Marriage Market Transfers of Resources and Property Rights *

[Preliminary]

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Abstract

We analyze the nature of marriage market transfers (dowry) by developing a simple competitive model of the marriage market in which bridal families decide how much to transfer to their daughter and how much to transfer to a potential groom. By allocating property rights over total marital transfers in this way, the bridal family influences the outcome of household bargaining. This approach connects two seemingly unrelated roles for dowries identified in the literature; as a pre-mortem inheritance for daughters (“bequest”) and as a price for grooms in the marriage market (“groomprice”). The analysis helps explain the historical record of dowries, whereby the prominent role of dowries transforms from bequest to groomprice during early modernization. The model produces some further results of interest: we show that positive assortative matching is not a robust prediction in this setting, and that equilibrium transfers are generally not Pareto efficient when transfers to the bride are in the form of premarital investment in human capital.

Keywords: dowry, gender, property rights, marriage

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1 Introduction

Most societies have been characterized by marriage payments at some point in their history. Dowry payments, which are a transfer from the bride's side of the family at the time of marriage, have been an integral component of marriage in most traditional societies of Europe and Asia (where more than 70% of the world's population reside), and often represent a significant financial burden for the bride's family.\(^1\)

Economists have interpreted such transfers in two distinct ways: first, as pre-mortem bequests by altruistic parents, and second, as prices that clear the marriage market.\(^2\) However, in the presence of intra-household bargaining, these two roles are intertwined - a bride with a large bequest is more attractive to potential partners, and the offer of a large price acts as a substitute for a direct bequest to the extent that the price allows the bride to marry a groom with greater earnings. We propose a model of the marriage market that captures this inter-relationship, and use it to understand the ways in which modernization affects the relative prominence of each role.

Specifically, we combine these aspects by considering a marriage market in which bridal families choose how much to transfer to their daughter and how much to transfer to potential grooms. In this way, bridal families not only choose the total marital transfer but also the allocation of property rights over such a transfer. Each bride and groom pair bargains over the allocation of their household resources after they have married, in the spirit of the ‘separate spheres’ approach of Lundberg and Pollak (1996). Property rights over the marital transfer matter because they influence the outcome of bargaining via altering outside options. The essential trade-off facing bridial families is that greater property rights to their daughter allows her to negotiate a greater share of household resources, but also makes her less attractive to wealthier potential grooms. Thus, bridal families must trade off a greater slice of the pie with obtaining a larger pie.

There is value in combining these aspects because historical evidence suggests that these two roles for dowry are related. Specifically, the prominent role of the dowry transforms from a bequest to a price during the early stages of modernization. This transformation effectively represents a loss of property rights for women over the marriage transfer, and all incidences of this groom price emergence have raised great concern amongst policy makers and typically prompt legislation designed to curb its spread. The paper therefore aims to identify the economic forces which lead to this transformation in the role of the dowry, and illustrates a possible link between the modernization process and the loss of property rights for women via the marriage market. We show how salient features of the modernization process - including rising male and female earnings as well as an improved status of women - shift equilibrium transfers of property rights toward the groom.

The model has a number of implications that are interesting in their own right and highlights the point that an explicit consideration of property rights contains material consequences.

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\(^1\)The alternative, transfers from the groom's side to the bride's, broadly termed as "brideprice", occur in a much larger number of pre-industrial societies, most prominently in Sub-Saharan Africa (refer to Anderson (2007a)).

for the study of marriage markets. For example, a specific matching pattern (positive assortative) is predicted when transfers are forced to be one dimensional, but this disappears when transfers also dictate the allocation of property rights. We show the ways in which competition for grooms typically unfolds in the property rights dimension (as opposed to the resource dimension).

The bequest aspect of marriage market transfers is the focus of Botticini and Siow (2003), Zhang and Chan (1999), and Suen et al. (2003). The first stresses the incentive advantages of bridal bequests, whereas the latter two stress intra-household bargaining. In contrast to this paper, all of these papers take the marriage market as given (in the sense that transfers in the marriage market are determined by an exogenous function of bride and groom characteristics, not including the bequest). In this paper, we draw these spheres together by acknowledging that transfers offered by the bridal family are a highly relevant characteristic that is priced in the marriage market.

The division of property rights over marital resources are typically irrelevant in existing models of the marriage market for one of two reasons. First, non-transferable utility models of the marriage market (e.g. Peters and Siow (2002)) assume that marital resources are allocated according to some fixed function of total household resources (e.g. arising from the consumption of a household public good). Second, transferable utility models of the marriage market assume that household resources are allocated and committed to in the marriage market, where participants in effect use the threat of alternative marriage partners as outside options (e.g. see Becker (1991), Iyigun and Walsh (2007), and Cole et al. (2001)). We pursue an alternative approach, one popularized by Lundberg and Pollak (1993), in which married couples can not effectively use the threat of divorce and re-marriage in household bargaining. Instead, the threat point is that associated with an “unproductive” marriage in which the participants simply consume the resources that they have property rights over. This seems highly reasonable in the context of developing countries, where divorce is far from costless.3

The following section provides a historical overview of the transformation of dowries from bequests to brides into prices for grooms, and its link to the modernization process. The basic model is introduced in Section 3, and is analyzed and extended upon in Section 4. Section 5 concludes.

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3There is a reasonably large literature confirming that intra-household bargaining matters. Browning and Chiappori (1998) provide evidence in favor of the ‘collective’ approach over the ‘unitary’ approach to modeling the household. In a dowry setting, Brown (2009) finds evidence that dowries improve outcomes for wives in China. Zhang and Chan (1999) find evidence that brides that enter a marriage with a high dowry have higher welfare (in terms of having help with chores) but find no evidence that those whose parents received a high payment experience any difference. One obvious explanation for this is that bridal families are able to fund dowry payments to their daughters, at least in part, by the bride price payments they receive. We implicitly assume that it is the groom that pays a negative groom price (as opposed to the groom’s parents). This distinction is largely irrelevant in patrilocal societies, and makes no difference in the cases where grooms receive transfers. Arunachalam and Logan (2008) cite evidence from the Survey on the Status of Women and Fertility indicating that brides in India report having more say over how their dowry is used when the dowry is in the form of jewelry, gold or silver compared to cash. For a more complete list, see Lundberg and Pollak (1996).
2 Historical Overview

The main aim of this section is to trace the links between the transformation from dowries as bequests into dowries as groomprices, in the historical record, to characteristics of the modernization process. We first establish historical instances where there has been a transformation in the institution of dowries and then identify concurrent economic forces.

2.1 The transformation of dowry

The dowry system dates back to at least the ancient Greco-Roman world (Hughes (1985)). With the Barbarian invasions, the Greco-Roman institution of dowry was eclipsed for a time as the Germanic observance of bride-price became prevalent throughout much of Europe; but dowry was widely reinstated in the late Middle Ages. Dowry continued to be prevalent in Renaissance and Early Modern Europe and is presently widespread in South Asia.

Dowry paying societies are patrilocal (upon marriage the bride joins the household of her groom) and dowry payments are wealth transfers from the bride’s family at the time of marriage which travel with the bride into her new household. Most commonly, the traditional dowry transfer is considered to be a “pre-mortem inheritance” to a daughter, which formally remains her property throughout marriage. Goody and Tambiah (1973) in particular has emphasized this role of dowry in systems of “diverging devolution,” where both sons and daughters have inheritance rights to their parent’s property. As Botticini and Siow (2003) summarize, a strong link exists between women’s rights to inherit property and the receipt of a dowry. This is seen in ancient Rome, medieval western Europe, and the Byzantine Empire. However, property rights over this transfer can vary. In particular the traditional institution can transform from its original purpose of endowing daughters with some financial security into a so-called ‘price’ for marriage. This component of dowry, often termed a “groomprice”, consists of wealth transferred directly to the groom and his parents from the bride’s parents, with the bride having no ownership rights over the payment.

There are numerous historical instances where dowry as bequests appear to have been superseded by groomprices. Chojnacki (2000) documents the emergence of a gift of cash to the groom (corredo) as a component of marriage payments in Renaissance Venice. In response, the Venetian Law of 1420 limited the ‘groom-gift’ component to one third of the total marriage settlement (Chojnacki (2000)). Reimer (1985) discusses laws implemented in the late thirteenth century Siena which are akin to the formal emergence of groom price. These comprised both an increase in the proportion of a woman’s dowry her husband had rights over, and forbade

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4 See Anderson (2007a) for a survey of the prevalence of dowries.
5 In several countries, dowry as a pre-mortem inheritance given to women was written into the constitution. Refer to Botticini and Siow (2003) for a historical synopsis of dowries and inheritance rights.
6 Studies have also emphasized the similarity between the amounts of dowry given to daughters and inheritances awarded to sons. Botticini and Siow (2003) show that average dowries in Renaissance Tuscany corresponded to between 55 and 80 percent of a son’s inheritance.
7 Legislation of dowries was pervasive in Early Europe. For example, the Venetian Senate first limited Venetian dowries in 1420 and payments were abolished by Law in 1537. Dowries were limited by Law in 1511 in Florence and prohibited in Spain in 1761. Similarly, the Great Council in Medieval Ragusa (Dubrovnik) repeatedly intervened to regulate the value of dowries between the thirteenth and fifteenth centuries (Stuard (1981)).
a woman from using her portion of the dowry without the consent of her husband. Krishner (1991) similarly confirms a pattern of legislations across northern and central Italy granting husbands broader control over a woman’s dotal assets beginning in the fourteenth century. Herlihy (1976) argues that outside of Italy, numerous indicators of the financial treatment of women in marriage were also deteriorating after the late middle ages in Europe.8 For example, common law, in which dowry came under immediate control of husbands, predominated in England during the sixteenth and seventeenth centuries (Erickson (1993) and Stone (1977)). Reher (1997) remarks that during the Early Modern period in Spain, husbands had greater control over their wives’ dowries in Castile relative to other parts of the country. Kleimola (1992) documents a decline of female property rights over their dowries in seventeenth century Muscovy, Russia. Historians also point out that the transformation from dowry in the form of property to dowry as cash, which occurred throughout the Western Mediterranean after the late middle ages, is indirect evidence of a loss of property rights for wives over their dowries.9 A cash dowry was more easily merged with the husband’s estate whereas dowry as property was a more visible sign of the wife’s patrimony. Further indirect evidence of dowries working to the detriment of women is given by early feminists who attacked the dowry system and objected to husbands’ control over the funds (see, for example, Goody (2000) and Cox (1995)).

Nowhere, however, has there been a more dramatic example of this transformation than in present-day India. The traditional custom of stridhan, a parental gift to the bride, has changed into modern-day groomprices which have a highly contractual and obligatory nature. Generally a bride is unable to marry without providing such a payment.10 The amounts of these payments typically increase in accordance with the ‘desirable’ qualities of the groom, and the total cash and goods involved are often so large that the transfer can lead to impoverishment of the bridal family.11 Accordingly, the Dowry Prohibition Act of 1961 attempted to distinguish and discriminate between the two components of the payment: that which was a gift to the bride, and that which was transferred to the groom and his parents. The aim was to abolish the groomprice component but allow bridal transfers to remain in tact (see, Caplan (1984)).12

There is comparatively little research explaining the dowry phenomenon in the rest of South Asia, despite substantial suggestive evidence that the transformation into groomprice is occurring.13 Following numerous complaints, the Pakistan Law Commission reviewed dowry legis-

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8Relative to Italy, a limited number of surviving marriage agreements make the evolution of customs more difficult to follow in other parts of Europe.
9For example, the transformation to cash dowries from real property occurred during the thirteenth century in Siena, thirteenth and fourteenth centuries in Genoa, fourteenth and fifteenth centuries in Toulouse, and fifteenth century in Provence (Hughes (1985)).
12The practice of dowry in India has essentially continued unabated despite its illegal standing. It has been argued that it is the clause in the Law which aimed to maintain the gift component of the dowry which provided a legal loophole (see Caplan (1984)). The original Law of 1961 continues to be amended to address these issues.
13See Lindenbaum (1981), Esteve-Volart (2003), and Arunachalam and Logan (2008) for investigations on dowry payments in rural Bangladesh.
lation and suggested an amendment in 1993 which updated the limits placed on dowries and also added a sub-clause stating grooms should be prohibited from demanding a dowry.\(^{14}\) In Bangladesh there seems to be a clear distinction between the traditional dowry, *joutuk*, gifts from the bride's family to the bride, and the new groom payments referred to as *demand*, which emerged post-Independence in the 1970s, (Amin and Cain (1995)). The scale of these demands do not appear to have reached that of urban India,\(^{15}\) but the escalation of these groom payments lead to them being made a punishable offense by the Dowry Prohibition Act of 1980.\(^{16}\)

We now trace the connection between the occurrences of groom prices outlined above, in both historic Europe and present-day South Asia, to characteristics of the modernization process.

### 2.2 Dowry transformation and modernization

In both the European and South Asian context, the emergence of a groom price in lieu of dowry as a bequest seems to have corresponded with increased commercialization. Given that dowry paying societies are typically stratified and endogamous (i.e., men and women of equal status tend to marry)\(^{17}\), the way in which increased wealth and new economic opportunities are distributed within and across status groups is of central relevance for the marriage market. Commercialization (or development) increasing inequality has reached, in the form of the Kuznet's curve, the status of a stylized fact in development economics. Though the evidence for the Kuznet's curve is beyond the present scope, and the subject of considerable debate, below we draw links between increased inequality, both in society and within status groups, and the instances of transformation of dowry to groom price.

This is a feature of European modernization when the groom price component of dowry began to emerge in the late Middle Ages and Early Renaissance period. Several countries in Europe experienced rebirths in their economies at this time of the commercial revolution; which was a period of discovery and trade corresponding with a burgeoning of commercial capitalism and the emergence of urban centers.\(^{18}\) The growth of commerce and banking reshaped economic lines as the increased variety and volume of commercial opportunities altered the income earning potential of men. Massive recruitment of talented men into the urban centers

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14The Pakistani parliament first made efforts to reduce excessive expenditures at marriages by an Act in 1976.
15See, for example, Kishwar and Vanita (1984), White (1992), and Rozario (1992).
16In addition to the economic repercussions, the increasing demands of groom-prices in South Asia have led to severe social consequences. The custom has been linked to the practice of female infanticide and, among married women, to the more obvious connection with bride-burning and dowry-death, i.e., physical harm visited on the wife if promised payments are not forthcoming (Bloch and Rao (2002), Kumari (1989), and Sood (1990) address these issues). The National Crime Bureau of the Government of India reports approximately 6000 dowry deaths every year. Numerous incidents of dowry-related violence are never reported and Menski (1998) puts the number to roughly 25000 brides who are harmed or killed each year. Relative to research on dowry related violence in India, there are few corresponding investigations for the rest of South Asia. However, this does not imply that such abuse towards women does not occur. In a recent international conference on the ‘dowry problem’, it was stated that consolidated research on the Pakistani and Bangladeshi experience is urgently needed (see Menski (1998). The case of Pakistan was particularly emphasized, where there was argued to be a need for legislation in light of the growing number of dowry abuse reports.
17This is in contrast to more homogenous (and often polygynous) tribal societies where bride-price is pervasive. For comparisons of marriage payments across societies, refer to Anderson (2007a).
18See, for example, Gies and Gies (1972), Lopez (1971), and Miskimin (1969).
from villages and small towns occurred, and social change accompanied this, as men of newly acquired wealth were drawn into the upper and middle urban classes (Herlihy (1978)). Watts (1984) argues that by the late fifteenth/early sixteenth century, in almost all areas of Europe to the west of the Elbe, the urban social structure bore little relationship to the high medieval ordering of society as wealth inequality began to increase in the main centers of merchant capitalism during this period (Van Zanden (1995)).

But this commercial revolution did not spread evenly.19 Northern and central Italy were the homes of great mercantile centers, such as Venice, Florence, and Genoa, in the late fourteenth and fifteenth centuries, Siena was a center of commerce in the thirteenth century, but fell into relative decay following the Black Death of the fourteenth century (Molho (1969), Luzatto (1961), Riemer 1985). Spain's mercantile period came later when Castile dominated in the sixteenth and seventeenth centuries (Vives (1969)).20 England was also undergoing its mercantile period at this time (Lipson (1956)). These periods of economic expansion in different centers of Europe corresponded with the emergence of groomprices in late thirteenth century Siena, in the urban centers of northern and central Italy during the fourteenth and fifteenth centuries, and in Early Modern Spain and England, as outlined in the previous section. Moreover, there is evidence that, over these periods, the groomprice component of dowries served to secure matches with more desirable grooms of high quality. For example, Chojnacki (2000) documents the evolution of groom-gift in fifteenth century Venice. At a time of social and economic upheaval, it was used to secure grooms from prominent families.

This characteristic of modernization also pertains to present-day India. Traditionally, one's caste (status group) innately determined one's occupation, education, and hence potential wealth. Modernization in India has weakened customary barriers to education and occupational opportunities for all castes and, as a result, increased potential wealth heterogeneity within each caste.21 There is direct evidence that increases inequality (or heterogeneity) amongst married men forces dowries to serve as a price in present-day India. Several studies connect groomprice to competition amongst brides for more desirable grooms.22 For example, Srinivas (1984) dates the emergence of groomprices in India to the creation of white collar jobs under the British regime. High quality grooms filling those jobs were a scarce commodity, and bid for accordingly. In the same vein, Chauhan (1995) links the widespread transformation of dowries into a groomprice to directly after Independence in 1947. This was a time of significant structural change where unprecedented opportunities for economic and political mobility be-

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19During this time, urbanisation first occurred in areas of northern and central Italy, southern Germany, the Low Countries, and the Spanish Kingdoms.
20Catalonia was also an early economic center in the thirteenth and fourteenth centuries (Vives (1969)).
21See Singh (1987) for a survey of case studies which analyze upward and downward occupational mobility within caste groups. The recent work of Deshpande (2000) and Darity and Deshpande (2000) shows that within-caste income disparity is increasing in India. This notion of modernisation causing increased heterogeneity within status (caste) groups also applies to Pakistan and Bangladesh. Despite that caste is rooted in Hinduism and is not a component of Islamic religious codes, for the purposes here, caste (or status group) does exist amongst Muslims in both Pakistan and Bangladesh. That is, there traditionally exists a hierarchical social structure based on occupation, where group membership is inherited and endogamy is practised within the different groups. See, for example, Korson (1971), Dixon (1982), Beall (1995), Ahmad (1977), and Lindholm (1985) for Pakistan. Ali (1992) provides an in-depth study of this issue for rural Bangladesh.
22See, for example, Srinivas (1984), Nishimura (1994), and Caplan (1984).
gan to open up for all castes (see also Jayaraman (1981). The same connection has been made in Bangladesh for the emergence of their post-Independence groomprices.

3 Model

3.1 Fundamentals

The economy is populated by $N_f + N_m$ one-child families; $N_f$ of these have a daughter - ‘female families’, and $N_m$ have a son - ‘male families’. We assume an excess supply of females; $N_f > N_m$.24

Each family is endowed with a wealth, $W$, and each male is endowed with a present value of earnings, $w$. Both of these are potentially heterogeneous. In contrast, females are homogeneous with respect to their present value of earnings, $\tilde{w}$ (this assumption is relaxed below). Families care about their consumption, $C$, as well as the consumption of their offspring, $c$. Specifically, they obtain a payoff of $V(C, c)$, where $V$ is strictly increasing in both arguments, strictly concave in $C$, weakly concave in $c$, and weakly supermodular (i.e. $V_{12} \geq 0$).

Female families choose a marriage market transfer bundle, $\tau = (\tau_f, \tau_m)$, where $\tau_f$ is a transfer to their daughter and $\tau_m$ is a transfer to her husband. We assume that $\tau_f \geq 0$ and that $\tau_m \geq -w$: i.e. female families can not receive transfers from their daughter, and can not receive more from a groom than their earnings. An outcome where $\tau_m < 0$ would be consistent with the phenomenon stressed in Zhang and Chan (1999) whereby marital transfers simultaneously go from and to the bridal family. Female families consume whatever remains of their wealth once these transfers have been made: $C = W - (\tau_f + \tau_m)$. For simplicity, male families simply consume their wealth. If an offspring is unmarried, they consume their earnings plus any parental transfers. If instead they are married, their consumption is determined by bargaining between them and their spouse.

3.2 Intra-household Bargaining

Following Lundberg and Pollak (1993), a marital relationship exists in one of two possible regimes - we label them ‘productive’ and ‘unproductive’. In an unproductive relationship, the total effective resources available for consumption equals the total physical resources, $R$, which consists of the sum of male earnings, female earnings, and total marriage market transfers ac-

23See, for example, Kishwar and Vanita (1984), White (1992), and Rozario (1992).

24As pointed out by Neelakantan and Tertilt (2008), observed sex ratios, either population-wide or at birth, may be poor proxies for the sex ratio in the marriage market. For instance, they note that in India there are approximately 0.95 females per male, but once dynamic considerations such as differences in age at marriage, mortality, and population growth are accounted for, there are approximately 1.09 females per male in the marriage market. Since the values of $N_f$ and $N_m$ are intended to capture marriage market conditions, we abstract from these dynamic considerations and instead simply take an excess supply of females as given. Alternatively, one can imagine a more complicated model in which $N_f = N_m$ but some males are sufficiently poor that they ‘unmarriage’. Again, it is simpler if we start with the excess females assumption rather than needlessly complicate matters in this way. Having a long side of the market is important for pinning down the equilibrium (see Peters and Siow (2002)).
companying the bride:

\[ R \equiv w + \bar{w} + \tau_f + \tau_m. \] (1)

The amount consumed by a bride or groom in an unproductive marriage, \( x_f \) or \( x_m \) respectively, is assumed to i) satisfy the resource constraint: \( x_f + x_m = R \), and ii) be positively correlated with the resources over which they possess property rights: their earnings plus the marriage market transfers they receive.\(^{25}\) For simplicity, we assume that consumption in the unproductive regime coincides with the resources over which the individual possesses property rights:

\[ x_f = \bar{w} + \tau_f, \quad \text{and} \quad x_m = w + \tau_m. \] (2)

In the productive regime, total effective resources are increased to

\[ \bar{R} = a_0 + (1 + a) \cdot R. \] (3)

The value of \( a_0 \geq 0 \) captures any fixed benefit to marriage (as in Iyigun and Walsh (2007)), whereas \( a \geq 0 \) captures the feature that benefits from marriage are potentially derived from increasing the productivity of resources available within marriage (as in Peters and Siow (2002)). Consumption is determined by Nash bargaining, using consumption in the unproductive regime as the outside option:

\[
(c_f, c_m) = \arg \max_{c_f, c_m} \left\{ [c_f - x_f]^\beta \cdot [c_m - x_m]^{1-\beta} \right\},
\] (4)

subject to \((c_f, c_m) \in \mathbb{R}_+^2\) and \(c_f + c_m \leq \bar{R}\), where \( \beta \in [0,1] \) parameterizes female bargaining power.

### 3.3 The Marriage Market

Males are characterized by a single dimension in the marriage market - their earnings, \( w \) - whereas females are characterized by their two-dimensional transfer bundle, \( \tau = (\tau_m, \tau_f) \). A competitive marriage market can be modeled in manner similar to the Rosen (1974) hedonic model of product differentiation. That is, brides are considered the multi-dimensional ‘product’ to be traded, female families are the ‘producers’ of this product, and male families are the ‘consumers’ of this product. The marriage market is described by a hedonic return function, \( m(\tau) \), which indicates the ‘price’ received for a bride with characteristics \( \tau \) as measured in units of male earnings, \( w \). Female families choose characteristics optimally given this function, and male families choose their most preferred bride in their ‘budget set’ \( \{ \tau \ | \ m(\tau) \leq w \} \). An equilibrium hedonic return function has the property that the measure of male families demanding each characteristic bundle equals the measure of female families supplying that bundle.

The problem of characterizing and describing the equilibrium hedonic return function is quite tractable when \( \tau \) is one-dimensional (as in Peters and Siow (2002)) as it typically requires only that we solve a first-order ordinary differential equation. The problem is considerably more difficult when \( \tau \) is multi-dimensional since this amounts to solving a partial differential equation. However, the Nash bargaining assumption allows us to convert the two-dimensional

\(^{25}\)Requiring that \( \tau_f \geq 0 \) and \( \tau_m \geq w \) guarantees that these consumption levels are non-negative.
problem into a one-dimensional problem which is much simpler to analyze. The solution for male consumption is

\[ c_m = [(1 - \beta) \cdot \alpha_0] + [1 + \alpha \cdot (1 - \beta)] \cdot x_m + [\alpha \cdot (1 - \beta)] \cdot x_f \]  

(5)

\[ = [(1 - \beta) \cdot \alpha_0] + [1 + \alpha \cdot (1 - \beta)] \cdot w + [\alpha \cdot (1 - \beta)] \cdot \bar{w} + q(\tau_m, \tau_f), \]  

(6)

where

\[ q(\tau_m, \tau_f) = [1 + \alpha \cdot (1 - \beta)] \cdot \tau_m + [\alpha \cdot (1 - \beta)] \cdot \tau_f. \]  

(7)

Notice how female characteristics are condensed into a single dimension, \( q(\tau_m, \tau_f) \), which we refer to as bride quality. All males prefer females with high qualities over females with low qualities. This quality index has the intuitive feature that males prefer more of either transfer to less, and prefer transfers with property rights assigned to them to transfers without such rights.

In this light, females are differentiated by a one-dimensional characteristic in the marriage market - their quality. The problem now becomes much more tractable since equilibrium is now described by a marriage market return function, \( m : \mathbb{R} \rightarrow \mathbb{R} \), where \( m(q) \) is the earnings of the groom that a female of quality \( q \) can expect to marry. Similarly, a male with earnings of \( w \) expects to marry a female with quality \( q = m^{-1}(w) \).

Furthermore, Nash bargaining implies a female consumption of:

\[ c_f = \beta \cdot \alpha_0 + [\alpha \cdot \beta] \cdot x_m + [1 + \alpha \cdot \beta] \cdot x_f \]  

(8)

\[ = \beta \cdot \alpha_0 + [\alpha \cdot \beta] \cdot [w + \tau_m] + [1 + \alpha \cdot \beta] \cdot [\bar{w} + \tau_f]. \]  

(9)

Analogous to the male case, females prefer to receive more of each transfer to less, and prefer transfers which assign them property rights.

### 3.4 Equilibrium

A marriage market return function constitutes an equilibrium if i) families are acting optimally given \( m \), and ii) \( m \) is consistent with optimal actions. These are elaborated on in turn.

A male household acts optimally if they participate in the marriage market - i.e. marry a female with quality \( q = m^{-1}(w) \) - if and only if it provides a higher payoff than remaining single. A female household’s problem is only slightly more complicated - if they decide to participate, their choice of transfer bundle, \((\tau_m, \tau_f)\), must maximize their payoff function. That is, \((\tau_m, \tau_f)\) must maximize \( V(C, c) \), where

\[ C = w - \tau_f - \tau_m \]

\[ c = \beta \cdot \alpha_0 + [\alpha \cdot \beta] \cdot \left[ m(q(\tau_m, \tau_f)) + \tau_m \right] + [1 + \alpha \cdot \beta] \cdot [\bar{w} + \tau_f]. \]

The final constraint is just the Nash bargaining outcome (9), using the fact that \( w = m(q) \).

Furthermore, each family must choose participation in the marriage market optimally. That is, all participating females must find that the above problem produces a payoff at least as large
as that associated with non-participation (and vice versa for non-participating females). Since non-participating females never make transfers to a groom, the payoff to non-participation is:

\[ u_0(W) \equiv \max_{\tau_f} \left\{ V(W - \tau_f, \bar{w} + \tau_f) \right\}. \]

Since payoff to participation is

\[ u(W) \equiv \max_{\tau_m, \tau_f} \left\{ V(C(\tau_m, \tau_f), c(\tau_m, \tau_f)) \right\}, \]

then optimal participation requires that a female family with a wealth of \( W \) participates if \( u(W) > u_0(W) \) and does not participate if \( u(W) < u_0(W) \).

The return function is said to be consistent with optimal actions if, for each \( q \in \mathbb{R} \), the measure of female families that wish to marry and have a quality of at least \( q \) equals the measure of male families that wish to marry and have earnings of at least \( m(q) \). This is a form of market-clearing condition that ensures expectations are rational in the sense that all expected marriages are accommodated.

### 3.5 Calculating Equilibrium

Since the key equilibrium object, the marriage market return function, maps \( q \) to \( w \), it is convenient to work in \((q, w)\) space. Preferences of male families are straightforward to depict in this space - higher values of \( q \) are preferred to lower values. In order to depict the preferences of female families in this space, let \( U(q, w | W) \) be the payoff to a female family with wealth \( W \) that is married to a groom with earnings \( w \) when they choose their transfer bundle optimally subject to the constraint that they deliver a bridal quality of \( q \). That is:

\[ U(q, w | W) \equiv \max_{\tau_m, \tau_f} V\left(W - \tau_m - \tau_f, c(w, \tau_m, \tau_f)\right), \quad \text{s.t.} \quad q(\tau_m, \tau_f) \geq q, \quad (10) \]

where \( c(w, \tau_m, \tau_f) \) is given by \((9)\) and \( q(\tau_m, \tau_f) \) is given by \((7)\). Given this function, we can derive the properties of indifference curves in \((q, w)\) space.

**Proposition 1.** Let \( I(q | W) \) be a family of indifference curves: i.e. we have \( U(q, I(q | W) | W) \) equals a constant. Then the slope of such indifference curves is

\[ I_q(q | W) = \frac{c_{\tau_f} - c_{\tau_m}}{c_w} = \frac{1}{\alpha \beta}, \quad (11) \]

and is therefore independent of \( W \).

**Proof.** See appendix.

One intuition for this result is as follows. In order to be maximizing, female families must find that both types of transfer have the same marginal return. In other words, they must be indifferent to marginal changes in the composition of a given total transfer. But, consider changing the composition by re-allocating property rights over \( x \) units of transfer away from the bride and toward the groom. This lowers female consumption by an amount that is independent of female family wealth. Similarly, an increase in male earnings raises raises female consumption by an amount that is independent of female family wealth. Therefore, the rate at which female families are willing to trade off compositional changes for changes in male earnings is independent of wealth. The fact that indifference curves are linear is, in part, an artifact of Nash
bargaining - in the appendix we describe the types of consumption functions that would not change the qualitative implications of this analysis.

An important implication of this fact is that the only way that the marriage market can clear is if \( m(q) \) coincides with one of these indifference curves. To see this, let \( w_0 \) be the lowest earnings among males. In order for some female family to marry such males, the \( m \) function would need to be something similar to that indicated in the left panel of Figure 1. This is because female families choose the point that lies on the highest indifference curve subject to lying on \( m \). However, if \( m \) were given by the indicated curve, then all female families would choose \( q_0 \) and would expect to marry a groom with earnings of \( w_0 \). If there are grooms with some other wealth, say \( w_1 \) as indicated in the second panel, then these grooms would not find partners. To rectify this, the \( m \) curve would need to adjust in a manner similar to that in the center panel. In such a case female families are indifferent between the \( w_0 \) and \( w_1 \) grooms. If there existed grooms with earnings at every point between \( w_0 \) and \( w_1 \), then the \( m \) function would need to adjust in a manner similar to that indicated in the right panel if all such grooms are to marry. That is, if \( q_0 \) is the bridal quality that must be offered in order to marry grooms with earnings of \( w_0 \), then the \( m \) function must be given by

\[
m(q) = w_0 + \frac{1}{\alpha \beta} (q - q_0)
\]

Since this is the groom earnings that a female family expects when delivering a quality \( q \), we can use \( w = m(q) \) in (9), to get that female consumption is

\[
c(T | q_0) = \beta \cdot \alpha_0 + (1 + \alpha \cdot \beta) \cdot \tilde{w} + \alpha \cdot \beta \cdot w_0 - q_0 + (1 + \alpha) \cdot T,
\]

where \( T = \tau_m + \tau_f \) is the total transfer. Thus, in equilibrium, female consumption is only a function of total transfers. The composition of a given total determines the extent to which female consumption is derived from direct parental transfers as opposed to from the earnings of the groom that they marry.

Given (13), the equilibrium payoff to a female family in the marriage market is now:

\[
u(W | q_0) = \max_i \left\{ V \left( W - T, c(T | q_0) \right) \right\}.
\]

When \( q_0 \) is such that \( u(W | q_0) = u_0(W) \), we have that \( u(W | q_0) > u'_0(W) \).

\[27\] This implies that \( q_0 \) defines a cut-off wealth level such that female families with higher wealth prefer to participate

\[27\] From the first-order conditions for married female families, we have \( V_i(C, c) = (1 + \alpha) \cdot V(C, c) \). From the first-order
and those with lower wealth prefer to not participate. In order to clear the marriage market, \( q_0 \) must be such that the cut-off wealth corresponds to the \( N_m \)th ranked female family wealth. If this wealth level is denoted \( W_m \), then the equilibrium value of \( q_0 \), denoted \( q_0^* \), satisfies

\[
u(W_m | q_0^*) = u_0(W_m).
\]  

(15)

Female families optimally choose total transfers of

\[
T^*(W) = \arg \max \left\{ V \left( W - T, c(T | q_0^*) \right) \right\},
\]  

(16)

and if they marry a male with earnings of \( w \) then, according to the equilibrium marriage market return function, they must offer a bride quality of

\[
m^{-1}(w) = q_0^* + \alpha \beta \cdot [w - w_0].
\]  

(17)

In short, a female family with a wealth of \( W \) that marries a groom with earnings of \( w \) optimally transfers that induce \( (T, q) = (T^*(W), m^{-1}(w)) \). This optimal transfer bundle is illustrated in Figure 2, where equations (16) and (17) are plotted in \((\tau_f, \tau_m)\) space. Explicitly, these transfers are

\[
\tau_m = m^{-1}(w) - \alpha(1 - \beta) \cdot T^*(W)
\]  

(18)

\[
\tau_f = (1 + \alpha(1 - \beta)) \cdot T^*(W) - m^{-1}(w).
\]  

(19)

We need to verify that transfers do indeed satisfy the maintained assumptions that \( \tau_f \geq 0 \) and \( \tau_m \geq -w \). That is,

\[
[q_0^* - \alpha \beta \cdot w_0] + [1 + \alpha \beta] \cdot w - \alpha(1 - \beta) \cdot T^*(W) \geq 0 \tag{20}
\]

\[
(1 + \alpha(1 - \beta)) \cdot T^*(W) - [q_0^* - \alpha \beta \cdot w_0] - \alpha \beta \cdot w \geq 0. \tag{21}
\]

The first says that \( W \) can not be too high relative to \( w \), otherwise we would require too great a transfer from the groom. The second says that \( w \) can not be too high relative to \( W \), otherwise we would require a positive transfer from the bride. The first of these holds for \((W_m, w_0)\)\(^{28}\), and the second will hold as long as \( w_0 \) is not too large relative to \( W_m \). Regardless, both conditions hold for any \((w, W)\) pair if \( \alpha \) is sufficiently small.\(^{29}\)

**Proposition 2.** Suppose \( \alpha \) is small enough that (20) and (21) hold for any \((w, W)\) pair. There exists an equilibrium in which \( N_m \) of the wealthiest female families and all of the male families participate in the marriage market. Any one-to-one assignment of male participants to female participants is supported in equilibrium. Female families of wealth \( W \) that are assigned to a male with earnings of \( w \) make transfers given by (18) and (19).

\(^{28}\)If the first did not hold, then it could not be the case that marginal female families are indifferent to entering the marriage market.

\(^{29}\)As \( \alpha \) goes to zero, the left side of (20) goes to \( w \) (which is non-negative) and the left side of (21) goes to \( T_0^*(W) \) (which is also non-negative). Intuitively, as \( \alpha \) becomes small bridal families make transfers in a manner similar to how they would in the absence of marriage.
4 Modernization and the Marriage Market

4.1 Earnings and the Marriage Market

We begin by examining how the marriage market adjusts to rising male earnings. One would naturally expect that female families will need to offer higher qualities, but it is not clear whether this will be achieved via greater total transfers with fixed relative property rights or a compositional shift in transfers over a fixed total transfer (or some combination of these). When marriage market transfers are restricted to being one-dimensional, the only way that quality can be increased is via greater transfers. This, however, is exactly the opposite of what happens when transfers are two-dimensional.

**Proposition 3.** An increase in all male earnings induces a shift in property rights toward the groom, with no change in the total transfer.

*Proof.* See appendix.

Figure 3 illustrates the effect of an increase in male earnings (keeping matching patterns fixed). Intuitively, the marriage market return function must adjust so that the marginal return (in units of male earnings) of each type of transfer is equalized (since the marginal costs are equal). Therefore, female families are indifferent to changes in the composition of a given total transfer on the margin. Since all female families are willing to trade off groom earnings and bridal quality at the same rate, this indifference to the composition of a given total transfer holds even away from the margin. Families are indifferent to changes in the total transfer only at the margin. Therefore, a higher quality is always least costly to provide via compositional changes.
One might conjecture that property rights are shifted toward grooms because their earnings are increased relative to female earnings. This, however, is not true. As female earnings increase, all female families - married or not - benefit. Married female families benefit more than do unmarried female families to the extent that the added female earnings are more valuable in marriage (because $\alpha > 0$). If married females do in fact benefit more, then the marriage market must adjust via an increased $q_0^*$ in order to retain indifference among marginal female families. All married females therefore must offer a higher quality, and therefore will therefore offer greater property rights to grooms. This also weakly decreases the total transfer made since married females have greater consumption.

It is however not necessarily the case that married females benefit from greater earnings than unmarried females because of the fact that the marginal married female has greater consumption than the marginal unmarried female, and therefore has a lower marginal utility of consumption. If this effect were sufficiently strong, then it is conceivable that $q_0^*$ must fall to clear the marriage market. Note however that the mechanism at work here is completely different from the intuition that greater female earnings act as a substitute for female quality in the marriage market.

**Proposition 4.** Suppose payoffs are quasi-linear in offspring consumption: $V(C, c) = v(C) + c$. An increase in female earnings, $\tilde{w}$, raises $m^{-1}(w)$ but does not change the total transfer. As such, there is a shift in property rights toward the groom.

*Proof.* See appendix.

Intuitively, the gains that would arise from greater female earnings are competed away by unmarried females. Since an increase in female earnings has more of an impact in married couples, the price of the lowest-earning groom (and therefore of all grooms) must increase -
thereby requiring a shift in property rights toward grooms. Despite this, all females are better off following such a change in their earnings.

In total, this section has demonstrated that rising earnings of both males and females leads to an equilibrium shift in property rights toward grooms. In addition to the evidence presented in Section 2.2, Arunachalam and Logan (2008) describe how transfers have shifted from bequest to price in Bangladesh since 1930 - a time of increasing modernization.

4.2 Female Status and the Marriage Market

The modernization process is accompanied by changes apart from rising earnings. One such change is a rising status of women. We model such a change in this framework by considering changes in the bargaining parameter, $\beta$. Much like rising female earnings, one may expect that greater bargaining power would shift property rights toward females, but this is not the case.

**Proposition 5.** An increase in female bargaining power, $\beta$, does not affect total transfers but induces a shift in property rights toward the groom.

**Proof.** Lemma 1 establishes that $\beta$ does not affect $T^*(W)$ but increases $m^{-1}(w)$. From (18) and (19), it therefore follows that $\tau_m$ increases and $\tau_f$ decreases with $\tau_m + \tau_f$ constant.

The intuition for this is similar to that of rising female earnings - any gains are competed away by unmarried females. In addition, a weaker bargaining power means that males have a greater demand for property rights over transfers. Thus, offering such rights represents a relatively attractive way in which to secure high earning grooms.

Arunachalam and Naidu (2008) find that stronger bargaining power (derived from a lower
cost of contraception) among women in Bangladesh has lead to an increase in dowry payments. The magnitude is reported to be an astonishing 80%.

### 4.3 Premarital Investment

It may be more realistic to assume that the male has property rights over all transfers received at the time of marriage. The above analysis is still applicable if we think of female families investing in the human capital of their offspring prior to entering the marriage market. One simple way to do this is suppose that an investment of \( \tau_f \) in a daughter’s human capital allows them to earn \( z \cdot \tau_f \) in the labor market. In this way, female earnings are endogenized and are no longer assumed to be homogeneous.

A key insight from this extension emerges in the case where \( z > 1 \). In such a case it is efficient for female families to make transfers purely in the form of human capital investment. However, by doing so the daughter becomes relatively unattractive in the marriage market relative to the case of pure resource transfers (which the male has property rights over). This implies that parents under-invest in the human capital of their daughters, but not because of an intrinsic prejudice against females. In fact, it is the concern for their daughter’s consumption that prompts parents to increase the attractiveness of their daughter in the marriage market.

If \( z \) is sufficiently small, then it will never be optimal to make human capital transfers. If \( z \) is sufficiently large, then it will never be optimal to make pure resource transfers. In order to focus on the case where both types of transfers are made, we assume that \( z \) is not too different from unity:

\[
1 - \frac{1}{1 + \frac{1}{\alpha \beta}} < z < 1 + \frac{1}{\alpha (1 - \beta)}.
\]

Using the same types of arguments as those presented above, male consumption is

\[
c_m = [1 + \alpha \cdot (1 - \beta)] \cdot w + q(\tau_m, \tau_f),
\]

where the quality index is now

\[
q(\tau_m, \tau_f) \equiv [1 + \alpha \cdot (1 - \beta)] \cdot \tau_m + [\alpha \cdot (1 - \beta)] \cdot z \cdot \tau_f.
\]

Similarly, female consumption is

\[
c_f = [\alpha \cdot \beta] \cdot w + [1 + \alpha \cdot (\tau_m + z \cdot \tau_f) - q(\tau_m, \tau_f)].
\]

Using the more general expression in Proposition 1, the slope of an indifference curve\(^{30}\) is

\[
I'(q | W) = \frac{1}{\alpha \beta} \cdot \left[ 1 + \frac{(1 + \alpha) \cdot (z - 1)}{1 - \alpha \cdot (1 - \beta) \cdot (z - 1)} \right].
\]

Once again, the fact that this is a constant implies that female families are indifferent between grooms in equilibrium. As in the above case, the marriage market return function adjusts so that families are indifferent to the composition of a total transfer. Specifically, consumption can be written

\[
c(T) = c_0 + (1 + \alpha) \cdot \left[ \frac{z \cdot q_{\tau_m} - q_{\tau_f}}{q_{\tau_m} - q_{\tau_f}} \right] \cdot T,
\]

\(^{30}\)The assumptions on the magnitude of \( z \) ensures that \( m'(q) > 0 \).
where \( c_0 \) is a constant that adjusts so that only the \( N^m \) most wealthy female families wish to participate.

The marriage market distorts the return to each type of transfer since it forces the marginal returns to be equal. It therefore follows that female families invest a less-than-efficient amount in the human capital of their daughters and transfer a more-than-efficient amount to grooms. Furthermore, if \( z > 1 \) then the term in brackets is greater than \( z \). This implies that the marriage market induces a private return to total transfers that is greater than the social return \((1 + \alpha)z\), leading to excessive aggregate transfers.

To get at this more formally, note that transfers of \((\tau_m, \tau_f)\) raise consumption possibilities by \([1 + \alpha] \cdot (\tau_m + z \tau_f)\). Since consumption can be transferred between bride and groom, transfers are Pareto efficient if and only if they satisfy

\[
\frac{V_1}{V_2} = (1 + \alpha) \cdot \max[1, z].
\]  

In equilibrium we have

\[
\frac{V_1}{V_2} = (1 + \alpha) \cdot \left[ \frac{z \cdot q_{\tau_m} - q_{\tau_f}}{q_{\tau_m} - q_{\tau_f}} \right].
\]  

The bracketed term is greater than \( z \) if \( z > 1 \), less than 1 if \( z < 1 \), and equals 1 if \( z = 1 \). Since \( z = 1 \) corresponds to the original case considered, we have the following.

**Proposition 6.** Equilibrium transfers are Pareto efficient if and only if \( z = 1 \).

### 4.4 Equilibrium Matching Patterns and the Nature of Marriage Market Competition

The equilibrium matching pattern arising in equilibrium is neither completely random nor positive assortative.\(^{31}\) It is perhaps best described as *coarse positive assortative* to reflect the fact that only the wealthiest female families are married (thus 'positive assortative') but the manner in which grooms are sorted across these families is random (thus 'course'). In contrast to Peters and Siow (2002), wealthier bridal families have no advantage in the competition for wealthier grooms. The reason is that they are able to offer quality by substituting transfers within a given total transfer. That is, the cost at which bridal quality is raised is the same across all wealth levels.

More generally, let us index the female families by \( i \) in such a way that \( W_i \geq W_{i+1} \) for all \( i \). Let \( \tilde{\phi} : \{1, ..., N_m\} \rightarrow \{1, ..., N_m\} \) be a one-to-one function, and let

\[
\phi(i) = \begin{cases} 
\tilde{\phi}(i) & \text{if } i \in \{1, 2, ..., N_m\} \\
0 & \text{otherwise.}
\end{cases}
\]  

Here female \( i \) gets assigned a partner of \( \phi(i) \), where this corresponds to the index of a male where 0 is interpreted as being unmarried. If \( \phi \) is such that (20) and (21) hold for all \( i = 1, ..., N_m \), then there exists an equilibrium in which female \( i \) marries male \( \phi(i) \).

The conditions (20) and (21) require that the difference between \( W \) and \( w \) not be too great. This provides a weak force toward positive assortative matching, but notice that the underlying

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\(^{31}\)Positive assortative matching just means that the wealthiest females marry the grooms with the highest earnings.
reasons for this have to do with boundary constraints, and not complementarity. That is, if a poor female can not marry a wealthy male then it is because they are unable to provide a bridal quality high enough (since offering property rights over the entire transfer does not cover the quality required by the market). Similarly, if a poor male can not marry a wealthy bride it is because they can not offer a quality low enough (since the quality arising when all of the groom's earnings are transferred to the bride and the bride has complete property rights over the transfer more than covers the quality required by the market).

5 Conclusions

We have developed an equilibrium model of the marriage market which helps us understand the joint determination of i) total marital transfers, and ii) the allocation of property rights over such transfers. We show how aspects of early modernization, including an increase in the average level and dispersion of male earnings, an increase in female earnings, and a strengthening of female bargaining power, induce greater property rights for grooms at the expense of brides.

We also demonstrate that marriage patterns will typically not be positive assortative, and that equilibrium transfers are not Pareto efficient in general when transfers to the bride are in the form of premarital investment in human capital. These results are of independent interest and provide a contrast to those produced from related models in which marital transfers are one-dimensional.

The analysis has some clear limitations that will be addressed in future research. For instance we have not explored the consequences of having more males than females, of allowing families to have multiple offspring, of allowing transfers from the grooms’ family, nor have we added any form of dynamic element. However, given that property rights over marital transfers are irrelevant in existing models of the marriage market, we view the analysis here as a useful first step in understanding the economic forces behind the transition in the role of dowry from bequest to groomprice.

A Proofs

Lemma 1. \( q_0^* \) is increasing in \( \beta \) and \( w_0 \). \( T^* (W) \) is independent of \( \beta \) and \( w_0 \). \( m^{-1} (w) \) is increasing in \( \beta \) and is unaffected by \( w_0 \).

Proof. Neither \( \beta \) nor \( w_0 \) affect \( u_0 (W_m) \). Therefore \( q_0^* \) adjusts so that \( c (T \mid q_0^*) \) is constant. This requires that

\[
(1 + \alpha \beta) \cdot \ddot{w} + \alpha \beta \cdot w_0 - q_0^* = \ddot{c}, \tag{31}
\]

for some \( \ddot{c} \). The left side increases with \( \beta \) and \( w_0 \), requiring that \( q_0^* \) increase to offset increases in these variables. Furthermore, \( T^* (W) \) maximizes \( V(W - T, \ddot{c} + (1 + \alpha) \cdot T) \). The constancy of \( \ddot{c} \) ensures the constancy of \( T^* (W) \).

Using \( \ddot{c} \), we can write \( m^{-1} (w) \) as

\[
m^{-1} (w) = \alpha \beta \cdot w + (1 + \alpha \beta) \cdot \ddot{w} - \ddot{c}, \tag{32}
\]

which is increasing in \( \beta \) but unaffected by \( w_0 \). \( \square \)
Proof of Proposition 1

Proof. Implicitly differentiating \( U(q, I(q \mid W) \mid W) = \) constant gives

\[
I_q(q \mid W) = -\frac{U_q(q, w)}{U_w(q, w)},
\]

(33)

By the envelope theorem, \( U_w(q, w) = V_2 \cdot c_w \). The value of \( U_q(q, w) \) equals the value of the Lagrange multiplier associated with the constrained maximization problem. The first-order conditions for that problem are

\[
V_1 = V_2 \cdot c_{\tau_m} - \lambda \cdot q_{\tau_m}, \quad V_1 = V_2 \cdot c_{\tau_f} - \lambda \cdot q_{\tau_f}.
\]

(34)

Equating the right side of these conditions and re-arranging gives

\[
-\lambda = \frac{V_2 \cdot c_{\tau_f} - c_{\tau_m}}{q_{\tau_m} - q_{\tau_f}}.
\]

(35)

Therefore

\[
I_q(q \mid W) = -\frac{\lambda}{V_2 \cdot c_w} = \frac{1}{c_w} \cdot \frac{c_{\tau_f} - c_{\tau_m}}{q_{\tau_m} - q_{\tau_f}}.
\]

(36)

From (9), we have \( c_{\tau_f} - c_{\tau_m} = q_{\tau_m} - q_{\tau_f} \) and \( c_w = \alpha \cdot \beta \).

Proof of Proposition 3

Proof. Lemma 1 establishes that \( w_0 \) does not affect either \( T^*(W) \) nor \( m^{-1}(w) \). Since \( m^{-1}(w) \) is strictly increasing in \( w \), it follows from (18) and (19) that \( \tau_m \) increases and \( \tau_f \) decreases.

Proof of Proposition 4

Proof. Given quasi-linearity, the value of \( q^*_0 \) is determined by

\[
\max_T \left\{ v(W - T) - [q^*_0 - \alpha \beta \cdot w_0] + (1 + \alpha \beta) \cdot w + (1 + \alpha) \cdot T \right\} = \max_T \{ v(W - T) + w + T \}
\]

(37)

By the Envelope Theorem, the derivative of the left side with respect to \( \tilde{w} \) is \((1 + \alpha \beta)\), whereas the derivative of the right side with respect to \( \tilde{w} \) is only 1. Therefore, the value of \( q^*_0 \) must increase to offset this difference. Changes in \( \tilde{w} \) do not affect the marginal return to \( T \), and therefore \( T^*(W) \) is also unaffected.

B Generalization

The proof of Proposition 1 suggests the ways in which the model can be generalized without making a qualitative impact on the results. Specifically, if male consumption can be written as \( c_m = g(w, q(\tau_m, \tau_f)) \), where \( g_2 > 0 \), then we are still able to identify a ‘bride quality’ index. If female consumption can be written as

\[
c_f = h(w) + \gamma_1 \cdot \tau_m + \gamma_2 \cdot \tau_f + r(q(\tau_m, \tau_f))
\]

(38)

then the slope of an indifference curve is

\[
I_q(q \mid W) = \frac{1}{h'(w)} \cdot \frac{\gamma_2 - \gamma_1 - r'(q) \cdot (q_{\tau_m} - q_{\tau_f})}{q_{\tau_m} - q_{\tau_f}}.
\]

(39)
If $\gamma_2 = \gamma_1$ (as in the original model), then this becomes

$$I_q(q \mid W) = \frac{-r'(q)}{h'(w)},$$

which is independent of $W$ (although, indifference curves will not be linear). If $\gamma_2 \neq \gamma_1$ (as in the premarital investment extension) then we would need to make the extra assumption that $q$ is linear in $\tau_m$ and in $\tau_f$.

References


