

The Economics of Marriage 30 Years after Becker

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Abstract

A transferable utility model of the marriage market, first analyzed by Becker, is used to rationalize marriage and cohabitation in contemporary Canada, gender differences in marital and labor supply behavior, and why dowries disappeared in modern industrial societies.

*This survey is prepared for presentation at the 2003 CEA meetings in Ottawa. I thank my co-authors Maristella Botticini, Eugene Choo, Gillian Hamilton, Michael Peters and Xiaodong Zhu for many of the results discussed here. Over the years, I have also benefited from discussions with Gary Becker, Pierre-Andre Chiappori, Lena Edlund, Shelly Lundberg, Robert Pollak, Joanne Roberts and Shannon Seitz on these and related issues. I also thank Alina Rahman for research assistance on this paper. I also gratefully acknowledge financial support from SSHRC of Canada.

1 Introduction

Thirty years ago, Gary Becker (1973, 1974) explicated a theory of marriage markets.¹ The theory was breathtaking in the depth of the analysis and

the range of marital behavior that it explained. A major contribution was a transferable utility model of the marriage market. Economists and other social scientists have been following up on his work since.²

This paper will survey work by my colleagues and I that use Becker's transferable utility model of marriage to:

- Estimate the gains to marriage and cohabitation in contemporary Canada.
- Provide a model of gender differences in marital and labor supply behavior.
- Explain the disappearance of dowries in many societies.

The topics discussed here are limited. I ignore other important recent advances on the economics of marriage including the study of search frictions in marriage markets (e.g. Aiyagari, et. al. 2000, Bergstrom and Bagnoli 1993, Burdett and Cole 1997, Fernandez, et. al. 2001, Mortensen 1985, Seitz 1999, Shimer and Smith 2000), intrahousehold bargaining and allocation of resources (e.g. Chiappori, et. al. 2002, Lundberg and Pollak 1996, Lundberg, et. al. 1997, Manser and Brown 1980, McElroy and Horney 1981), divorce and remarriage (e.g. Becker, et. al. 1977, Chiappori and Weiss 2000, Cohen 1987, Weiss and Willis 1985, Weiss and Willis 1993), the legal environment and marital behavior (e.g. Brinig 2000, Gruber 2000, Hamilton 1999, Mnookin and Kornhauser 1979, Stevenson and Wolfers 2000), reproductive technologies and marital behavior (e.g. Akerlof, et. al. 1996, Goldin and Katz 2002, Siow 2002). Even the issues discussed here are limited to the contributions of my colleagues and I. References in the original papers show how these papers fit into the larger literature.

¹Becker 1991 summarizes his work on marriage markets and other aspects of the economics of the family.

²On 04/16/03, the Social Science Citation Index showed that Becker 1973 has been cited 261 times. An early application was Grossbard-Shectman 1993. Bergstrom 1997 and Weiss 1997 provide surveys of the economics literature up to the mid-nineties.

2 A transferable utility model of marriage and cohabitation

This section reports some ongoing work by Eugene Choo and myself.³ The objective of the larger research program is to estimate a transferable utility model of the marriage market and to use the model to study how the marriage market adjust to changes in the supplies of different types of men and women, different types of living arrangements (E.g. cohabitation versus marriage), different types legal environment (E.g. whether abortion is legal or not). This section will consider a model of marriage and cohabitation. The objective is to use this model to present a positive and normative description of adult living arrangements in Canada at the end of the millenium.

There are I types of men and J types of women. Let M be the population vector of men whose i 'th element is m_i , and F be the population vector of women whose j 'th element is f_j .

There are three kinds of adult living arrangements, l . Individuals can live alone (a), live in a marriage (μ) or cohabit (c).⁴ For a type i man to marry a type j woman, he must transfer τ_{ij}^μ amount of income to her. For a type i man to cohabit with a type j woman, he must transfer τ_{ij}^c amount of income to her. Ignoring living alone, there are $2 \times I \times J$ sub-markets for living arrangements between men and women. The market for living arrangements clears when given equilibrium transfers, τ_{ij}^l , the demand by men of type i for type j women in living arrangement l is equal to the supply of type j women for type i men in living arrangement l for all l, i, j . Note that there is no apriori restriction on the sign of τ_{ij}^l for any l, i, j .

To implement the above framework empirically, we adopt the extreme value random utility model of McFadden 1974 to generate market demands for partners. At a point in time, each type of individual considers matching with each type of the opposite gender. Let the utility of male g of type i who match a female of type j in living arrangement l be:

$$V_{ijg}^l = \tilde{\alpha}_{ij}^l - \tau_{ij}^l + \varepsilon_{ijg}^l, \quad \text{where} \quad (1)$$

³Choo and Siow 2003, which reports on the marriage market in the United States, is the first paper in this project.

⁴While the methodology can in principle handle gay couples, in practice we cannot accomodate gay couples because sexual orientation is not revealed in census data. So all gay couples are treated as living alone, a . Or put another way, they are not in a heterosexual marriage or cohabitation.

$\tilde{\alpha}_{ij}^l$: Systematic gross return to male of type i in living arrangement l with female of type j .

τ_{ij}^l : Equilibrium transfer made by male of type i to female of type j in living arrangement l .

ε_{ijg}^l : realization of i.i.d. random variable with type I extreme value distribution.⁵

Equation (1) says that the payoff to person g in living arrangement l with a female of type j consists of two components, a systematic and an idiosyncratic component. The systematic component, $\tilde{\alpha}_{ij}^l - \tau_{ij}^l$, is common to all males of type i in living arrangement l with type j females. The systematic return is reduced when τ_{ij}^l , the equilibrium transfer, is increased.

The idiosyncratic component, ε_{ijg}^l , measures the departure of his individual specific match payoff, V_{ijg}^l , from the systematic component. We assume that the distribution of ε_{ijg}^l does not depend on the number of type j females, f_j . Put another way, there are sufficient number of females of type j such that his idiosyncratic payoff from choosing type j female does not depend on f_j . The payoff to g from remaining alone, denoted by $j = 0$, is:

$$V_{i0g}^a = \tilde{\alpha}_{i0}^a + \varepsilon_{i0g}^a \quad (2)$$

where ε_{i0g}^a is also the realization of an i.i.d. random variable with type I extreme value distribution. ε_{ijg}^l and ε_{i0g}^a are uncorrelated for all l, i, j .

Male g has $2J + 1$ living arrangements to choose from. He will choose the living arrangement which maximizes his utility and thereby will receive utility:

$$V_{ig} = \max[V_{i0g}^a, V_{i1g}^\mu, V_{ijg}^\mu, \dots, V_{iJg}^\mu, V_{i1g}^c, \dots, V_{ijg}^c, \dots, V_{iJg}^c] \quad (3)$$

We assume that the numbers of men and women of each type is large. Let l_{ij}^d be the number of l, i, j living arrangements demanded by i type men and a_{i0} be the number of single i type men. Then McFadden 1974 showed⁶ that:

$$\begin{aligned} \ln l_{ij}^d - \ln a_{i0} &= \tilde{\alpha}_{ij}^l - \tilde{\alpha}_{i0}^a - \tau_{ij}^l \\ &= \alpha_{ij}^l - \tau_{ij}^l \end{aligned} \quad (4)$$

The term $\alpha_{ij}^l = \tilde{\alpha}_{ij}^l - \tilde{\alpha}_{i0}^a$, is the systematic gross return to a i type male in an l, i, j living arrangement relative to being single. The above is

⁵The random variable $\varepsilon \sim EV(0, 1)$, with the cumulative distribution given by $F(\varepsilon) = e^{-e^{-\varepsilon}}$.

⁶The result is also derived in many econometrics textbook (e.g. p. 780, Ruud 2000).

a quasi-demand equation by type i men for living arrangement l with type j women.⁷ Unlike the usual demand equation, the transfers for non-type j women appear nominally absent in Equation (4). But they are not absent as these other transfers are all embodied in $\ln a_{i0}$.

The random utility function for women is similar to that for men except that in living arrangement l with a type i men, a type j women receives a transfer, τ_{ij}^l . Let $\tilde{\gamma}_{ij}^l$ denote the systematic gross gain that j type women get from living arrangement l with i type men, and $\tilde{\gamma}_{0j}^a$ be the systematic payoff that j type women get from remaining single. The term $\gamma_{ij}^l = \tilde{\gamma}_{ij}^l - \tilde{\gamma}_{0j}^a$, is the systematic gross gain that j type women get from living arrangement l with i type men relative to being single. Let l_{ij}^s be the number of j type women who wants to participate in living arrangement l with i type men and a_{0j} be the number of single j type women.

The quasi-supply equation of type j women in l, i, j living arrangement is be given by:

$$\ln l_{ij}^s - \ln a_{0j} = \gamma_{ij}^l + \tau_{ij}^l \quad (5)$$

Again, the transfers for all other relevant living arrangements are embodied in $\ln a_{0j}$.

There are $2 \times I \times J$ living arrangements for every combination of types of men and women. The marriage market clears when given equilibrium transfers, τ_{ij}^l , the demand by men of type i for living arrangement l, i, j , l_{ij}^d , is equal to the supply of type j women for living arrangement l, i, j , l_{ij}^s , for all l, i, j .

When the markets for all l, i, j arrangements clear,

$$l_{ij}^d = l_{ij}^s = l_{ij} \quad (6)$$

Substituting (6) into Equations (4) and (5) to get:

$$\ln l_{ij} - \ln a_{i0} = \alpha_{ij}^l - \tau_{ij}^l \quad (7)$$

$$\ln l_{ij} - \ln a_{0j} = \gamma_{ij}^l + \tau_{ij}^l \quad (8)$$

The above two equations can be used to estimate gains to living arrangements. $\ln l_{ij} - \ln a_{i0}$, which is observable, measures the systematic net gain to a type i male from an l, i, j living arrangement. $\ln l_{ij} - \ln a_{0j}$, which is

⁷It is not a demand curve because $a_{i0} = m_i - \sum_l \sum_j l_{ij}$.

also observable, measures the systematic net gain to a type j female from an l, i, j living arrangement. Note that these systematic net gains depend on demand and supply conditions, embodied in the equilibrium transfer π_{ij}^l .

Equate (7) and (8) to get:

$$\tau_{ij}^l = \frac{\ln a_{i0} - \ln a_{0j} + \alpha_{ij}^l - \gamma_{ij}^l}{2} \quad (9)$$

Substituting (9) into (5),

$$\ln l_{ij} - \frac{\ln a_{i0} + \ln a_{0j}}{2} = \frac{\alpha_{ij}^l + \gamma_{ij}^l}{2} = \pi_{ij}^l \quad (10)$$

Equation (10) has an intuitive interpretation. The left hand side of (11) is the log of the ratio of the number of l, i, j living arrangements to the geometric average of those types who are single. The right hand side, π_{ij}^l , has the interpretation as the total systematic gain to living arrangement l per partner for **any** i, j pair relative to the total systematic gain per partner from remaining single.

One expects the systematic gains to living arrangement l to be large for i, j pairs if one observes many l, i, j arrangements. However there are two other explanations for numerous l, i, j arrangements. First, there are lots of i type men and j type women in the population. Second, there are relatively more i type men and j type women in the population than other types of participants. Scaling the number of l, i, j arrangements by the geometric average of the numbers of singles of those types control for these effects.⁸

Since $(\ln l_{ij} - \frac{\ln a_{i0} + \ln a_{0j}}{2})$ is observable, the per capita gains to an l, i, j arrangement, π_{ij}^l , relative to remaining single is also observable. Note that π_{ij}^l is independent of population vectors, M and F .

Furthermore,

$$\begin{aligned} \min(\ln l_{ij} - \ln a_{i0}, \ln l_{ij} - \ln a_{0j}) &\leq \ln l_{ij} - \frac{\ln a_{i0} + \ln a_{0j}}{2} \leq \max(\ln l_{ij} - \ln a_{i0}, \ln l_{ij} - \ln a_{0j}) \\ \min(\alpha_{ij}^l - \tau_{ij}^l, \gamma_{ij}^l + \tau_{ij}^l) &\leq \pi_{ij}^l \leq \max(\alpha_{ij}^l - \tau_{ij}^l, \gamma_{ij}^l + \tau_{ij}^l) \end{aligned}$$

⁸The term $2\pi_{ij}$ is not the expected total gain to marriage for an i, j couple that chooses to marry each other. Observed i, j married couples get in total $2\pi_{ij}$ plus the idiosyncratic payoffs of each spouse which is the result of optimizing behavior. Since they could have married other types or not marry, the average total payoff of i, j couples who married each other relative to not marrying is weakly larger than $2\pi_{ij}$.

The above shows that π_{ij}^l , the total gains per partner to living arrangement l, i, j , is a weighted average of the systematic net returns by gender.

Let $\Pi_{ij}^l = \exp(\pi_{ij}^l)$. Rewrite Equation (10) as:

$$\begin{aligned}\Pi_{ij}^l &= \frac{l_{ij}}{\sqrt{a_{i0}a_{0j}}} \\ &= \frac{l_{ij}}{\sqrt{(m_i - \sum_l \sum_k l_{ik})(f_j - \sum_l \sum_k l_{kj})}}\end{aligned}\tag{11}$$

Taking Π_{ij}^l as given, Equation (11) is a generalized marriage matching function. A marriage matching function predicts the number of i, j marriages given the population vectors M and F .⁹ Equation (11) extends the marriage matching function to include cohabitations.

The generalized marriage matching function is non-parametric and fully saturated. That is, it will fit any cross section marriage and cohabitation distributions. So the current assumptions underlying the model can only be relaxed by imposing other restrictions.¹⁰

The generalized marriage matching function as defined in Equation (11) is homogeneous of degree zero in population vectors and the number of l, i, j arrangements. If we assume the systematic returns as defined by π_{ij}^l stays fixed, doubling M and F will result in a doubling of l_{ij} . Thus our generalized marriage matching function has no scale effect in population vectors.

3 Marriage and cohabitation in contemporary Canada¹¹

The data used were extracted from 1996 Canadian Census Public Use Microdata Files on Families and Individuals (PUMFF and PUMFI). A full description of the data extracted is in the appendix. Both PUMFI and PUMFF files contain data based on a 2.8% sample of the population enumerated in

⁹Marriage matching functions are common in the demographic literature. See Pollak 1990a 1990b; Pollard and Hohn 1993/4; Pollard 1997.

¹⁰The well known limitations of McFadden's multinomial logit demand model apply here.

¹¹Using a different marriage matching function, Qian 1998 provides a similar analysis with US data. Wu (2000) provides a comprehensive descriptive analysis of cohabitation and marriage behavior in contemporary Canada.

the census. Since the age data in PUMFF was categorical, we used 6 age groups (15 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 and over).

Table 1 provides a summary of the data.

Table 1: Data Summary			
	Number	Mean	S.D.
Age male	389074	34.5	21.1
Age female	403316	36.2	21.8
Age married male	161495	49.4	14.5
Age married female	161494	46.7	14.1
Age cohabit male	25348	37.5	11.7
Age cohabit female	25516	34.8	11.1

The average age of females in the data is slightly higher than the average age of males reflecting the longer life expectancy of females. About 41% of the adults were married and 0.64% of them were cohabitants. Thus cohabitation was not a quantitatively significant choice for the general adult population. The average age of the married population is significantly higher than the average age of cohabitants. With a single cross section, we cannot tell if cohabitation is primarily a transitory phase among young adults or otherwise.

Figure 1 shows the numbers of males and females, the numbers of married males and married females, and the numbers of cohabitating males and cohabitating females by age.

Figure 2 shows the systematic net gains to marriage for females. These gains rose as the age of the female rose. The gains also were also highest between spouses of similar ages. Off the age diagonal, the gains fell faster for women who were older than their spouses.

Figure 3 shows the systematic net gains to marriage for males. They roughly have the same shape as that for the females.

Figure 4 shows the difference in systematic net gains to marriage for males relative to females. For ages less than forty, females systematically gained more from marriage relative to men. After age forty, males systematically gained more from marriage.

Figure 5 shows the systematic net gains to cohabitation for females. Compared with the systematic net gains to marriage, the average gain to cohabitation is lower. Also, unlike the systematic net gains to marriage, the gains to cohabitation fall with age. Again the gains are largest for same aged partners.

Figure 6 shows the difference in systematic net gains in marriage relative to cohabitation for females. In most instances, except at the very young ages, the differences are positive. The differences increased with age and are highest along the age diagonal. This means that cohabitations are relatively more frequent than marriages the larger the age differences between the partners.

The systematic net gains to cohabitation for males are similar to that for females.

Figure 7 shows the total systematic gains per partner in marriage. Like the systematic net gains figures, the total gains rose with age, is highest along the age diagonal. The ridge along the age diagonal shows that the total gains fell faster for women married to younger men than men married to younger women.

Figure 8 shows the total systematic gains per partner in marriage and cohabitation for same aged couples. The gains to marriage rose steeply with age, was roughly flat between age 35 to 60, and fell slowly after 60. Note that the gains to marriage exceeded the gains to remaining single by age 35. The gains to cohabitation is higher than that for marriage for young ages. It rose and peaked before age 30 and fell continuously thereafter. The gains to cohabitation never exceeded the gains to remaining single.

Using a transferable utility model of the marriage market, the above figures presented a positive and normative description of adult living arrangements in Canada in 1996.

4 Marriage and gender

Women are fecund for a shorter period of their lives than men. Trivers 1972 first explored the implication of this gender difference for gender roles. The anthropological, psychology and behavioral ecology literature has developed further implications for human societies (E.g. Betzig 1997). Siow 1998 provided a formal analysis and synthesis of this literature. My model predicted:

1. Divorced women are less likely to remarry than divorced men.¹²
2. There are proportionately less never married women than men.¹³

¹²Chamie and Nsuly 1981, Dupaquier, et. al. 1981,

¹³Haines 1996, United Nations 1992.

3. The average age of first marriage is lower for women than men.¹⁴
4. The age of first marriage for men is positively correlated with their wage.¹⁵
5. Controlling for age, married men have higher wages than non-married men.
6. Married men spend more time in the labor force than married women. They spend less time on child rearing than their spouses.¹⁶
7. Married men have higher wages than married women.¹⁷

I explained the above differences as follows. Consider a constant population society where individuals live for three periods, one as a child, one as a young adult and one as an old adult. Every young adult has to decide whether to marry or remain single. Abstracting from other benefits of marriage, the only reason to marry is to have children. Young and old men are fecund whereas only young women are fecund.

An adult may have at most one spouse at a time (monogamy). An adult may marry when young, divorce and remarry another person when old. Since the only role of marriage is to procreate, young single men and women, old single and divorced men may marry. Old single and divorced women will not marry or remarry respectively (Point 1).

Eligible men must offer the same reservation utility to prospective spouses (young women) if they wish to marry. I assume women prefer to marry rather than remain single which means that all young women will marry.

In a stationary equilibrium without population growth and with a equal number of young men and women, some young men must remain single when some divorced men remarry. Some of these single young men will remain unmarried when they are old. If all single young men marry when old, then

¹⁴United Nations 1990.

¹⁵Using US data, Bergstrom and Schoeni (1996), Vella and Collins found a positive correlation. Keeley (1975) found a negative correlation. Bergstrom and Schoeni argued that Keeley's results are due to model misspecification. Using Taiwanese data, Zhang (1995) found a positive correlation for one subsample, a negative correlation for another subsample and a positive correlation for the pooled sample.

¹⁶In 8 OECD countries, the labor force participation rates of married men are higher than married women (Blau and Kahn 1995).

¹⁷This is true for all 9 OECD countries that they have data for (Blau and Kahn).

divorced men cannot remarry since there will not be enough eligible women. Thus when some divorced men remarry, some men will always be single. Since all young women marry, there are proportionately less never married women than men (Point 2). While some men will always remain single, some single young men will marry when they become old. Thus the average age of first marriage is lower for women than men (Point 3).

All young adults have the same labor market opportunities. Time at work produces current income and increases the expected future wage of the individual. Due to uncertainty in human capital accumulation, only some old adults will be successful in obtaining a higher wage. Single old men who marry have higher wages than young married men. They use this higher wage to compensate their spouses for marrying older men (Point 4). Single old men who marry will also have higher wages than single old men who do not marry (Point 5).

When a young couple marry, they each have to decide how much time to spend in the labor market and how much time to spend with their children. The mother can use her future labor earnings to only buy private consumption when old. The father can use his future labor earnings to buy future private consumption and to compete for a new wife (and have another child) if his current marriage fails. Thus the young father has a potential additional use for future labor income which is not available to the mother. The cost of working, time spent with their child, is the same for both parents. With an additional benefit but the same cost, the father will choose to spend more time at work than the mother (Point 6). His future wage will also be higher (Point 7).

The positive correlation between the level of future labor earnings and the incidence of remarriage is critical in generating current differences in time use between husbands and wives.¹⁸ Divorced men who remarry must outbid some old single men for spouses. In this model, human capital uncertainty allows some lucky divorced men to outbid unlucky single old men for spouses. Without human capital uncertainty, divorced men will not be able to outbid single old men for spouses. There is no remarriage and no difference in time use between young husbands and wives. These alternative predictions under alternative market structures show the importance of market structures in determining gender roles.

¹⁸Becker et al. (1977), Wolf and MacDonald (1979) provide evidence of this correlation in US data.

Economists are beginning to study the implications of differential fecundity on gender roles (e.g. Edlund 1999, 2001; Siow and Zhu 2002, Willis 1999). Hamilton and Siow 2000 applied a search theoretic variant of the above model to rationalize marital behavior in 18th century Quebec.

5 Why dowries?

Parents transfer wealth to their children in many ways. The dowry is distinctive because it is a large transfer made to a daughter at the time of her marriage. Dotal (dowry giving) marriages were common in the Near East, Europe, East Asia, South Asia, and pockets of the Americas. Although the custom has largely disappeared in the western world, it remains popular in South Asia.

The standard economic model of dowries, implicit in Gary S. Becker 1991, assumes that dowries (and brideprices) are used as pecuniary transfers to clear the marriage market.¹⁹ The model has two predictions. When grooms are relatively scarce, brides pay dowries to grooms; when brides are relatively scarce, grooms pay brideprices to brides. Moreover, a dowry is a component of bridal wealth. As other components of bridal wealth grow, dowries will disappear and may be replaced by brideprices.

The standard economic model of dowries faces two potential objections. First, if the main purpose of dowries is to clear the marriage market, how do marriage markets clear in societies without dowry or brideprice? In most modern societies that previously had dowries, brideprices did not emerge when dowries disappeared. Second, the standard model of dowries cannot account for why in many dotal societies the timing of intergenerational transfers is gender specific, with parents assigning dowries to their daughters and leaving bequests to their sons. This feature of dotal societies has been first noticed by the anthropologist Jack Goody (1973) and his observation has been confirmed in different dotal societies (see the historical survey in Botticini and Siow 2002, hereafter BS).

Botticini and Siow (forthcoming) provide a theory of dowries that is consistent with the standard model without being open to the two objections discussed above. At the market level, our model of marriage market clearing

¹⁹See, for example, Boserup; Becker; Edlund 2001; Grossbard-Shechtman; Rao (1993); Das Gupta and Li (1999); Tertilt (2001); and Anderson (2003).

follows the standard economic model. We assume that the marriage market, with or without dowries, clears by wealth matching between brides and grooms.²⁰ At the individual level, we also conform to the standard model by focusing on the substitution between different components of bridal wealth. However, the standard model of dowries implicitly postulates that pecuniary transfers at the time of marriage are part of the least costly mix of providing bridal wealth. This assumption precludes a discussion of the circumstances in which dowries are or are not part of the least costly mix of providing bridal wealth. Such a discussion, though, is relevant for understanding the modern disappearance of the dowry. The novelty of our theory of dowries is the assertion that *the modern disappearance of dowries is due to a change in the environment for producing bridal wealth and not to a change in the relative values of brides versus grooms. Thus, brideprices do not have to appear when dowries disappear.* Also, the general absence of pecuniary transfers at the time of marriage in modern industrial societies suggests that these transfers are an inefficient way to redistribute resources between husbands and wives, and not that there is no redistribution between spouses.²¹

We present a specific environment in which dowries are optimal and also discuss when they are not optimal. We study an intra family incentive problem. Our model begins with the observation that dowries occur primarily in monogamous *virilocal* societies, where married daughters leave their parental home and married sons do not. We argue that in these societies altruistic parents use dowries and bequests to mitigate a free-riding problem between siblings. Since married sons live with their parents, they have a comparative advantage in working with the family assets relative to their married sisters. Absent any incentive problem, parents should not assign any dowry but rather give the daughters their full share of the estate through bequests. However, if married daughters fully share in the parents' bequests, their brothers will not obtain the full benefits of their efforts in extending the family wealth and, therefore, will supply too little effort. While bequests are more efficient for distributing wealth to daughters, they have poor incentive effects for sons. Thus, in order to mitigate the disincentive for their sons, parents will want to assign large dowries and consequently small bequests to their daughters.²²

²⁰E.g., Becker; Lam (1988); Weiss (1997); and Peters and Siow (2002).

²¹Lundberg, Pollak, and Wales (1997), Chiappori, et. al. (2002), and the references therein provide empirical evidence of such redistribution.

²²Our model is in the spirit of Junsen Zhang and William Chan (1999). They argue

Our theory suggests that dowry contracts, which may be complicated, should not contain claims on shares of income generated with the bride's family assets. In other words, a married daughter may not be only discriminated against in her parents' bequests as observed by Goody. She may also be excluded from inter vivos claims on income generated from her natal family's assets. However, BS shows with data from a premodern economy (early Renaissance Tuscany) that the provision of dowries and the exclusion of daughters from bequests do not necessarily indicate that parents value their sons' welfare more than their daughters'.

The nexus between virilocality and dowries helps us explain the disappearance of dowries in previously dotal societies. Virilocal societies are primarily agricultural economies and/or economies where the gains for children to remain in the family business is substantial. As the labor market in a dotal society becomes more developed, and as the demand for different types of occupations grows, children are less likely to both hold their parents' occupations and to work for their families. The return to investing in general rather than family-specific human capital also increases. The use of bequests to align work incentives within the family becomes less important. Since it is costly to provide a dowry, the demand for dowry (within the family) will fall as the need to use bequests to align the work incentives of sons falls. Instead of the dowry, parents will transfer wealth to both their daughters and sons as human capital investments and bequests. Therefore, the development of labor markets will be important in reducing the role of dowries. When dowries become an inefficient source of bridal wealth, they will wither. Unlike the standard economic model, we argue that there is no connection between the disappearance of dowries and the appearance of brideprices.

We compare the predictions of our theory vis-a-vis the historical development of dowries, bequests, brideprices, and marriage gifts in various civilizations of the past. Our theory of dowries is consistent with narrative evidence from ancient Near Eastern civilizations, ancient Greece, Roman Empire, thirteenth-century Byzantium, western Europe from about the sixth to the fifteenth century, the Jews from antiquity to about 1300, Arab Islam from the seventh century to modern times, China, Japan, early-modern England, modern Brazil, contemporary Greece, and North America. Some of the predictions of the model are also consistent with quantitative evidence from

that daughters in virilocal societies may prefer dowries because they will have difficulties in getting their share of the natal families' wealth otherwise.

a unique data set of four thousand marriage contracts and many legacies from medieval and early Renaissance Tuscany which we collected and coded. We also discuss the absence of dowries and the prevalence of brideprices in contemporary African societies. Lastly, we compare our theory with the recent developments of the dowry system in India, where dowries instead of withering seem to become more important.

Some remarks are in order to clarify the limit of our contribution. First, we take virilocality as given and proceed in analyzing dowries and bequests under that assumption. Mark R. Rosenzweig and Kenneth I. Wolpin (1985) provide rationales of why agricultural societies are primarily virilocal.

Second, our theory has nothing new to say about the equilibrium determination of bridal wealth, a focus of much of the existing literature. It is also silent on the substitution between dowry and the bride's human capital or labor supply. We focus on the internal organization of the family whereas most of the existing literature on dowries focuses on how families respond to external shadow prices.

Third, our model provides a particular environment in which dowries emerge endogenously. To the extent that virilocality and the associated free-riding concern apply, we expect to see dowries in that society. However, ours is not necessarily the only environment to support dowries.²³ There are likely to be other roles for dowries related to the organization of intra- and inter-families transactions.

6 Conclusion

Thirty years ago, Becker presented a transferable utility model of the marriage market. Here and in the original papers, my colleagues and I show that this model is useful for rationalizing data on marital behavior (including marriage, cohabitation, gender roles and dowries) from contemporary Canada, and the United States, 18th century Quebec, cross cultural data and data from early Renaissance Tuscany. The model will have other as yet unexplored implications. Thus, I expect that Becker's transferable utility model of the marriage market will become as useful in its field as Marshall's partial equilibrium model of the competitive industry.

²³Non-economists suggest other theories of dowry. See Harrell and Dickey (1985) for a survey.

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Appendix

The data used were extracted from 1996 Canadian Census Public Use Microdata Files on Families and Individuals (PUMFF and PUMFI). These files provide information on the demographic, social and economic characteristics of the Canadian Population (family and non-family persons).

Both PUMFI and PUMFF files contain data based on a 2.8% sample of the population enumerated in the census.

The target population in the Family file includes all census families composed of Canadian citizens, landed immigrants and non-permanent residents living in a private dwelling on Census Day; the target population in the Individual file includes all Canadian citizens, landed immigrants and non-permanent residents having a usual place of residence in Canada.

Although both files contain data about family status of the individuals, the records in the Family file keep track of the spouses and common-law partners of heads of the households. The data in Individual file have no serial numbers and no data pertaining to the persons' spouses or common-law partners. Therefore, in the calculations involving married and cohabiting couples, we only used data from PUMFF.

A cohabitating couple is defined as follows. Question 6 in the individual census form asks:

“Is this person living with a common-law partner? (Common-law refers to two people who live together as husband and wife but who are not legally married to each other.)”

If the answer is yes, the individual and his or her partner were coded as cohabitating by the census.

The age range studied was from 15 to 75 and over. However, the age variable in the Family file, denoted as ‘agef’ for female persons and ‘agem’ for male persons, was compressed into 7 age categories (15 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 to 74, 75 and over), while the age variable in the Individual file, denoted as ‘agep’ refers to the age at last birthday. To make these variables consistent, we compressed the age variables in both PUMFI and PUMFF into 7 age categories (15 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 to 74, 75 and over).

We use ‘cfstruc’ (Census Family Structure) variable from PUMFF file to determine whether a family falls into one of these categories: family of a now-married couple with or without never married children of either or both spouses, family of a common-law couple with or without children of either

or both spouses, or a lone-parent family. Because we are only interested in observations containing married and common-law couples with or without children, we remove the rest of unnecessary records. We then separate the files into two datasets, one containing age distributions of married couples, and the other one containing age distributions of common-law couples. This process did not present complexity, and therefore we only lost a small number of observations.

Calculating the number of available persons was not as straightforward, because PUMFI contains records of both family and available persons. The PUMFI file does not contain the 'sfstruc' variable we mentioned earlier, so the layout and distribution of records' family status in PUMFI are slightly different than those in the PUMFF file.

Therefore, in order to determine the number of available males, we subtracted the sum of married and common-law couples from a total number of males in PUMFI. Derivation of available females was analogous.

The differences between the numbers of available persons of both sexes that we have calculated and the actual numbers from the PUMFI follow further below in the document.

Some of the discrepancies in our calculations have arisen do to the unavailable or missing data in the records. Whenever we encountered a missing value pertaining to the variable we required in our calculations, we were forced to delete the entire record.

As mentioned above, we have lost a number of observations during our extractions of data for married, cohabiting and available persons. The numbers for actual and observed calculations follow below:

Total number of observations in the PUMFF extract file: 342 231.

Number of observations of married couples with or without children in PUMFF extract file: 161 315. Number of observations of married couples with or without children after we have deleted missing age variables: 161 295. In our calculations we deleted 8 observations due to missing 'agef' (age of female partner) and 12 observations due to missing 'agem' (age of male partner).

Number of observations of common-law couples with or without children in PUMFF extract file: 25 384. Number of observations of common-law couples with or without children after we have deleted missing variables: 25 380. We deleted 2 observations due to missing 'agef', and 2 observations due to missing 'agem'.

Total number of observations of males in PUMFI extract file: 389 113

Number of observations of available males after we have applied our extraction method and deleted all missing variables: 117849

Total number of observations of females in PUMFI extract file: 403 335

Number of observations of available females after we have applied our extraction method and deleted all missing variables: 135 978

Total number of observations deleted due to missing age variable in PUMFI: 58

Figure 1- numbers of men and women by age

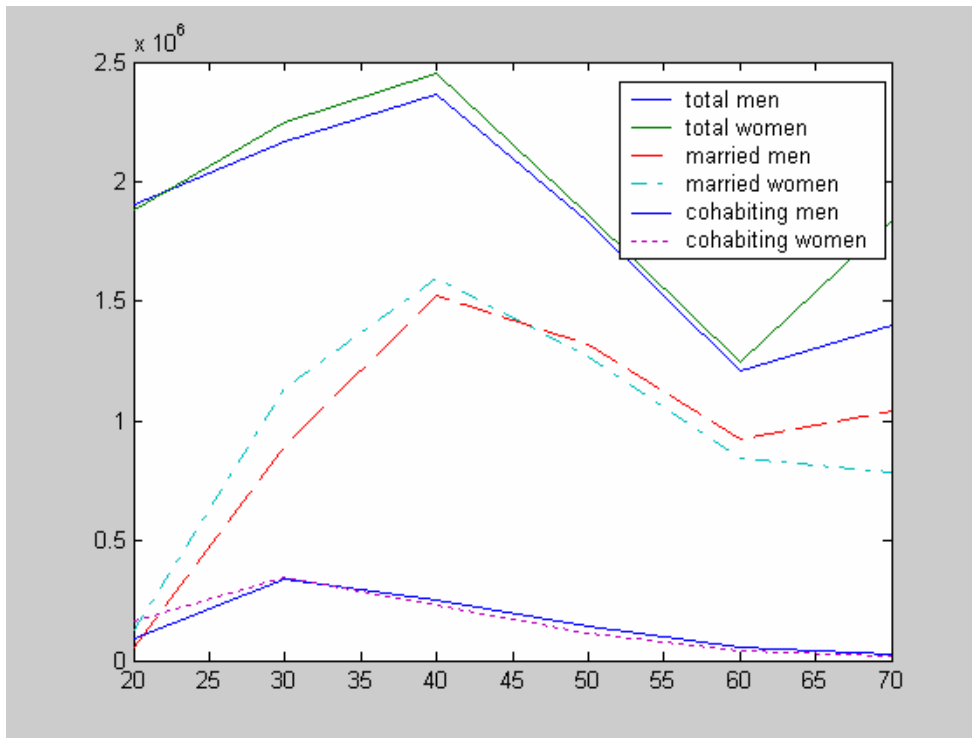


Figure 2
Net gains to marriage for women

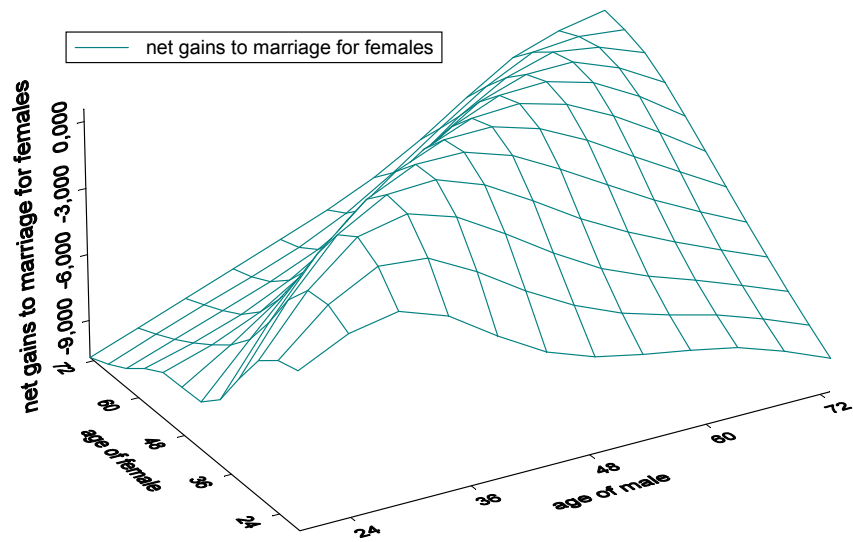


Figure 3
Net gains to marriage for men

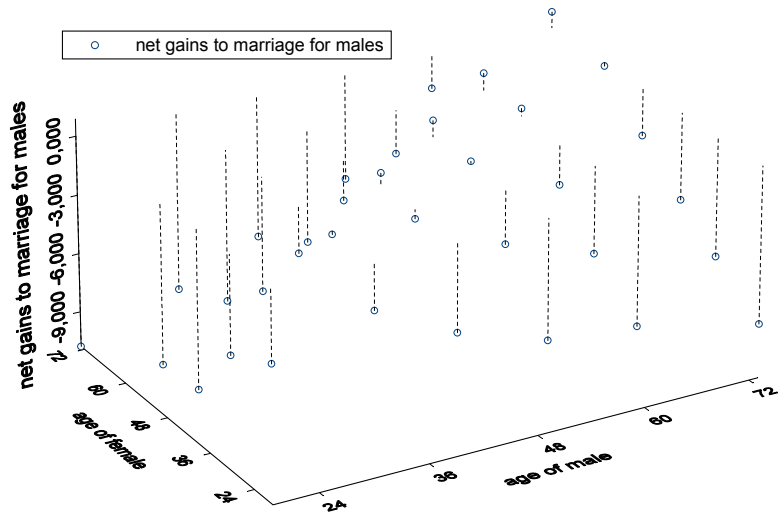
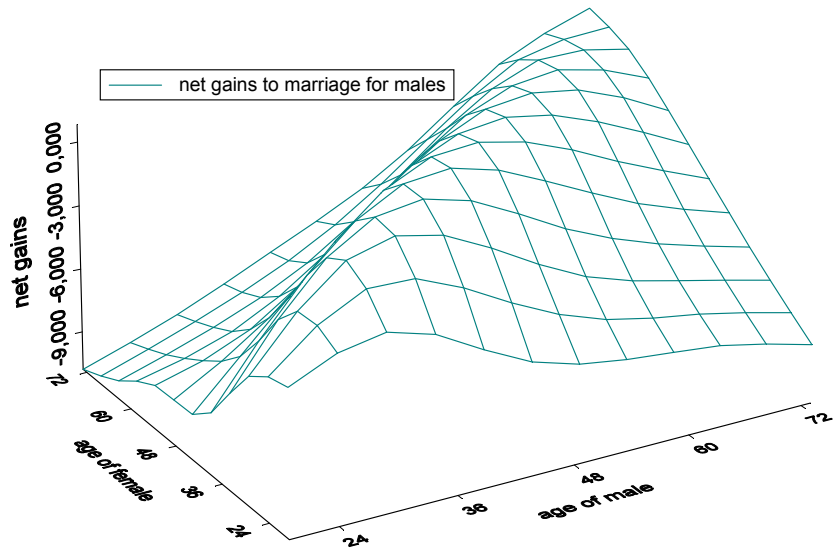


Figure 4
Difference in net gains in marriage for males relative to females

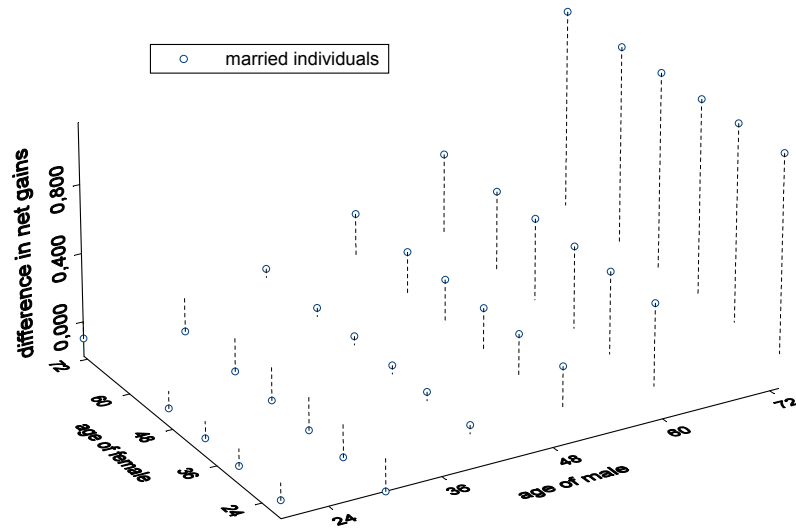


Figure 5
Net gains to cohabitation for females

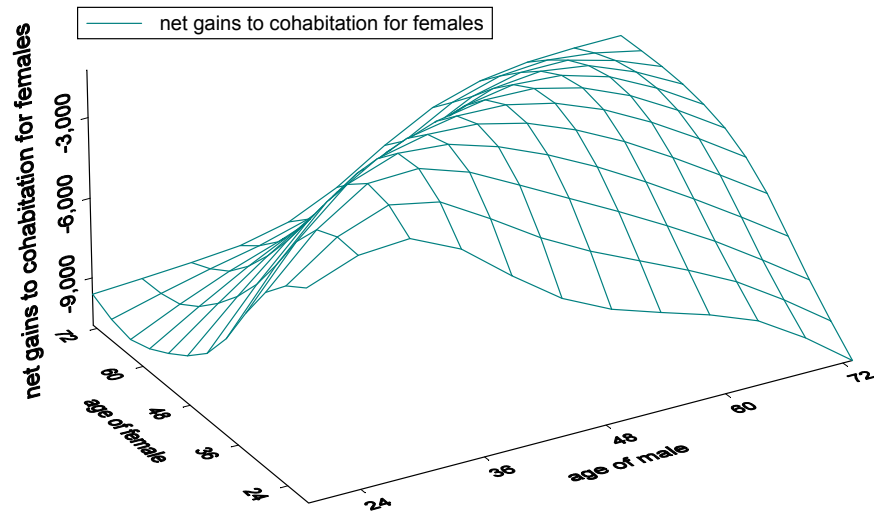
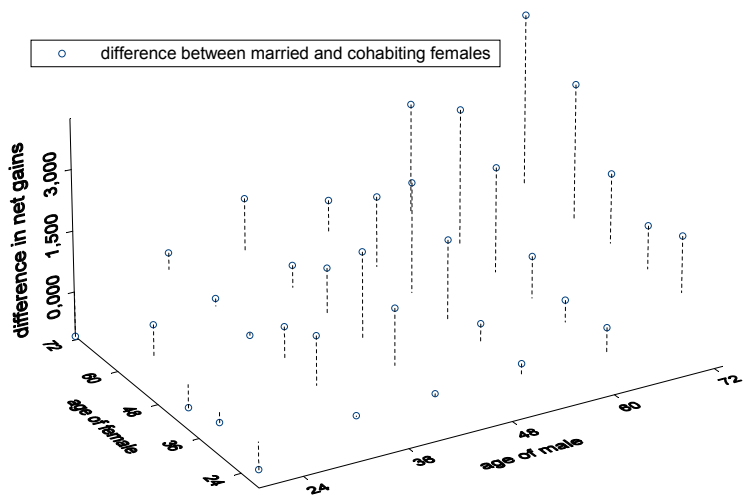
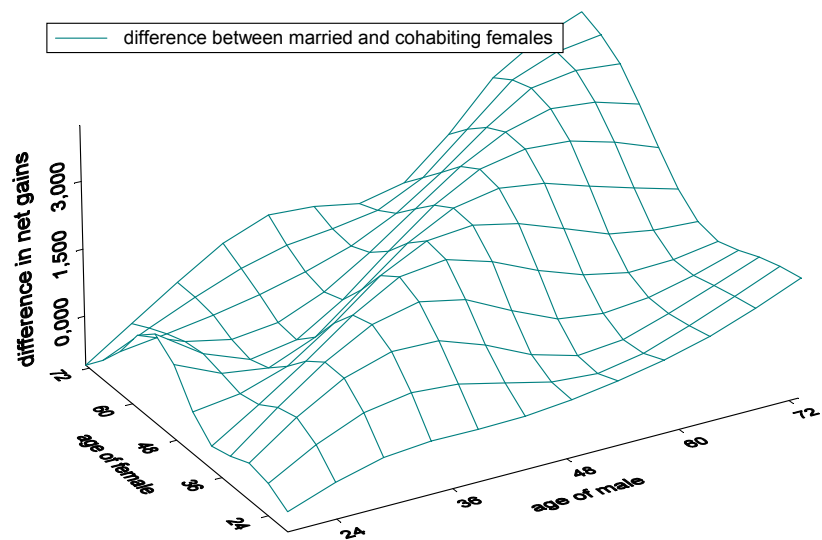


Figure 6
Difference in net gains between married and cohabiting females



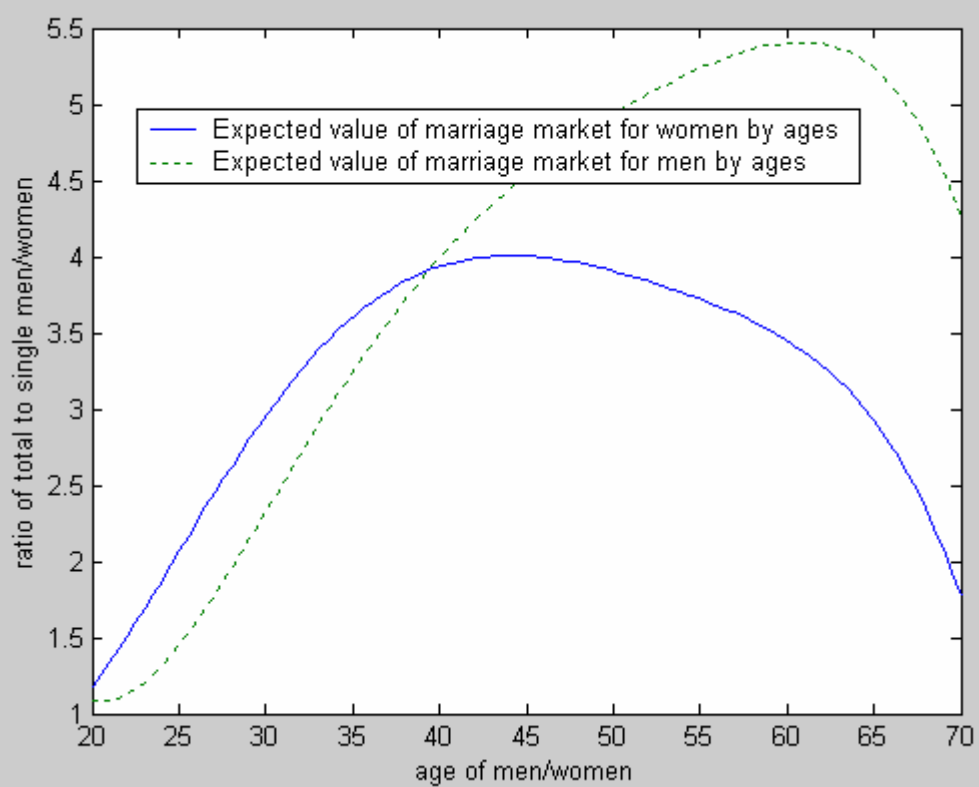
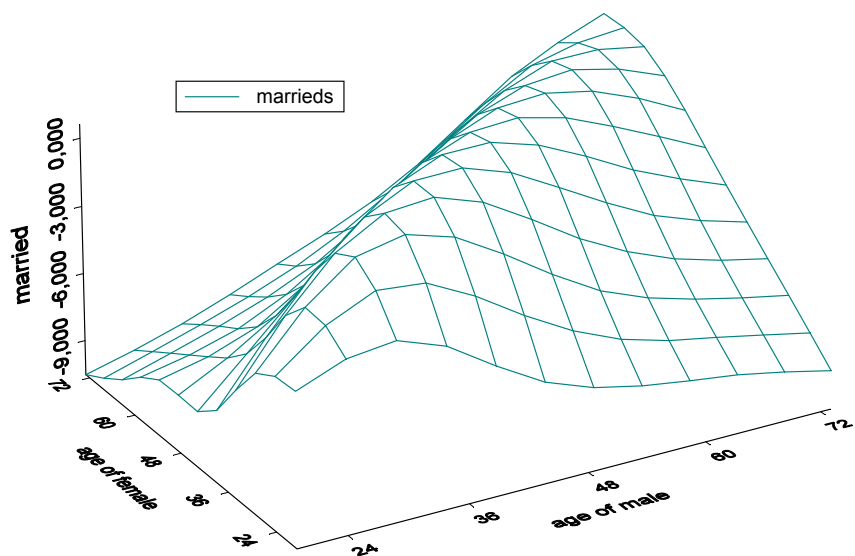


Figure 7
Graph of π^u



Graph of π^c

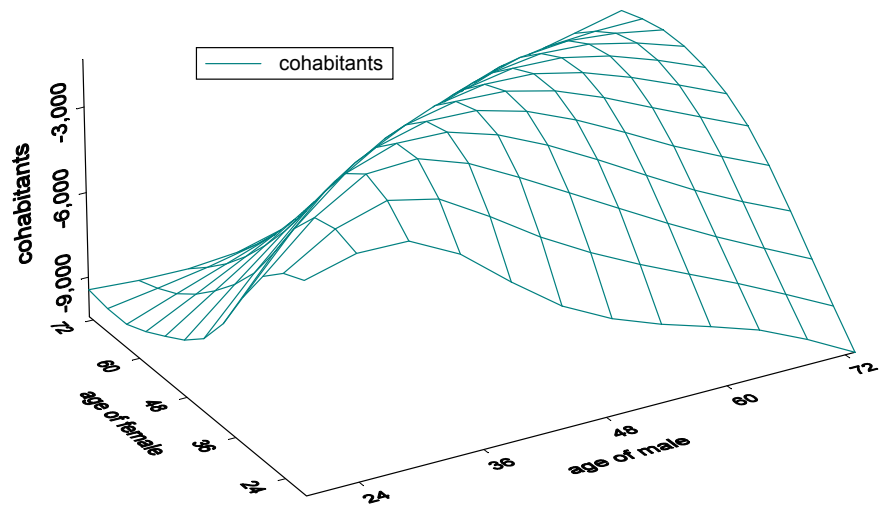


Figure 8
Same age π^u and π^c

