony, we know whether they married, and if so, the dates of each marriage (if there was more than one), who they married, and known vital information about the spouse,

[28]Nault, Desjardins, and Légaré (1990: 274) report that (principally male) immigration "became more and more marginal relative to the native white population [after 1673]. Out migration, although significant at some moments, was negligible in total."

and the number and sequence of children produced from each marriage. If the spouse was born outside the colony sometimes less is known about their birth date and place (and hence their life span).

Three sets of individuals that likely were wealthy have been identified through information in the parish and notary public's records. The first is members and offspring of the nobility (Gadoury, 1991). The second is members and offspring of the 'bourgeois' class (Noguera, 1994).[29] The ability to sign one's name was also an indication of wealth or privilege, as a minority of people enjoyed this skill. We employ a narrow and broad definition of status. The narrow definition includes only individuals from a noble or bourgeois family. The broader definition includes those individuals with a parent that could sign his or her name. In this case, the sample is restricted to those individuals whose parents were married in the province (at least one of whom was born in the colony). We interchangeably characterize these groups as 'wealthy' or 'high-status.'

The sample employed here includes only individuals born before 1700 with known life span. Information on life span is necessary for our analysis. This requirement implies that the individual must have experienced both birth and death in the colony.[30] Because the PRDH have not completed the data reconstitution for parish records written after 1800, we restrict the sample to those born before 1700.[31] This ensures that the data reconstitution was complete for everyone in our sample. We also restrict the sample to those individuals that lived until at least age 15, since we are studying marriage market participation. These restrictions affect the sample size as follows: a birth record exists for 19,580 individuals (born before 1700), life span is known for 15,334 of them. Almost 4,000 died before age 15, leaving 11,578 in the sample.

We work with three versions of this sample. The NB (noble-bourgeois) sample consists of the 'full' sample–all (11,578) individuals with known life

[29] A bourgeois is essentially a man with a professional affiliation. Women were bourgeois only if they married a bourgeois.

[30] There are some exceptions. In some cases people died outside of the colony, but their date of death was uncovered through supplementary documents (wills, for example, or death records in other locations, such as France).

[31] Most births occurred soon before 1700. While the first birth in this sample was recorded in 1620, 84 percent of individuals in this sample were born between 1670 and 1699, and 61 percent were born after 1679. These statistics refer to the NB sample (see below).

span (summary statistics are discussed in section 3.4). A high status individual is one whose family was either noble or bourgeois.

A second sample isolates an urban marriage market. The NBQ sample consists of individuals who were born in Quebec City (for marriage rate information) or married in Quebec City (in the study of marriage behavior).[32] We employ the narrow definition of high status in the NBQ sample.

The NBS (noble-bourgeois-sign) sample employs the broader definition of high status, and consists all individuals whose parents were married in New France (with at least one born in the colony). For information on marriages (such as age-at-first-marriage) the sample consists of a subset of marriages– those in which both the husband and wife's parents were married in the colony (so that parent literacy is known for both spouses). Because of the parental requirements, the sample size is considerably smaller than the NB sample (6,573 births, as opposed to 11,578 births).

3.4 Reduced form estimates

Table 1 presents point estimates from three samples. None of these samples are random samples from the relevant population. Rather, they are supposed to be censuses of the relevant populations. As such, the sample moments are population moments. Traditional standard errors will overestimate the imprecision of our estimates. Here we provide only point estimates of the data and the models. We demonstrate the sensitivity of the estimates to changes in the definition of status and marriage market locale by drawing on different samples. We also consider robustness across time periods.

We begin the discussion with the NB sample where a high status individual is one whose family was either noble or bourgeois. Column (1) presents the data for the NB sample. 5.8% of the population were high status (row 1). They had shorter life spans than low status individuals (rows 2-3). Men, and high status individuals, had relatively low marriage rates (rows 5-8). As

[32]Quebec City was the largest city in the colony at this time, but most people lived and farmed along the St. Lawrence River near the urban centres. In 1688, 14 percent of the colony lived in Quebec City. In comparison, 12 percent of births that occurred after 1680 were registered in the city. Prior to this, when the population was smaller, a higher proportion of people lived close to Quebec City and registered their children's births there: 35 percent of births before 1680 were registered in Quebec City, and between 13 and 37 percent of the 1666 population lived in this city (the 1666 census excluded roughly one thousand Royal troops from the census; 13 and 37 percent correspond to the proportion if none or all of the troops lived in the city).

rows 12 to 14 illustrate, a low incidence of within-class marriages, as well as a very low mixed-class marriage rate, contributed to the low marriage rate among the high status. In addition, they also tended to marry late (rows 15-18). Row 21 indicates that there were more women than men in the sample. Part of this imbalance stems from a higher death rate for young males.

Column (4) presents the reduced form estimates for the NB sample. As shown in row 1, the point estimate for η is 0.988. That is, women had an additional 1.2% chance per period of leaving the marriage market. This difference in exit rates between men and women explains the difference in marriage rates between the two sexes. The estimates for p_h and p_l are 0.962 and 0.966 respectively. Since we use life spans in our estimation, the estimates simply reflect the fact that high status individuals had shorter lives than low status individuals.

Row 4 shows that the estimate of δ is 1.38. This means that one period in the model is 1.38 years or an eligible woman received a match every 1.38 years. The estimated probabilities of meeting a high status female and a low status female are 0.059 and 0.5 respectively (rows 5-6). Thus an eligible male may not have met any eligible female with probability 0.441, whereas an eligible female always met an eligible male (rows 7-8). This difference in the meeting probabilities (that arises because of the gender-specific exit rates) explains the difference in marriage rates between the sexes.

The estimated rejection probabilities appear in rows 9 to 12. The estimate for $\lambda(H,h)$ is 0.667. Relative to the rejection probabilities for mixed status matches, high status individuals were less likely to reject other high status individuals when they met. There were few of these high status pair marriages because high status individuals were so unlikely to meet each other. The estimated rejection rates for mixed status matches, $\lambda(H,l)$ and $\lambda(L,h)$, are very high, each roughly 0.94. These high rejection rates are needed to fit the low number of observed mixed status marriages because a high status individual was quite likely to meet a low status individual. The estimated rejection rate for low status pairings is 0.734, higher than that for Hh matches. The marriage rate of low status individuals was nonetheless high because low status people were so prevalent in this society.

The estimated model generates additional moments that may be matched against the data. The model predicts the same fraction of $\frac{\pi_{Lh}}{\pi_{Ll}}$ matches as that observed in the data (row 13). On the other hand, the predicted value for $\frac{\pi_{Hh}}{\pi_{Ll}}$ is lower than the actual mean (row 14). Regarding age at first marriage, the predicted mean age of first marriage ($MAFM$) for high status males is higher than for all other types, which corresponds to the pattern observed in the data (rows 15-17). The model also correctly predicts that the age of first marriage for both high status males and females is higher than that for their lower status counterparts. The model tends, however, to underpredict males' $MAFM$. For example, the predicted $MAFM$ for high status males is 26.4, compared to an observed $MAFM$ of 31.4 years. It overpredicts high-status women's $MAFM$ (24.0 versus 21.8). In general, the age of first marriage estimates exhibit less across-gender variation than is observed in the data.

In summary, the estimated statistical model provides economically plausible estimates of the reduced form parameters for the NB sample. The estimated model also generated predictions for other moments which are largely consistent with the data.

With the NB sample we assume that the province of Quebec was a single marriage market. It is likely that the relevant marriage markets for participants were smaller. Also, the low marriage rate of high status individuals in the NB sample may be due to the fact that high status individuals in rural Quebec had difficulty meeting other high status individuals. To address these concerns, we employ the NBQ sample that includes only individuals who were born in Quebec City (for the marriage rates; or married in the city for the number of marriages by status calculations). We maintain the narrow definition of high status.

In this sample, 10.7% of the population were high status (first row in column 2). High status individuals tended to live in urban areas. Average life spans were lower in the city than for the entire province. As noted, the unsanitary conditions of colonial cities made them relatively unhealthy places to live. The marriage rates were lower in the city than in the colony as a whole. This was especially true for men, where just over half of high-status men, and 22 percent of low-status men, never married (compared with 41 and 18 percent, respectively, for the colony as a whole). In contrast, the marriage rates for women varied little between Quebec City and the rest of the colony.

In order to fit the lower marriage rates, the model estimated η as 0.951, which is much lower than the previous estimate (row 1, column 5). That is, in Quebec City, women dropped out of the marriage market at a higher rate than for the entire province. Eligible women were much more scarce in Quebec City. The hazard of meeting a woman was 0.424, which was substantially smaller than for the NB sample. The estimate of δ implies that one period was 2.37 years (hence meetings were less frequent).

The rejection rate was 0.496 for Hh matches, and 0.526 for Ll matches (rows 9 and 12). The rejection rates for mixed status matches were much higher (as true in each sample).

The estimated model predicts that $\frac{\pi_{Lh}}{\pi_{Ll}}$ was 0.026 as compared with 0.057 in the data. The ranking of average ages of first marriage is consistent with the data. Compared to the NB sample there is closer quantitative correspondence between the predicted and actual average ages of first marriage. This closer correspondence suggests that the NBQ sample more accurately reflected the marriage market that participants actually faced.

One factor that might have contributed to the lower (and larger gender differences in) urban marriage rates was a higher concentration of single male immigrants. The proportion of immigrants in the city is unknown, but it was likely higher than that observed in the surrounding rural areas. We cannot account for this factor directly because our sample does not include immigrants. We do attempt to account for it indirectly later in the paper (section 4.6) by examining a subset of the sample that covers births after 1670, a time period when immigration was a trivial component of the population. The results are fairly robust to this sample redefinition.

The low marriage rates of the high status individuals in the NB sample may be due to our narrow definition of high status. The actual high status marriage class may be larger. To investigate this possibility, we estimate the model using the NBS sample. In this case, the definition of high status is broadened to include individuals with a parent that could sign their marriage record but, as discussed, the sample necessarily includes only those individuals whose parents married in the colony.

Column (3) in Table 1 presents the data for the NBS sample. The proportion of high status individuals in the population expands to 32.7%. While quantitatively smaller, the qualitative differences between the behavior of high and low status individuals and between men and women continue to hold. For example, high status individuals were less likely to marry than low status men and women and a higher proportion of women, compared to men, ever married.

Column (6) presents the reduced form estimates for the NBS sample. The point estimate for η is 0.988 which is the same as in the NB sample. The estimated survival probabilities are marginally lower than in the NB sample. The point estimates for the meeting probabilities, $q(H)$ and $Q(h)$, are 0.264 and 0.369 respectively. These estimates, significantly larger than in either of the other two samples, reflect the larger share of high types in the population.

Unlike the NB or NBQ samples, an Hh match was now more likely to fail than a Ll match (the NBS rejection probabilities are 0.858 and 0.676, respectively, rows 9 and 12). Since high types were more prevalent and therefore more likely to meet each other in this sample, they had to reject each other more often to fit their lower marriage rates.

In some respects the estimates from the NBS sample do not fit as well as those derived from the NB or NBQ samples. For example, the fraction of $\frac{\pi_{Lh}}{\pi_{Ll}}$ matches (0.419) is well above the observed fraction of 0.322. In comparison, the NB sample prediction for $\frac{\pi_{Lh}}{\pi_{Ll}}$ perfectly matches the observed ratio. In the case of average first marriage age, though, estimates using the NBS sample map more closely to the observed ages. As with the NB and NBQ sample estimates, though, the predicted $MAFM$ for high and low status men is lower than the observed averages.

To summarize, first, the estimates of η are all less than one. This is the first evidence that a larger exit rate for women from the marriage market is significant in explaining aggregate gender differences in the marriage market. Second, all of the estimates of the failure probabilities, except one, are larger than one-half. That is, the modal match is rejected. These estimated failure probabilities show that search friction was a significant factor in affecting marriage market behavior. Third, the estimated models also provides rankings of the average ages of first marriages for the different groups that are by and large consistent with the data.

Four caveats are in order. First, the models predict declining marriage hazards for single men and women (when we do not control for status). Controlling for social status, it predicts a constant hazard for men and a declining hazard for women due to unobserved exit of single women from the marriage market. As shown in Figure 2, the empirical marriage hazards are not consistent with the theoretical hazards. How these models should be extended to incorporate more realistic marriage hazards is a topic for future research.

Second, the model predicts non-assortative matching in husbands' and wives' ages, which is counterfactual. There are many ways to generate positive assortative matching in spouses' ages. For example, age dependent survival probabilities will induce a demand for younger spouses which will lead in equilibrium to positive assortative matching in spouses' ages.

Third, although the model is able to predict the high average age of first marriage for high status males, it assumes that these males entered the marriage market at age 17. Thus most married men had long searches before they succeeded in marrying. An alternative interpretation of the data is that males do not enter the marriage market until much later. In the mean time, they tried to accumulate wealth. Those who were successful married and those who were not did not marry (Siow (1998)). This alternative model may also be able to account for the general under prediction of the average age of first marriage of low status men. This data set is not suitable for estimating this alternative model because it does not have any measure of the changes in individuals' wealth status.

Fourth, we model the difference in the marriage rates and age at marriage as arising from women's higher exit rate from the marriage market. One also may be able to generate these results with a model that allowed for a differential entry rate, with men entering at a higher rate than women. The disproportionate entry of male immigrants into the colony suggests that such an interpretation may have some relevance. As noted, however, immigrants are believed to have been of minor importance in the colony after the mid-1670s. Given that the vast majority of births and certainly marriages occur after 1680, the immigrant flows are not expected to introduce significant bias into the sample. Nevertheless, it may help to explain the excessive scarcity of women in Quebec City. Working in the other direction, though, was the gender distribution of the population that survived to age 15–there were more women than men in each of the samples (and the scarcity of males was especially large in the city). We explore the probability of marriage in the micro-data using multivariate regression techniques to illustrate that the lower marriage rate among males and high status individuals observed in the aggregate data is not caused by measurable heterogeneity across these populations (see Appendix C). In the next section, we defend our interpretation.

4 A behavioral framework

4.1 Importance of differential fecundity

In our behavioral model, we interpret η as the arrival rate of menopause and assume that infertile women do not enter the marriage market. Hence each woman who is fecund in the current period will remain fecund in the next period with probability $\eta < 1$. Menopause is irreversible. In contrast, men are fecund for every period of their lives. Differential fecundity is the only exogenous difference between men and women in this society.

To justify our interpretation of η, we present two kinds of evidence on the importance of differential fecundity in the marriage market. Figure 3 plots the distribution of fathers and mothers' ages at the time their children were born. The age distribution for men clearly exhibits a higher mean than women's age distribution. More importantly, men continued to have children when women in the same birth cohort could no longer have children. That is, at an age when women could not have children, men of the same age still demanded children. Only men marrying younger women satisfied this demand.

We also examine remarriage behavior. If menopause leads women to exit the marriage market, we would expect remarriage to be less common among widows, compared to widowers, and widowers to prefer fertile over infertile women. Women who remarried are not expected to exhibit the same preference for young men, since male fertility is not correlated with age.

Overall, the remarriage rate for men is almost twice that of women (45 percent versus 27 percent, Table 1, column (1)). Part of this difference could simply reflect the relative availability of potential spouses, since there were more widows than widowers in the population. As Figure 4 illustrates, however, men entering their second marriage tended to marry even younger women than men entering their first marriage. In contrast, women entering their second marriage tended to be closer to their spouse's age than women entering their first marriage.

To examine these issues more carefully we estimate the probability of remarriage as a function of gender, the presence of children from the previous marriage, and age at widowhood. We also include status, year, and urban marriage controls in each regression. Age at widowhood and previous children are expected to act as proxies for future female fertility. Age-at-widowhood is predicted to be a deterrent to female remarriage and a first marriage that did not produce children may have signalled infertility, hurting the survivor's chances at remarriage.

Table 2 presents the probit estimates. The sample is a subset of the NB sample–individuals known to have been widowed from their first marriage (subsequent remarriage behavior is ignored). We examine women and men together in column (1), and their behavior separately in columns (2) and (3), respectively. Column (1) indicates that the probability of a man remarrying was 0.314 higher than that of a woman (a larger difference than found in the raw means).[33] Comparing the age-at-widowhood coefficients for women and men across columns (2) and (3) reveals that age hurt both men's and women's chances of remarriage, but the age penalty for women was twice that experienced by men. Column (2) also indicates that a widow without a child from her first marriage had a 0.15 lower probability of remarriage. This infertility penalty fell as the age of widowhood increased (it disappears by age 30). Potential spouses did not, however, value children from the first marriage per se—the remarriage rate fell as the number of (previous) children increased. On the other hand, an absence of children from the first marriage did not affect the remarriage probability of widowers (column (3)). These results provide further evidence of the importance of differential fecundity in the marriage market.[34]

[33]This result is well known and holds for many countries and across time. For example, in a current study Chamie and Nsuly (1981) show that divorced men were more likely to remarry than divorced women in all 47 countries they examined. For some historic evidence, see Dupâquier et al. (1981).

[34]Research on historic remarriage behavior argues fertility as well as other factors were important deterrents to female remarriage. For example, Hufton (1995: 218-22) states that post-menopausal women did not tend to remarry. She goes on to argue that women faced more social pressure than men to remain in their widowed state. The minimum acceptable mourning period was much longer for women (at least a year, compared to 3-6 months for men) and men's honor required them to replace their wives quickly because engaging in menial tasks like cooking, cleaning, and child rearing was degrading. Hufton also cites contemporary correspondence that illustrates various church's views on widowhood. In short, they tended to believe that because widows had acquired 'carnal knowledge' the best antidote to this unfortunate situation was chastity.

4.2 A Behavioral Model

As noted above, the statistical model is determined by eight parameters: a, p_h, p_l, η, $\lambda(H,h)$, $\lambda(H,l)$, $\lambda(L,h)$ and $\lambda(L,l)$. From an economic point of view, p_h and p_l are survival probabilities and η represents differential fecundity. These parameters may be regarded as exogenous to the marriage market. On the other hand, the failure probabilities $\lambda(H,h)$, $\lambda(H,l)$, $\lambda(L,h)$ and $\lambda(L,l)$ are endogenous variables. In what follows, we provide a simple behavioral model for determining these endogenous failure probabilities.

When an eligible man of status s and a woman of status S meet, they draw an idiosyncratic match value w from the cumulative distribution $F(w)$. Let $2w\gamma(S,s)$ be the total per period marital output to be divided by the husband and his fecund wife if they marry. $\gamma(S,s)$ is the systematic component of output which depends on the statuses of the couple. Let the man's expected per period return in marriage if his wife is fecund be $wg(S,s)+b(S,s)$. Let $wG(S,s)+B(S,s)$ be the woman's per period expected return in the marriage if she is fecund. Since total output is shared between the man and the woman if they marry, $wg(S,s)+b(S,s)+wG(S,s)+B(S,s)=2w\gamma(S,s)$. We employ a Nash bargaining solution to divide the marital output (termed an unequal sharing model, section 4.3). We briefly describe estimates from an equal sharing model at the end of the paper.

Both individuals must agree for the marriage to occur. For analytic convenience, we assume that if the wife is menopausal each spouse receives the return that he or she derives as a single person.[35]

Let $u(s)$ be the value that a man of status s obtains from entering the marriage market. Let him meet an eligible woman of status S. Let them draw a match value of w. If they marry, he will get in expected present value $v(S,s,w)$:

$$v(S,s,w)=wg(S,s)+b(S,s)+p_s[p_S(\eta v(S,s,w)+\overline{\eta}u^i(s))+\overline{p}_S u(s)], \quad (6)$$

where $wg(S,s)+b(S,s)$ is his current payoff if he marries. If he survives into the next period, which occurs with probability p_s, there are three mutually exclusive outcomes. His wife also survives and remains fecund. In this case, his value from marriage in the next period will be $v(S,s,w)$. This will occur with probability $p_S\eta$. He will get the expected present value $u^i(s)$ if his

[35] This assumption must be changed if there is divorce. As it stands, all married men would prefer to divorce their menopausal wives. We make this assumption here because a richer specification is not identified since we do not observe any divorce.

marriage survives but his wife becomes menopausal. This will occur with probability $p_s\overline{\eta}$. Finally, he will get $u(s)$ if his wife dies and he returns to the marriage market. This will occur with probability $\overline{p}_S$.

When his wife becomes menopausal, he gets k_s per period while he remains married. He returns to the marriage market when she dies. So:

$$\begin{aligned} u^i(s) &= k_s + p_s(p_S u^i(s) + \overline{p}_S u(s)) \\ &= \frac{k_s + p_s\overline{p}_S u(s)}{1 - p_s p_S} \end{aligned}$$

Thus (6) becomes:

$$v(S,s,w) = \frac{wg(S,s) + b(S,s) + p_s\overline{p}_S(1 + \frac{\overline{\eta}p_s p_S}{\overline{p_s p_S}})u(s) + \frac{\overline{\eta}p_s p_S k_s}{\overline{p_s p_S}}}{1 - \eta p_s p_S}$$

If they do not marry, he will get k_s, the per period return from being single, and $p_s u(s)$ the expected return from re-entering the marriage market in the next period.

Assuming that he wants to maximize the expected present value of marital consumption, he will choose:

$$u(S,s,w) = \max[v(S,s,w), k_s + p_s u(s)] \tag{7}$$

His reservation match value, $\omega(S,s)$, is defined by:

$$\begin{aligned} v(S,s,\omega(S,s)) &= k_s + p_s u(s) \qquad (8) \\ \omega(S,s) &= \frac{k_s(1 - \frac{p_s p_S \overline{\eta p_S p_s}}{\overline{p_s p_S}}) + u(s)\frac{p_s p_S \overline{\eta p_S p_s}\ \overline{p_s}}{\overline{p_s p_S}} - b(S,s)}{g(S,s)} \end{aligned}$$

Let $U(S)$ be the value that a fecund woman of status S obtains from entering the marriage market. Let k_S be her per period gain from being single.

Using the same reasoning as before, when a woman of type S meets a man of type s and draws a match value of w, the woman's gain from marriage is:

$$V(S,s,w) = wG(S,s) + B(S,s) + \eta p_S[p_s V(S,s,w) + \overline{p}_s U(S)] + \frac{\overline{\eta} p_S k_S}{1 - p_S}$$

The last term in this expression is her payoff when she becomes menopausal. It includes only her per period return from being single because she will not return to the marriage market as a menopausal widow. To maximize utility, she will choose:

$$U(S,s,w) = \max[V(S,s,w), k_S + p_S(\eta U(S) + \frac{\overline{\eta} k_S}{1-p_S})] \tag{9}$$

Her reservation match value, - (S,s), is defined by:

$$V(S,s,\text{-}\ (S,s)) = k_S + p_S(\eta U(S) + \frac{\overline{\eta} k_S}{1-p_S}) \tag{10}$$

$$\text{-}\ (S,s) = \frac{k_S(\overline{\eta p_S p_s}\frac{\overline{\eta p_S}}{\overline{p_S}} - \frac{\overline{\eta} p_S}{\overline{p_S}}) + U(S)\overline{\eta p}_S \eta p_S p_s - B(S,s)}{G(S,s)}$$

The binding reservation match value for an Ss match is then:

$$\underline{w(S,s)} = \max[\omega(S,s), \text{-}\ (S,s)] \tag{11}$$

The expected value of an Ss match for a man is then:

$$x(S,s) = F(\underline{w(S,s)})(k_s + p_s u(s)) \tag{12}$$
$$+ \frac{\int_{\underline{w(S,s)}}(wg(S,s) + b(S,s) + p_s\overline{p}_S(1 + \frac{\overline{\eta} p_s p_S}{\overline{p_s p_S}})u(s) + \frac{\overline{\eta} p_s p_S k_s}{\overline{p_s p_S}})dF(w)}{1-\eta p_s p_S}$$

The expected value of an Ss match for a woman is:

$$X(S,s) = F(\underline{w(S,s)})(k_S + p_S(\eta U(S) + \frac{\overline{\eta} k_S}{1-p_S})) \tag{13}$$
$$+ \frac{\int_{\underline{w(S,s)}}(wG(S,s) + B(S,s) + \eta p_S\overline{p}_s U(S) + \frac{\overline{\eta} p_S k_S}{1-p_S})dF(w)}{1-\eta p_S p_s}$$

Let $\widehat{q(S')}$ be an eligible man's subjective probability that he will meet an eligible woman of type S'. An eligible man will not meet any woman with subjective probability $(1-\sum_{S'}\widehat{q(S')})$. Then the expected utility of an eligible man of type s is:

$$u(s) = (1 - \sum_{S'} \widehat{q(S')})(k_s + p_s u(s)) + \sum_{S'} \widehat{q(S')} x(S', s) \tag{14}$$

Let $\widehat{Q(s')}$ be an eligible woman's subjective probability that she will meet an eligible man of type s'. Since women are scarce, we assume that every eligible woman will meet a man in each period. Then the expected utility of an eligible woman of type S is:

$$U(S) = \sum_{s'} \widehat{Q(s')} X(S, s') \tag{15}$$

4.3 Unequal Sharing

We assume the parties involved in a match can credibly commit to transferring resources to each other after marrying. That is, if there are gains from marriage, the two individuals involved can divide the expected gains to facilitate the marriage. So all matches which result in a gain for the two parties combined will occur. For the case of Quebec, Hamilton (1999) provides micro evidence from nineteenth-century Quebec marital contracts that illustrate that potential spouses transferred resources to each other to facilitate marriages.

Recall that $2w\gamma(S, s)$ is the total per period marital output to be divided by the husband and his fecund wife if they marry. The share of output obtained by each spouse depends on his or her bargaining power and outside opportunities. As first recognized by Manser and Brown (1980) and McElroy and Horney (1981), the Nash Bargaining model provides a convenient framework to analyze these within-family transfers. Using the Nash bargaining solution with equal bargaining power to divide the output, we show in the appendix that:

$$g(S, s) = G(S, s) = \gamma(S, s) \tag{16}$$

$$b(S, s) = \frac{k_s(1 - \frac{p_s p_S \overline{\eta p_S p_s}}{\overline{p_s p_S}}) - k_S(\overline{\eta p_S p_s} \frac{\overline{\eta p_S}}{\overline{p_S}} - \frac{\overline{\eta} p_S}{\overline{p_S}}) + (u(s) \frac{\overline{\eta p_S p_s}\ \overline{p_s}}{\overline{p_s p_S}} - U(S) \overline{\eta p}_S \eta) p_S p_s}{2}$$

$$B(S, s) = -b(S, s)$$

$b(S,s)$ is the per period transfer that the husband gets if his wife is fecund. It is increasing in his outside option (not marrying and returning to the marriage market in the next period) and decreasing in her outside option. $B(S,s)$ (equal to $-b(S,s)$) is the transfer that she gets from him if they marry. Substituting (16) into (11) yields:

$$\omega(S,s) = \text{-}\ (S,s) = \underline{w(S,s)} \tag{17}$$
$$= \frac{k_s(1 - \frac{p_s p_S \overline{\eta p_S p_s}}{\overline{p_s p_S}}) + k_S(\overline{\eta p_S p_s}\frac{\overline{\eta p_S}}{\overline{p_S}} - \frac{\overline{\eta} p_S}{\overline{p_S}}) + (u(s)\frac{\overline{\eta p_S p_s}\ \overline{p_s}}{\overline{p_s p_S}} + U(S)\overline{\eta p}_S \eta) p_S p_s}{2\gamma(S,s)}$$

That is, the man and the woman have the same reservation match value. The same reservation match value is to be expected because both parties will agree to marry as long as there are gains to marriage.

4.4 Marriage market equilibrium

Let individuals' subjective steady state matching probabilities be $\widehat{q(S)}$ and $\widehat{Q(s)}$. Given these subjective matching probabilities, $\underline{w(S,s)}$, the binding reservation match values, are determined as in the previous section. Substitute $F(\underline{w(S,s)})$ for $\lambda(S,s)$ in equations (1) to (5). Given $F(\underline{w(S,s)})$, a_h, p_h, p_l and η, equations (1) to (5) may be solved to provide realized steady state values for $q(S)$ and $Q(s)$. If the realized steady state values for $q(S)$ and $Q(s)$ are equal to the individuals' expectations of those values, $\widehat{q(S)}$ and $\widehat{Q(s)}$, we have found a rational expectations marriage market equilibrium for the behavioral model.

We do not show that a marriage market equilibrium exists for all admissible parameter values. Rather, we will study the existence of market equilibria which are consistent with reduced form estimates of the model.

4.5 Empirical methodology

Our approach is to employ the reduced form parameter estimates to calculate relevant parameters of the behavioral model. We estimate the systematic gains from marriage, $\gamma(H,h)$, $\gamma(H,l)$, $\gamma(L,h)$, $\gamma(L,l)$, and the per period returns to being single, k_h and k_l. We assume that $F(w)$ is the standard uniform distribution, hence $\lambda(S,s) = F(\underline{w(S,s)}) = \underline{w(S,s)}$. Thus no parameter of the distribution has to be estimated. Since there are only four reservation match values $\underline{w(S,s)}$, we can estimate at most four behavioral parameters. Thus these parameters must be restricted such that there will be at most four unknown parameters. We set $k_l = 1$ and $\gamma(H,l) = \gamma(L,h)$. Using equation (17) as the reservation match value, the remaining unknown behavioral parameters, $\gamma(H,h)$, $\gamma(H,l) = \gamma(L,h)$, $\gamma(L,l)$, and k_h are linear in the reduced form parameters (see equations 8, 10, and 12 to 15). Thus the estimates will be unique.

If higher status spouses produce more marital output, then:

$$\gamma(H,h) > \gamma(H,l) = \gamma(L,h) > \gamma(L,l) \tag{18}$$

As outlined in section 4.3, $g(S,s)$, $G(S,s)$, $b(S,s)$ and $B(S,s)$ are determined by the Nash Bargaining solution. This solution is fully characterized by the previously discussed parameters and does not add additional unknown parameters. Thus the behavioral model is in principle identified.

4.6 Structural estimates

Table 3 presents parameter estimates for the unequal sharing model. Column (1) presents the structural estimates for the NB sample. Because $k_l = 1$, all parameter estimates are interpreted relative to the per period return of a single low status individual. The estimate for k_h is 23.27. This means that single high status individuals had a much higher per period payoff than single low status individuals. The estimate for $\gamma(H,h)$ is 37.84, compared to 14.39 for $\gamma(H,l)$. Thus there was a relatively large systematic loss for a high status individual who married a low status individual rather than another high status individual. This large loss explains the reluctance of high status individuals to marrying down and also explains their relatively low marriage rates. On the other hand, the estimate for $\gamma(L,l)$ is 2.44. So low status individuals gained significantly from marrying up. Our estimates of the systematic returns to marriage satisfies (18): marital output was increasing in skill.

Because high status individuals lost and low status individuals gained in a mixed-status marriage, the transfers from the low status individuals to the high status individuals were substantial (rows 6 and 7). On the other hand, the transfers involved in own-status matches were much smaller. In both Hh and Ll matches, men paid small transfers to women in marriage.

In terms of expected lifetime discounted consumption, rows 9 to 12 show that high status individuals were much better off than low status individuals.

Holding status constant, men entering the marriage market enjoyed slightly lower utilities than women. Thus even though men were always fecund relative to women, the relative scarcity of women benefited women.

Column (2) provides structural estimates for the NBQ sample. The results are quantitatively similar to that in the NB sample. Again (18) is satisfied, hence marital output was increasing in status. There are two differences from the NB sample. First, the estimate for k_h is 11.0 which is much lower than in the NB sample (where k_h is 23.27). Second, the estimate for $\gamma(L, l)$, 7.99, is much larger than the 2.44 estimated with the NB sample. This larger estimate for $\gamma(L, l)$, compared to the relatively similar estimate for $\gamma(H, l)$, 9.55, means that low status individuals did not gain as much from mixed status marriages. This lesser gain is confirmed by the lower estimated transfers from low status individuals to high status individuals in mixed status marriages. High status individuals continue to have higher lifetime utilities than low status individuals, although the advantage is 3 to 1 rather than more than 10 to 1 in the NB sample. Finally, fecund women continue to have fared slightly better than men.

In contrast, the parameter estimates from the NBS sample appear nonsensical (column (3)). They suggest that high status people were worse off than low status people, high status people (and low status people who married up) were better off single, and that high status individuals were better off if they matched with a low status person, relative to another high status person. The reason for these nonsensical results is the higher rejection rate for Hh matches than Ll matches as found in the reduced form estimates. This higher rejection rate for Hh matches seems implausible.

We interpret the nonsensical structural estimates in Column (3) as rejecting the NBS sample as a relevant marriage market as the participants saw it. This appears to arise because the broader definition of high status does not capture true status distinctions in New France. To illustrate, we estimated the model using the same sample, but employing the 'narrow' definition of high status (noble or bourgeois family). The results are similar to those found with the NB and NBQ samples. Single high status people were better off than single low status individuals; high status gained more from marriage than low status individuals; and high status lost from marrying down, while low status gained from marrying up. Fecund women were also better off than men.[36] These results indicate that the estimates are sensitive

[36]The estimates are as follows: $k_h = 5.42$; $\gamma(H, h) = 8.29$; $\gamma(H, l) = \gamma(L, h) = 3.88$;

to the definition of high status, and that the smaller sample itself was not the cause of the bizarre NBS results. A broad definition that encompasses a large share of the population diminishes the gains associated with status.

In summary, the parameter estimates from the NB, NBQ, and narrowly defined NBS samples tell a consistent story. High status individuals had low marriage rates because the gains to Hh matches far outweighed mixed-status matches. The advantages that high status individuals had over low status individuals were smaller in the NBQ sample. Estimates of gender differences were the same for both the NB and NBQ sample. There were systematic transfers between spouses in these marriages. Controlling for status, fecund women fared marginally better than men. Men fared better than menopausal women.

The behavioral estimates for the NBS sample suggest that expanding the definition of high status to include the ability of parents to sign their marriage register is not appropriate. Treating Quebec City as one marriage market seems a priori more plausible than treating the entire province as one marriage market. Furthermore, while the results from the NB, NBQ, and narrow high status NBS samples are qualitatively similar, there is some suggestion that both the reduced form and behavioral estimates are quantitatively the most reasonable with the NBQ sample. On the other hand, examining Quebec City separately has the disadvantage of potential sample bias arising from (unobserved) male immigrants.

In general, point estimates of the structural parameters and welfare calculations are quite sensitive to the reduced form estimates. For example, the estimated per period gain from being single for a high status individual ranged from -11.36 to 23.27. The estimated discounted utility of being a high status male ranged from -241.84 to 655.01. The wide range of structural estimates suggest that the reduced form parameters are quite informative about the structural parameters. Whether this sensitivity is general to this class of models is unknown.

It is also noteworthy that our approach provides a new interpretation of women's lower average age of first marriage. Impending menopause will lower women's reservation match value (ceteris paribus), but it also makes women relatively scarce in the marriage market. This improves their chances of meeting a mate and allows them to be more discriminating (thus raising their reservation values). Thus, whether differential fecundity lowers women's

$\gamma(L,l) = 2.10$; $U_H = 117.95$; $u_h = 117.01$; $U_L = 36.47$; $u_l = 34.76$.

average age of first marriage relative to men is ambiguous. Our structural estimates show that women were more discriminating than men in the marriage market, but because the chances of meeting a spouse were higher for eligible women, they tended to spend less time searching and married at a younger age.

Lastly, we offer a further check on the sensitivity of the results to sample specification. We excluded births before 1670 from each of the three samples (NB, NBQ, and NBS), because of the greater potential for missing (unmarried) immigrants from the marriage market during the early part of the century. In addition, women were especially scarce during the early part of the settlement process, an imbalance that had largely dissipated by the time the population was growing primarily through natural increase.[37] These estimates are reported in Tables 4 and 5. They are consistent with the results for all years (tables 1 and 3), but the returns to high status are generally smaller.

4.7 Equal sharing estimates

In an equal sharing model, the man's expected per period return in marriage if his wife is fecund is equal to that of his wife. Thus $g(S, s, w) = G(S, s, w) = w\gamma(S, s)$ and $b(S, s) = 0$. The justification for considering an equal sharing model is that much marital output, e.g. children, cannot be divided easily between the spouses. The equal sharing model is inefficient in the sense that there are matches that fail in which both parties would agree to marry if they could transfer resources between them. However this inefficiency cannot be avoided if spouses are unable to honor these transfers after marrying.

We estimate the behavioral parameters in the following way. First, for any Ss match, we guess as to whether the man or woman's reservation match value is binding. Given our four guesses about who has the binding reservation match values, the behavioral parameters $\gamma(H, h)$, $\gamma(H, l)$, $\gamma(L, l)$, k_h and k_l are linear in $\lambda(S, s)$, p_h, p_l, η, $q(S)$ and $Q(s)$. See equations (8), (10), and (12) to (15). Thus we can obtain estimates of these behavioral parameters by solving the system of linear equations. Given the estimates of the behavioral parameters, we check to see if our four guesses about who has the binding reservation match values satisfy equation (11). If the guesses are correct, we

[37] See Landry (1992). In the 1660s hundreds of single women were brought to the colony to alleviate the gender imbalance.

have found a set of behavioral estimates. We also use this method to check for multiple sets of behavioral estimates that fit the reduced form estimates.

Unfortunately, the equal sharing model is over-identified for some parameters and unidentified in others when high status individuals had the binding reservation match values in mixed status matches. But the Nash Bargaining estimates suggest that this was the case. Thus we are unable to obtain any estimate of the equal sharing model for the cases of interest. We do find an equilibrium for the NBQ sample in which men had the binding reservation match values in Hh matches and women had the binding reservation match values in all other matches. In this case, the estimates were $k_h = 15.5$; $\gamma(H,h) = 36.3$; $\gamma(H,l) = \gamma(L,h) = 21.3$; $\gamma(L,l) = 37.7$; $U_H = 260$; $u_h = 256$; $U_L = 226$; $u_l = 228$. The estimates show that marital output was not increasing in status, violating (18). On the other hand, single high status individuals had 15 times higher per period return than single low status individuals and the present value of consumption is higher for high types than low types. Although consistent with equilibrium, these estimates are economically implausible.

In summary, due to the identification problem with mixed status matches, we are unable to present estimates for an equal sharing model. This lacuna should not be considered as evidence against the equal sharing model. Rather, we are unable to shed light on the equal sharing model with the data in this paper.

4.8 Historic Context: Gains to Assortative Matching

Our explanation that the low marriage rates among high-status individuals stemmed in part from gains to assortative matching has some contextual support, although the historic record is not entirely unambiguous. A low marriage rate among an aristocratic class often is attributed to families' desire to retain their elite status (e.g., Hurwich, 1998). In a number of European countries, this goal was entrenched in their inheritance systems. These societies practiced primogeniture, hence subsequent sons were less attractive than first-born sons, and dowries were prohibitively large (e.g., Hufton, 1995).

For most of the New French, all children (male and female) claimed an equal share of their parent's estate and dowries were rare (Dechêne (1992)). The small number of families that owned seigneuries, however, could (legally) practice a watered-down form of primogeniture. Half of the estate, including the house, passed to the first son, while the remainder was divided equally among the other children. The objective was to discourage partitioning of the seigneuries.[38] Thus, given their expected inheritances, one presumes that most young, elite children could have attracted mates.

High status parents, however, may have had incentive to deter their children from marrying down. Because husbands and wives held equal claim to most marital assets, the family's wealth would have been diluted if a son or daughter married down. In addition, female children of noble families stood to lose their 'status' if they married a non-noble male. A variety of evidence suggests that parents attempted to orchestrate their children's marriage prospects and alliances.

First, the surviving written record, although sparse, indicates as much. In one case a mother was incensed with her son's (an army officer) prospective bride. The woman was from a noble family, but, she suspected, not a family of means. She wrote to him with her concerns:

> You greatly concern yourself with the gentleness of character, mannerisms, and good qualities of the one who possesses your heart. The portrait you make of her infinitely prepares me in her favor, but I find it quite extraordinary that you do not provide any details regarding her capabilities or the arrangements you have made with her father and her mother. ...The silence that you keep regarding this matter proves that she is not rich; fortune, I agree my son, does not provide perfect happiness to man, but beware, it is necessary.[39]

Second, the rate of consanguine marriages appears to have been relatively high among the noble population, which is consistent with these families exhibiting concern about wealth and status maintenance. Gadoury find that 10 percent of noble marriages were within-family, compared to 4 percent for the population as a whole.[40] Among the aristocracy in France 'arranged'

[38]For more information on seigneuries see, for example, Greer (1997) or Harris (1966).

[39]Author translation. Source: Letter from Madame Vassal de Monviel, cited in Gadoury (1991: 94).

[40]This proportion represents the share of marriages that received dispensation from the church (effectively, permission to marry) (Gadoury (1991: 108)). As Gadoury notes, it is a lower bound because the church charged a fee for such dispensations. Surprisingly, Noguera (1994: 144) estimates a consanguine rate of just 2 percent for the bourgeois class. This estimate appears to be sensitive to the definition of bourgeois-the rate is 4.5% among merchants.

marriages were the norm, and it was common to marry distant, or not so distant, relatives. (Gadoury (1991: 93)).

Third, not all elite children entered the marriage market because noble families supplied priests and nuns to the church. This phenomenon may have reflected piety alone, but it also conveniently limited a family's chances of marrying down. Second sons typically entered the priesthood. Hamilton and Siow (1999) find evidence of such a second birth effect among the noble population.

Finally, there were also civil or ecclesiastical restrictions on marriage that gave parents the right to reject their children's suitors in some circumstances. For example, minors could not marry without their parents' permission. Marriage banns, published in churches before the sacrament took place, also gave the public an opportunity to object to a union.[41]

The colonial (French) government was also firmly against its military officers (noble men) marrying common girls. For example, a 'poor' marriage between an army officer (and nephew of a colonial governor) and a non-aristocratic woman was an affront to the groom's family as well as the local governors. In a letter to the bishop of Quebec, the *Conseil de la Marine* blamed the church for conducting the ceremony without the governor's permission:

> The bishop has just married Sr. Adhémar de Lantagnac, the nephew of the troop lieutenant to a girl of no means and without social standing [of 'low birth'] whose mother [the lieutenant] saw serving at the father's cabaret, even though he [the bishop] had been asked not to do so.[42]

The reasons for the government's preoccupation with advantageous alliances are unclear, except to the extent that social standing mattered.[43]

[41] There are examples of parents seeking annulments for marriages that took place without their consent. See Gadoury (1991: 95-97).

[42] Author translation. Source: "Délibération du Conseil de la Marine" January 1721, Archives des colonies, Series C11A, vol. 43, folio 131. Cited in Gadoury (1991: 93).

[43] On one occasion the colonial governor wrote to the government minister in France, assuring him that "I will insist...that in the future officers will make marriages that are both suitable and profitable." Letter dated October 20, 1691, cited in Dechêne (1992: 235).

5 Conclusion

The strength of the model and approach we adopt is in its ability to fit the broad stylized facts of the marriage market under consideration. Given the level of aggregation and simplifying assumptions, the specific welfare estimates should be considered provisional. Nevertheless, the basic features of our model are likely to be more general than its application to Quebec because gender differences in age-at-marriage, marriage rates and fecundity, assortative matching, and class or wealth distinctions in marriage behavior are common features of both current and historic marriage markets.

Further research could advance our understanding of these issues. Narrowly, the model should be extended to include fertility, work and investment in human capital. The issues of divorce, cohabitation and single parenthood also have to be addressed. This class of models has to be estimated with modern data. There is also a need to integrate micro and macro data to estimate them.

More broadly, gender differences are fundamental to empirically relevant equilibrium models of marriage and the family. Yet there is no agreement on the factors that cause these differences. Since these models provide a coherent framework for doing quantitative policy and welfare analysis (e.g. Aiyagari et al. and Greenwood et al.), it is important to begin to cull the range of assumptions that we currently entertain. The ability to estimate these models using microdata is encouraging (e.g. Seitz, Wong).

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A Appendix: The Nash Bargaining Solution

Let a man of status s meets a woman of status S and they draw a match value of w. Let $\beta 2w\gamma(S,s)$ be the per period marital output that the man receives in a fecund marriage. The woman will receive $(1-\beta)2w\gamma(S,s)$. If they marry, the value of marriage to the man is:

$$v(S,s,w,\beta) = \frac{\beta 2w\gamma(S,s) + p_s\overline{p}_S(1+\frac{\overline{\eta}p_s p_S}{\overline{p_s p_S}})u(s) + \frac{\overline{\eta}p_s p_S k_s}{\overline{p_s p_S}}}{1-\eta p_s p_S}$$

The value of marriage to the woman is:

$$V(S,s,w,\beta) = \frac{(1-\beta)2w\gamma(S,s) + \eta p_S \overline{p}_s U(S) + \frac{\overline{\eta}p_S k_S}{1-p_S}}{1-\eta p_S p_s}$$

Applying the Nash bargaining solution with equal bargaining power,[44] $\beta(S,s,w)$ is determined by:

$$\beta(S,s,w) = \arg\max_{\beta}[v(S,s,w,\beta) - (k_s + p_s u(s))][V(S,s,w,\beta) - (k_S\frac{\overline{\eta p_S}}{\overline{p_S}} + \eta p_S U(S))]$$

$$= \frac{1}{2} + \frac{k_s(1-\frac{p_s p_S\overline{\eta p_S p_s}}{\overline{p_s p_S}}) - k_S(\overline{\eta p_S p_s}\frac{\overline{\eta p_S}}{\overline{p_S}} - \frac{\overline{\eta}p_S}{\overline{p_S}}) + (u(s)\frac{\overline{\eta p_S p_s}\ \overline{p_s}}{\overline{p_s p_S}} - U(S)\overline{\eta p}_S\eta)p_S p_s}{4w\gamma(S,s)}$$

Thus:

$$g(S,s) + b(S,s) = \beta(S,s,w)2w\gamma(S,s)$$

$$= w\gamma(S,s) + \frac{k_s(1-\frac{p_s p_S\overline{\eta p_S p_s}}{\overline{p_s p_S}}) - k_S(\overline{\eta p_S p_s}\frac{\overline{\eta p_S}}{\overline{p_S}} - \frac{\overline{\eta}p_S}{\overline{p_S}}) + (u(s)\frac{\overline{\eta p_S p_s}\ \overline{p_s}}{\overline{p_s p_S}} - U(S)\overline{\eta p}_S\eta)p_S p_s}{2}$$

and:

$$G(S,s) + B(S,s) = (1-\beta(S,s,w))2w\gamma(S,s)$$

$$= w\gamma(S,s) - \frac{k_s(1-\frac{p_s p_S\overline{\eta p_S p_s}}{\overline{p_s p_S}}) - k_S(\overline{\eta p_S p_s}\frac{\overline{\eta p_S}}{\overline{p_S}} - \frac{\overline{\eta}P_S}{\overline{p_S}}) + (u(s)\frac{\overline{\eta p_S p_s}\ \overline{p_s}}{\overline{p_s p_S}} - U(S)\overline{\eta p}_S\eta)p_S p_s}{2}$$

[44] E.g. Chapter 6, Osborne and Rubinstein (1990).

B Data Appendix

B.1 Representativeness of the PRDH Data Set

Charbonneau et al. (1993) describes the parish registers covering the period up to 1730. Most of the registers pertaining to the aboriginal population (mission registers) have not survived. For the non-aboriginal population, there were 80 parishes in the current Quebec territory. The registers for 48 of the parishes are 'intact', and 16 out of the remaining 32 have information gaps that total less than five years. They write: "as a whole, annual losses affect 11.4 percent of the registers from the 80 parishes" (Charbonneau et al. (1993): 43). The losses are most frequent in the earliest years of the colony's history. They estimated that the loss rate was likely in the neighborhood of one out of every 10 years between 1680 and 1700, and worse before 1680. Note that the population was quite small before 1680, hence comparatively few entries were missed when a parish book from 1640, versus 1740, was lost.

There are other potential sources of omissions apart from parish books. Individual entry sheets may have been misplaced and the priests may have missed some vital events. It is unlikely that all illegitimate births and abandoned babies were baptised (and registered). When the parish registers were incomplete, information was garnered from other sources, two of which are mentioned here. First, the nominal censuses from 1666, 1667, and 1681, which listed an individual's name, age, and often their occupation (if male). Second, marriage contracts, which most couples signed shortly before marrying. Hence if the parish marriage register was lost, a record of the couple's intent to marry was recovered from the notarial archives. Overall, Charbonneau et al. (1993: 62) estimate that marriage and death information is known in about 85 percent of cases. Of the remaining 15 percent, missing information often can be inferred from other sources (for example, for an individual with no death record, an upper bound on life span can be established in some cases from the date their spouse remarried). See also Légaré (1988: 5).

These data are better than most reconstituted family data sets because the information is linked across all of the colony's parishes.[45] Hence there is no loss of information on individuals that moved from one parish to another,

[45] Wrigley and Schofield's work on family reconstitution for England (1541-1871) is well known. See Wrigley and Schofield (1989, 1983); and Wrigley, Davies, Oeppen, and Schofield (1997).

which is a source of censuring bias in English reconstitution data sets.[46] Certainly it is the richest vital record data set available for exploring seventeenth and eighteenth century North American experiences.

B.2 Status Variables

Gadoury (1991) identified the nobility either through the use of a noble title in civil documents (ecuyer or chevalier) or service to the King (for those that did not work with their hands). In New France a substantial portion of those that did not inherit the title were army officers. After 1680 the title could be 'purchased' if the person brought sufficient capital to the colony.

Noguera (1994) assigned bourgeois status to any male that married before 1760, identified himself as having one of a set of trades or bourgeois status on any notarial or vital record document at any time during his life, and was not a noble. A bourgeois occupation included bourgeois, négociant [merchant/trader], armateur [ship owner], marchand bourgeois, bourgeois marchant, marchand [merchant], greffier au Conseil Supérieur [court clerk—judge, Crown's notary, Crown's lawyer], conseiller du Roi [Crown's counsel], délégué de l'intendant et subdélégué de l'intendant [Intendant's delegate. The Intendant was the Crown's representative or top official in the colony], grand voyer [overseer], contrôleur de la marine, directeur du Domaine, lieutenant général civil et criminel procureur du Roi, grand prévôt, directeur de la ferme, receveur, visiteur et contrôleur du Domaine, or garde magasin.

[46] There is a considerable literature on the sources of bias in data sets based on family reconstitution. Most of the literature focuses on biases that might arise because immigrants are excluded from the data sets. This sample selection has been shown to bias estimates of mean age-at-marriage and life expectancy in the English reconstitutions. See, for example, Levine (1976). Ruggles (1992) argues that biases will arise even if the age-specific demographic behavior of migrants and non-migrants was identical, because the probability of a demographic event occurring (and being recorded) in a parish rises the longer an individual remains in the parish. Hence life span will be biased downward because long-lived people have a greater chance of migrating than short-lived people. Age-at-marriage also will be understated because people that delay marriage have more opportunities to migrate. In contrast, Desjardin (1993) illustrates that the data employed here (the PRDH data set) do not suffer from inter-parish-migration censuring. He estimates mean age-at-marriage for men and women born between 1680 and 1740, and shows that the marriage age of those who moved between parishes was not very different from those who remained in their birth parish.

B.3 Representativeness of the Sample

The sample employed here (19,580 births before 1700, 15,334 with known life span) includes illegitimate births and individuals known to have left the province. The data sources for the 19,580 births are as follows: baptism (17,445); death record before baptism (251); marriage record, census list, or other document (1,890). The PRDH calculated that 1,094 people were born in the province but did not appear on any surviving records. This estimate is based on two factors: an assumption that the ratio of marriages arising from baptisms that survived is the same as the marriage-baptism ratio for missing baptisms records and an estimate of the undercounting of births due to infant mortality (individuals who died before baptism without a surviving death record).

C Appendix: Micro-data Analysis of Marriage Rates

It is possible that the comparatively low marriage rates of men and high status individuals observed in the raw means are simply an artifact of the aggregation of the data. To investigate this possibility we examine the micro-evidence, estimating the probability of marriage as a function of gender and status, with additional controls for birth year, life span, and whether the individual was born in a city.

The birth year variable is a proxy for temporal changes in the marriage market. It will help to pick up some of the effect of female scarcity that occurred early in the colony's history, a factor that may have contributed to the lower male marriage rate.[47] To further account for this possibility we also restrict the sample to those born after 1670 (columns 3-4) and those born after 1680 (columns 5-6).

Life span is expected to be correlated with the marriage rate because people who did not live past the typical marriage age were unlikely to marry. A quadratic term is included because the marginal effect of life span on the

[47]Before the 1660s, the immigrant composition was almost entirely male. This changed in the 1660s when the French Crown undertook a migration policy specifically designed to correct the gender imbalance. For an examination of this episode see Landry (1992). The male-to-female ratio is estimated to have fallen from 6.7 in 1666 to 1.4 in 1681 (Charbonneau et al., 1993: 81). See also Roy and Charbonneau (1978).

probability of marriage likely diminished with age. Life span might account for part of the gender differences in marriage rates because males tended to marry at a later age, hence they faced a higher chance of dying before marrying. To account for this, we include separate interaction variables between gender and life span in some of the regressions.

The urban birth dummy variable may account for some of the differences between the urban and rural marriage markets. The urban settings likely contained a higher proportion of (disproportionately male) immigrants, who are excluded from our sample. In addition, the urban environment was relatively unhealthy, hence individuals raised in these settings may have been less attractive mates. On the other hand, the closer proximity of potential mates may have led to higher marriage rates in the cities.

The sample is restricted to those individuals with known life span, who lived until at least age 15. Restricting the sample to those with known life span has a much larger positive effect on marriage rates of men versus women. This restriction increases marriage rates because those with unknown life span were disproportionately less likely to have had a marriage recorded in the province. Two factors help account for this: (1) a nontrivial proportion of childbirth (pre baptism) deaths were unrecorded (especially in the early decades); (2) emigration was more common among the young, and the young were less likely to have been married. Both factors likely affected men more than women.[48] Excluding individuals with unknown life span will lead to an overestimate of the probability of marriage only if those individuals whose life span was unknown (i.e., emigrants) had a higher marriage rate than those that stayed in the province.[49]

The results of the estimations are reported in Table 6. The coefficients reported are maximum likelihood probit estimates of the change in probability of a one-unity change in the independent variable, evaluated at the means of the independent variables. The probability of marriage without any controls was, on average, 5.4 points lower for men than women (for the sample with all years).[50] This probability is not appreciably altered when the life

[48]Males were more likely to die in the first few years of their life. Males were also more likely to emigrate, and because they tended to marry later in life, they were more likely to have been single when they emigrated.

[49]Furthermore, it will bias the male-female differential in marriage probability only if the difference in the marriage rate of those with known and unknown life span varied across gender.

[50]The regression without additional controls refers to . For the sample of individuals

span, urban, year, and status controls are included (it rises to 5.6, column 1). The probability of marriage rises with life span (at a diminishing rate), as expected. It was lower for individuals born in a city, which may reflect either the distortions of the unmeasured immigrant population or the unattractiveness of city dwellers.[51] The separate life span variables for males (column 2) indicate that the marginal effect of an added year of life on marriage rates were about twice as large for men than women (0.016+0.018 for men, 0.016 for women). Males now appear much less likely to marry than women (all else equal), as the coefficient on the male dummy variable dropped to -0.65. This large negative value is partially offset by the faster rate of increase in marriage rates among males that lived longer.

Restricting the sample to births that occurred after 1670 (col. 3-4) or after 1680 (col. 5-6) reduces the male-female difference in marriage rates, but it does not eradicate it. The birth year effect becomes insignificant once the sample is restricted to those born after 1680.

Table 6 also sheds light on the marriage rates of high status individuals (narrowly defined). Without any control variables, the probability of marriage for high status individuals is 0.234 points lower than that experienced by low status people (unreported result). This raw correlation could reflect unmeasured aspects of heterogeneity across the high and low status populations–non-randomness that is correlated with marriage rates. For example, a disproportionate share of high status people were born in the cities, which may help to explain their low marriage rates. Their chances of marriage also may have been reduced by their relatively short lives. Controlling for urban birth, life span and birth year (columns 1 and 2) does marginally reduce the coefficient on the high status variable, but it is still economically large (-0.204) and precisely estimated. Restricting the sample to those born after 1670 or 1680 does not appreciably affect this result (columns 3-6). The lower probability of marriage among high status individuals is also not particularly gender specific (see columns 7 and 8, which examines the probability of marriage for men and women separately).

born after 1670 the raw male coefficient (with no other explanatory variables) is -0.043. It is -0.028 for the sample with births after 1680. All effects discussed are significant at the one percent level.

[51] Adding a separate interaction variable for males born in the city (unreported results) yielded a statistically insignificant coefficient, which suggests that the immigrant population was not at the root of the lower urban marriage rate.

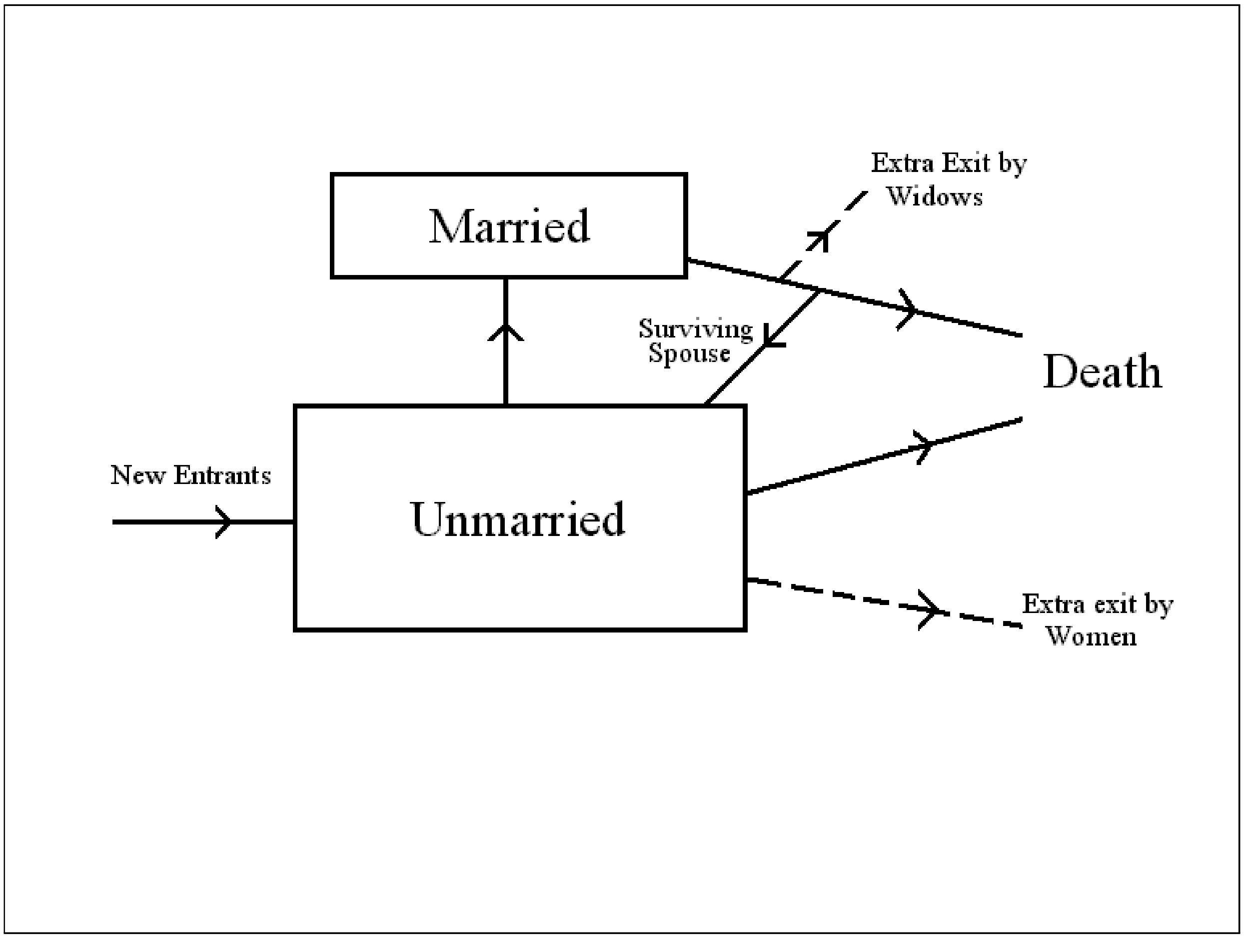

Figure 1: Flow chart of marriage market

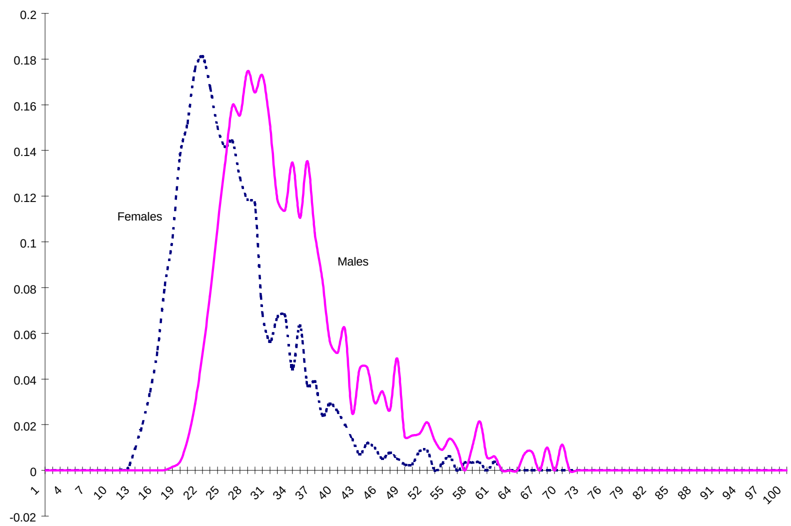

Figure 2: Marriage Hazard Rates by Gender

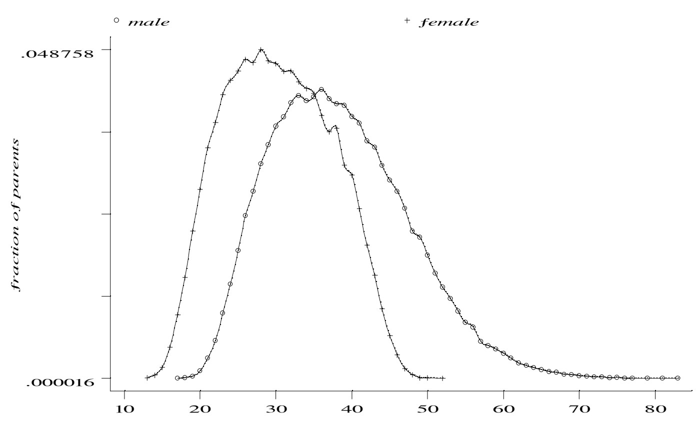

Figure 3: Densities of Parent's Age at Birth of Child

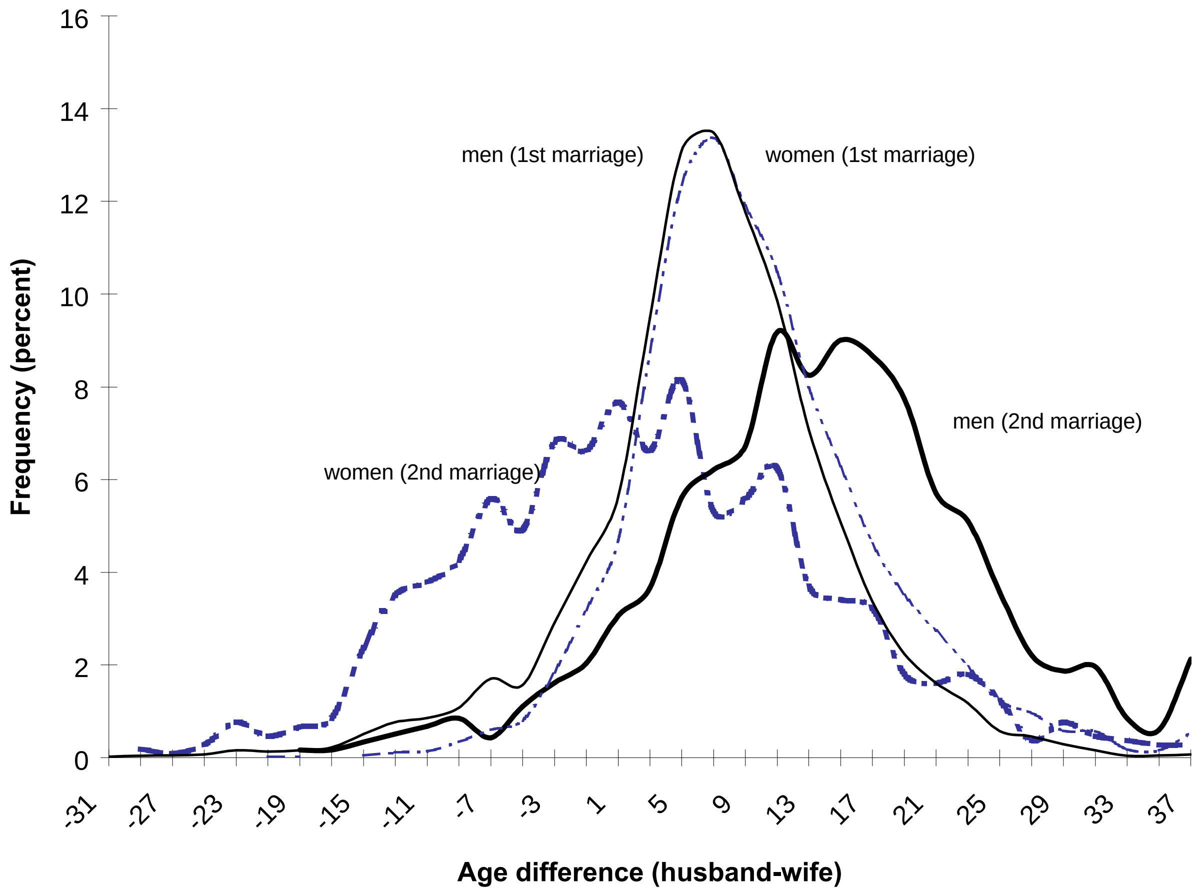

Figure 4: Spousal Age Differences: by Gender and Marriage Rank

		Observed means				Estimated means		
		(1)	(2)	(3)		(4)	(5)	(6)
		NB	NBQ	NBS		NB	NBQ	NBS
(1)	% h^*	5.8	10.7	32.7	η	0.988	0.951	0.988
(2)	Life span h^*	53.7	51.1	56.5	p_h	0.962	0.931	0.948
(3)	Life span l^*	57.8	56.0	58.2	p_l	0.966	0.939	0.950
(4)					δ	1.383	2.367	2.042
(5)	% unmarried h m^*	41.1	50.9	24.3	$q(H)$	0.059	0.069	0.264
(6)	% unmarried h f^*	35.7	35.8	20.6	$q(L)$	0.5	0.355	0.426
(7)	% unmarried l m^*	17.7	22.1	16.7	$Q(h)$	0.088	0.146	0.369
(8)	% unmarried l f^*	12.2	13.0	12.9	$Q(l)$	0.912	0.854	0.631
(9)	% widowers remarry	44.6	46.4	47.8	$\lambda(H,h)$	0.667	0.496	0.858
(10)	% widows remarry	26.8	31.1	26.9	$\lambda(H,l)$	0.942	0.886	0.772
(11)					$\lambda(L,h)$	0.937	0.921	0.762
(12)	$\frac{\pi_{Hl}}{\pi_{Ll}}^*$	0.024	0.043	0.425	$\lambda(L,l)$	0.734	0.526	0.676
(13)	$\frac{\pi_{Lh}}{\pi_{Ll}}$	0.022	0.057	0.322	$\frac{\pi_{Lh}}{\pi_{Ll}}$	0.022	0.026	0.419
(14)	$\frac{\pi_{Hh}}{\pi_{Ll}}$	0.021	0.062	0.264	$\frac{\pi_{Hh}}{\pi_{Ll}}$	0.013	0.030	0.152
(15)	MAFM h m	31.4	30.2	26.9	MAFM h m	26.4	26.1	25.4
(16)	MAFM h f	21.8	21.3	22.6	MAFM h f	24.0	22.7	23.6
(17)	MAFM l m	28.2	28.7	26.4	MAFM l m	23.9	25.2	24.1
(18)	MAFM l f^*	21.3	21.3	22.3				
(19)	N (births)	11578	2428	6573				
(20)	N (marriages)	6837	1007	1311				
(21)	% m (birth sample)	46.50	44.32	46.92				

* moments used in estimation. All age related data is measured in years. m = males; f = females; h = high; π_{Ss}=number of Ss marriages; MAFM = mean age at first marriage; η = per period probability that women remain in the marriage market; p_s= per period survival probability for type s; $\lambda(S,s)$ = rejection probability for an Ss match; δ= length of a period (in years); $q(S)$= probability of a male meeting a female of type S.
Source: Samples include individuals with known life span who lived until at least age 15.

Table 1: Reduced form estimates

	All	Male	Female
	(1)	(2)	(3)
Male widowed from first marriage	**0.314**		
	(0.018)		
No children in first marriage (NC)	**-0.159**	**-0.148**	-0.141
	(0.058)	(0.029)	(0.169)
Number of children in first marriage	**-0.006**	**-0.012**	0.009
	(0.002)	(0.003)	(0.004)
Age at first spouse's death (AGE)	**-0.024**	**-0.018**	**-0.029**
	(0.001)	(0.001)	(0.001)
First married in a city	**-0.038**	-0.020	**-0.072**
	(0.017)	(0.017)	(0.035)
Year of first marriage	**-0.004**	**-0.004**	**-0.004**
	(0.0004)	(0.0004)	(0.001)
NC $\times$ AGE	**0.004**	**0.005**	0.004
	(0.002)	(0.002)	(0.004)
Signed first marriage record	0.031	-0.015	**0.112**
	(0.020)	(0.020)	(0.036)
Noble parents	-0.090	-0.099	0.001
	(0.050)	(0.037)	(0.118)
Bourgeois parents	**-0.089**	**-0.073**	-0.076
	(0.035)	(0.030)	(0.089)
F-test on high status variables	**0.040**	**0.039**	**0.021**
N	4609	2923	1686
Pseudo R-squared	0.409	0.425	0.361

The dependent variable equals 1 if the individual remarried, 0 otherwise. Values reported are maximum likelihood probit estimates of the change in probability of a one-unit change in the independent variable, evaluated at the means of the independent variables. Bold type indicates significance at the 5% level. White corrected standard errors are in parentheses. The F-test tests that the high-status coefficients (noble parents, bourgeois parents, and signing) are jointly zero. *Source:* The sample consists of individuals known to have been widowed from their first marriage, subsequent remarriages are ignored.

Table 2: Incidence of Remarriage: probit estimates

		Sample		
		(1)	(2)	(3)
		NB	NBQ	NBS
(1)	k_h	23.27	11.00	-11.36
(2)	$\gamma(H,h)$	37.84	26.34	-14.81
(3)	$\gamma(H,l)$	14.39	9.55	-7.86
(4)	$\gamma(L,l)$	2.44	7.99	0.97
(5)	$b(H,h)$	-0.248	-0.488	0.135
(6)	$b(H,l)$	-11.94	-5.12	6.776
(7)	$b(L,h)$	11.53	3.82	-6.587
(8)	$b(L,l)$	-0.168	-0.799	0.055
(9)	$U(H)$	661.34	186.45	-244.74
(10)	$u(h)$	655.01	179.40	-241.84
(11)	$U(L)$	52.19	61.04	12.69
(12)	$u(l)$	46.18	49.19	14.22

k_h = per period value of being single (for high types); $\gamma(S,s)$ = systematic gains from an Ss marriage; $b(S,s)$ =per period transfer from wife to husband (or husband to wife, if negative); $U(S)$ =expected utility of an eligible woman of type S.

Table 3: Unequal sharing estimates

		Observed means				Estimated means		
		(1)	(2)	(3)		(4)	(5)	(6)
		NB	NBQ	NBS		NB	NBQ	NBS
(1)	% h^*	5.2	10.2	33.2	η	0.985	0.919	0.990
(2)	Life span h^*	53.0	49.2	56.4	p_h	0.939	0.879	0.951
(3)	Life span l^*	57.8	55.1	58.1	p_l	0.946	0.898	0.953
(4)					δ	2.19	3.90	1.95
(5)	% unmarried h m^*	44.4	56.7	24.0	$q(H)$	0.056	0.069	0.283
(6)	% unmarried h f^*	38.4	41.4	21.0	$q(L)$	0.595	0.426	0.443
(7)	% unmarried l m^*	17.5	23.5	16.4	$Q(h)$	0.078	0.130	0.376
(8)	% unmarried l f^*	13.1	14.8	13.2	$Q(l)$	0.922	0.870	0.624
(9)	% widowers remarry	43.9	44.1	48.1	$\lambda(H,h)$	0.509	0.657	0.867
(10)	% widows remarry	22.7	26.3	26.7	$\lambda(H,l)$	0.925	0.806	0.791
(11)					$\lambda(L,h)$	0.928	0.857	0.780
(12)	$\frac{\pi_{Hl}}{\pi_{Ll}}^*$	0.020	0.051	0.428	$\lambda(L,l)$	0.668	0.445	0.695
(13)	$\frac{\pi_{Lh}}{\pi_{Ll}}$	0.017	0.037	0.326	$\frac{\pi_{Lh}}{\pi_{Ll}}$	0.017	0.035	0.425
(14)	$\frac{\pi_{Hh}}{\pi_{Ll}}$	0.014	0.043	0.262	$\frac{\pi_{Hh}}{\pi_{Ll}}$	0.010	0.012	0.160
(15)	MAFM h m	31.5	28.8	26.8	MAFM h m	26.6	25.6	25.3
(16)	MAFM h f	23.4	23.9	22.7	MAFM h f	24.7	23.3	23.7
(17)	MAFM l m	27.5	28.0	26.3	MAFM l m	24.4	26.1	24.0
(18)	MAFM l f^*	22.3	22.6	22.4				
(19)	N (births)	9554	1634	6247				
(20)	N (marriages)	4748	581	1262				
(21)	% m (birth sample)	46.25	43.08	46.65				

* moments used in estimation. All age related data is measured in years. m = males; f = females; h = high; π_{Ss}=number of Ss marriages; MAFM = mean age at first marriage; η = per period probability that women remain in the marriage market; p_s= per period survival probability for type s; $\lambda(S,s)$ = rejection probability for an Ss match; δ= length of a period (in years); $q(S)$= probability of a male meeting a female of type S.
Source: Samples include individuals with known life span who lived until at least age 15.

Table 4: Reduced form estimates: Born after 1670

		Sample		
		(1)	(2)	(3)
		NB	NBQ	NBS
(1)	k_h	8.65	7.91	-7.70
(2)	$\gamma(H,h)$	19.32	12.68	-9.79
(3)	$\gamma(H,l)$	6.38	7.33	-4.77
(4)	$\gamma(L,l)$	2.97	8.85	1.44
(5)	$b(H,h)$	-0.13	-0.13	0.06
(6)	$b(H,l)$	-4.08	-2.56	4.78
(7)	$b(L,h)$	3.80	1.93	-4.71
(8)	$b(L,l)$	-0.15	-0.48	0.001
(9)	$U(H)$	161.98	69.40	-173.33
(10)	$u(h)$	159.37	67.82	-172.13
(11)	$U(L)$	37.36	36.22	21.13
(12)	$u(l)$	33.90	32.13	21.43

k_h = per period value of being single (for high types); $\gamma(S,s)$ = systematic gains from an Ss marriage; $b(S,s)$ =per period transfer from wife to husband (or husband to wife, if negative); $U(S)$ =expected utility of an eligible woman of type S.

Table 5: Unequal sharing estimates: Born after 1670

	All years		Born after 1670		Born after 1680		Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	**-0.056**	**-0.648**	**-0.050**	**-0.624**	**-0.038**	**-0.638**		
	(0.006)	(0.039)	(0.007)	(0.045)	(0.008)	(0.051)		
Life span	**0.024**	**0.016**	**0.025**	**0.018**	**0.026**	**0.019**	**0.037**	**0.016**
	(0.0008)	(0.001)	(0.0009)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Life span^2	**-0.0002**	**-0.0001**	**-0.0001**	**-0.0001**	**-0.0002**	**-0.0001**	**-0.0003**	**-0.0001**
	(0.0000)	(0.00001)	0.0000	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.0000)
Life span $\times$ male		**0.018**		**0.018**		**0.019**		
		(0.002)		(0.002)		(0.002)		
Life span^2 $\times$ male		**-0.0001**		**-0.0001**		**-0.0001**		
		(0.00002)		(0.00002)		(0.00002)		
Born in a city	**-0.040**	**-0.040**	**-0.042**	**-0.041**	**-0.057**	**-0.055**	**-0.047**	**-0.033**
	(0.007)	(0.007)	(0.008)	(0.009)	(0.011)	(0.011)	(0.012)	(0.009)
Birth year	**-0.001**	**-0.002**	**-0.002**	**-0.002**	0.00005	-0.00003	-0.0006	-0.002
	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0008)	(0.0008)	(0.0004)	(0.0003)
High status	**-0.204**	**-0.210**	**-0.217**	**-0.224**	**-0.195**	**-0.207**	**-0.212**	**-0.206**
	(0.021)	(0.021)	(0.026)	(0.025)	(0.031)	(0.030)	(0.034)	(0.027)
N	11578	11578	9554	9554	6819	6819	5384	6194
Pseudo R squared	0.251	0.280	0.263	0.289	0.270	0.294	0.402	0.144

Notes: Dependent variable: married = 1, 0 otherwise. Values reported are maximum likelihood probit estimates of the change in probability of a one-unity change in the independent variable, evaluated at the means of the independent variables. Bold type indicates significant at the one percent level. White corrected standard errors are in parentheses. Source: Sample for columns 1-2 includes everyone born in the province before 1700 with known life span of more than 15 years; the samples in columns 3-4 and 5-6 are a subset of this sample, with an additional restriction on the year of birth; the sample in columns 7 and 8 include all years.

Table 6: Incidence of Marriage: probit estimates.