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 pre-marital 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. In understanding the purpose of dowries, the literature has focused on two distinct aspects: i) a price for grooms which clears the marriage market (Becker 1991, Rao 1993, Anderson 2003 and 2007a), and ii) a pre-mortem inheritance given to daughters by altruistic parents (Botticini and Siow 2003, Zhang and Chan 1999).

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 transfer. 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 groomprice 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 groomprice 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 develop a simple competitive model of the marriage market in which each bride and groom pair bargains over the allocation of their household resources. The amount of resources available to a household depends on the earnings potential of the groom and the total marital transfer from the bridal family. Property rights over the marital transfer matter because they influence the outcome of bargaining via altering outside options. The essential trade-off facing bridal families is most easily seen by considering the allocation of property rights over a fixed total transfer. Granting more 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. We show how salient features of the development process - including rising male and female earnings as well as an improved status of women - shift equilibrium transfers of property rights toward the groom.

Existing models of the marriage market are typically unable to shed light on the dowry transformation for the simple reason that property rights over marital resources are typically irrelevant. This is due to one of two reasons. First, non-transferable utility models of the marriage market assume that marital resources are allocated according to a fixed function of total resources. For example, Peters and Siow (2002) assume that consumption arises from a household public good. Second, transferable utility models of the marriage market assume that

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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 2007b).
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 (Becker (1974), Iyigun and Walsh (2008), Cole, Mailath, and Postelwaite (2001)). We pursue an alternative approach, one popularized by Lundberg and Pollack (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.

Botticini and Siow (2006) and Zhang and Chan (1999) focus on the role of dowries as transfers to the bride. In Botticini and Siow (2006) such transfers are rationalized by parents providing suitable incentives to their sons, whereas Zhang and Chan (1999) propose that such transfers aid in household bargaining. Both take the marriage market as given, where transfers in the marriage market are determined by an exogenous function of bride and groom characteristics. 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 model produces a number of other results, and highlights the point that an explicit consideration of property rights contains material consequences 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 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. Section 3 develops a simple two-sided competitive matching framework for analyzing the two roles of dowry. Section 4 describes some extensions to the model and Section 5 concludes.

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.2 Dowry paying societies are patrilocal (upon marriage the bride joins the household of her groom) and dowry payments

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2See Anderson (2007b) for a survey of the prevalence of dowries.
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 (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 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 wife’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. 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 1979). Reher (1997) remarks that during the Early Modern period in Spain, husbands had greater control over their wives’ dowers in Castile relative to other parts of the country. Kleimola (1992) documents a decline of female property rights over their dowers 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

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3 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.

4 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 dowers in Renaissance Tuscany corresponded to between 55 and 80 percent of a son’s inheritance.

5 Legislation of dowers was pervasive in Early Europe. For example, the Venetian Senate first limited Venetian dowers 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 dowers between the thirteenth and fifteenth centuries (Stuard 1981).

6 Relative to Italy, a limited number of surviving marriage agreements make the evolution of customs more difficult to follow in other parts of Europe.
indirect evidence of a loss of property rights for wives over their dowries.\textsuperscript{7} 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 \textit{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.\textsuperscript{8} 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.\textsuperscript{9} 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).\textsuperscript{10}

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.\textsuperscript{11} Following numerous complaints, the Pakistan Law Commission reviewed dowry legislation 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.\textsuperscript{12} In Bangladesh there seems to be a clear distinction between the traditional dowry, \textit{joutuk}, gifts from the bride’s family to the bride, and the new groom payments referred to as \textit{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,\textsuperscript{13} but the escalation of these groom payments lead to them being made a punishable offense by the Dowry Prohibition Act of 1980.\textsuperscript{14}

\textsuperscript{7}For 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).
\textsuperscript{10}The 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.
\textsuperscript{11}See Lindenbaum (1981), Esteve-Volart (2003), and Arunachalam and Logan (2006) for investigations on dowry payments in rural Bangladesh.
\textsuperscript{12}The Pakistani parliament first made efforts to reduce excessive expenditures at marriages by an Act in 1976.
\textsuperscript{13}See, for example, Kishwar and Vanita (1984), White (1992), and Rozario (1992).
\textsuperscript{14}In 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).
We now trace the connection between the occurrences of groomprices outlined above, in both historic Europe and present-day South Asia, to characteristics of the modernization process; specifically increased groom heterogeneity.

2.2 Dowry transformation and modernization

In both the European and South Asian context, the emergence of a groomprice 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)\(^{15}\), 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 groomprice.

This is a feature of European modernization when the groomprice 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.\(^{16}\) 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 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.\(^{17}\) Northern and central Italy were the homes of great mercantile centers, such as Venice, Florence, and Genoa, in the late fourteenth

\(^{15}\)This 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 (2007b).

\(^{16}\)See, for example, Gies and Gies (1972), Lopez (1971), and Miskimin (1969).

\(^{17}\)During this time, urbanisation first occurred in areas of northern and central Italy, southern Germany, the Low Countries, and the Spanish Kingdoms.
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, Luzzatto 1961, Riemer 1985). Spain’s mercantile period came later when Castile dominated in the sixteenth and seventeenth centuries (Vives 1969). 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. 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. 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 began 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.

The next section builds a simple model able to explain the historical connection between the emergence of groom price, increased male earnings and heterogeneity.

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18 Catalonia was also an early economic center in the thirteenth and fourteenth centuries (Vives 1969).
19 See 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.
20 See, for example, Srinivas (1983), Nishimura (1994), and Caplan (1984).
21 See, for example, Kishwar and Vanita (1984), White (1992), and Rozario (1992).
3 Model

The economy is populated by \( N = N^f + N^m \) one-child families; \( N^f \) of these have a daughter (‘female families’) and \( N^m \) have a son (‘male families’). The observation that males marry younger females, along with population growth, tends to produce a situation in which there are more females than males in a given marriage market. For this reason, suppose \( N^f > N^m \).

Each family \( j \) is endowed with a wealth, \( W_j \), which can be used for parental consumption, \( C_j \). In addition, parents care about the consumption of their offspring, \( c_j \). We assume

\[
U_j = u(C_j) + v(c_j),
\]

where \( u \) is a strictly increasing and concave function and \( v \) is a strictly increasing and weakly concave function.

The amount that offspring can consume is influenced by who they marry. We assume males live in their parent’s household with their wives. Males are potentially heterogeneous with respect to their discounted future earnings, \( w \). Females are productively homogeneous, and all have discounted future earnings of \( \tilde{w} \). Marital resources consist of the sum of these earnings, plus any transfers received at the time of marriage. We think of female families making the transfers (which are potentially negative). Specifically, they transfer \( \tau_g \) to the groom and \( \tau_b \) to the bride (their daughter). Total household resources are therefore \( R \equiv w + \tilde{w} + \tau_g + \tau_b \), where the male has formal ownership (property rights) over \( R^m = w + \tau_g \) and the female has formal ownership over \( R^f = \tilde{w} + \tau_b \). Property rights matter here because they represent consumption levels in the event that the marriage is unproductive. On the other hand, if marriage is productive, then there are \((1 + \alpha) \cdot R\) total effective resources to allocate across the bride and groom where \( \alpha \geq 0 \) parameterizes the benefit of a productive marriage. This allocation is sensitive to the outside options in the unproductive marriage.

Given that a female family transfers \( \tau_g + \tau_b \), their consumption is:

\[
C^f = W^f - \tau_g - \tau_b.
\]

The consumption of male families is not important for the analysis, but to fix ideas we assume for simplicity that male families consume their wealth \( W^m \). The consumption enjoyed by offspring depends on total marital resources \( R \), and to reflect sensitivity to property rights, in general we write \( c^k = c^k(\tau_g + w, \tau_b + \tilde{w}) \) for \( k = f, m \).

In the marriage market, males are characterized by a single dimension - their earnings, \( w \) - whereas females are characterized by their two-dimensional transfer bundle, \( \tau = (\tau_g, \tau_b) \). A competitive marriage market can be modeled in manner similar to Rosen’s 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 characterized by a hedonic return function, \( p(\tau) \), which describes 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’ \( \{\tau \mid p(\tau) \leq w\} \). Loosely, 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.

Even if the model is conceptually clear, it is no easy matter to compute the multi-dimensional hedonic price function or even to describe its interesting properties with any clarity. The analysis is tractable when both sides have a one-dimensional characteristic (as in Peters and Siow (2002)). By placing a suitable structure on how consumption is determined from household resources (i.e. the \( c^k \) functions), it is possible to reduce female characteristics to a single dimension. The required structure follows naturally from a simple Nash bargaining problem:

\[
(c^f, c^m) = \arg\max_{c^f, c^m} \left[ (c^f - R^f)^\beta \cdot (c^m - R^m)^{1-\beta} \right],
\]  
subject to \((c^f, c^m) \in \mathbb{R}_+^2 \) and \( c^f + c^m \leq (1 + \alpha) \cdot (R^f + R^m) \), where \( \beta \in [0, 1] \) parameterizes female bargaining power.

Assuming an interior solution (to be verified below), the solution for male consumption is:

\[
c^m = (1 + \alpha \cdot (1 - \beta)) \cdot R^m + \alpha \cdot (1 - \beta) \cdot R^f
\]  
\[
= (1 + \alpha \cdot (1 - \beta)) \cdot w + \alpha \cdot (1 - \beta) \cdot \tilde{w} + q(\tau_g, \tau_b),
\]  
where

\[
q(\tau_g, \tau_b) \equiv (1 + \alpha \cdot (1 - \beta)) \cdot \tau_g + \alpha \cdot (1 - \beta) \cdot \tau_b.
\]  

Notice how female characteristics are condensed into a single dimension, \( q(\tau_g, \tau_b) \), which we refer to as bride quality. This is possible because of the fact that \( c^m \) is linear in \( R^f \) and \( R^m \). Any linear function, if imposed from the outset, would achieve this; however the Nash bargaining structure not only justifies where this linearity comes from but also allows us to analyze quantities of interest such as female bargaining power.

In a similar way, female consumption is:

\[
c^f = \alpha \cdot \beta \cdot R^m + (1 + \alpha \cdot \beta) \cdot R^f
\]  
\[
= \alpha \cdot \beta \cdot w + (1 + \alpha \cdot \beta) \cdot \tilde{w} + \tilde{q}(\tau_g, \tau_b),
\]  
where

\[
\tilde{q}(\tau_g, \tau_b) \equiv \alpha \cdot \beta \cdot \tau_g + (1 + \alpha \cdot \beta) \cdot \tau_b.
\]  

Again, female characteristics are condensed into a single dimension, \( \tilde{q}(\tau_g, \tau_b) \). Notice that

\[
q(\tau_g, \tau_b) + \tilde{q}(\tau_g, \tau_b) = (1 + \alpha) \cdot [\tau_g + \tau_b]
\]  

### 3.1 Equilibrium

Equilibrium is 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 \( q = m^{-1}(w) \).

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, \((\tau_g, \tau_b)\), must maximize their payoff function. That is, they solve:

\[
\max_{\tau_b, \tau_g} u(W - \tau_b - \tau_g) + v(c^f) \tag{10}
\]

subject to \( c^f \) is given by (8) and \( w = m(q(\tau_g, \tau_b)) \). That is, subject to

\[
c^f = \alpha \cdot \beta \cdot m(q(\tau_b, \tau_g)) + (1 + \alpha \cdot \beta) \cdot \tilde{w} + \tilde{q}(\tau_g, \tau_b). \tag{11}
\]

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.

3.2 Deriving Equilibria

To begin solving the model, we start with the problem faced by a female family that decides to marry. The first-order conditions for (10) are:

\[
u'(W - \tau_b^* - \tau_g^*) = v'(c^f(\tau_g^*, \tau_b^*)) \cdot (1 + \alpha \cdot \beta) \cdot (1 + \alpha \cdot (1 - \beta)))\]

\[
u'(W - \tau_b^* - \tau_g^*) = v'(c^f(\tau_g^*, \tau_b^*)) \cdot (1 + \alpha \cdot \beta) + \alpha \cdot \beta \cdot m'(q^*) \cdot (1 - \beta)\],

where \( q^* = q(\tau_g^*, \tau_b^*) \). Combining these conditions gives

\[
m'(q^*) = \frac{1}{\alpha \cdot \beta} \tag{14}
\]

which, by integrating both sides and imposing \( m(q_0) = w_0 \), where \( w_0 \) is the lowest earnings among males and \( q_0 \) is the equilibrium quality that must be supplied in order to marry such a male (which is to be determined), gives:

\[
m(q^*) = w_0 + \frac{1}{\alpha \cdot \beta} \cdot (q^* - q_0). \tag{15}
\]

Substituting this back into (11), and defining \( T \equiv \tau_b + \tau_g \), we have:

\[
c^f = \alpha \cdot \beta \cdot w_0 - q_0 + (1 + \alpha \cdot \beta) \cdot \tilde{w} + q(\tau_g, \tau_b) + \tilde{q}(\tau_g, \tau_b) \tag{16}
\]

\[
c^f = \alpha \cdot \beta \cdot w_0 - q_0 + (1 + \alpha \cdot \beta) \cdot \tilde{w} + (1 + \alpha) \cdot T \equiv c^f(T), \tag{17}
\]

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 wealth of the groom that they marry.

The optimal total transfer for a bridal family with wealth \( W \), denoted \( T^*(W) \), satisfies

\[
u'(W - T^*(W)) = v'(c^f(T^*(W))) \cdot (1 + \alpha). \tag{18}
\]
It is straightforward to show, via the implicit function theorem, that $dT^*(W)/dW \in (0, 1]$. The optimal transfers must therefore sum to $T^*(W)$, and therefore satisfy

$$
\tau_g^* = T^*(W) - \tau_b^*.
$$

(19)

In order to pin down the optimal composition of this total, suppose that the family marries a groom with earnings of $w$. Then, according to matching return function (15), we must have

$$
w = w_0 + \frac{1}{\alpha \beta} \cdot (q(\tau^*_b, \tau^*_g) - q_0),
$$

which, once re-arranged, is:

$$
\tau^*_g = \frac{A(w)}{1 + \alpha (1 - \beta)} - \frac{\alpha (1 - \beta)}{1 + \alpha (1 - \beta)} \cdot \tau^*_b,
$$

(20)

where $A(w) \equiv \alpha \beta \cdot [w - w_0] + q_0$.

The conditions (19) and (20) are depicted in Figure 1. The steeper of the lines (line (1)) represents (19), whereas the flatter line (line (2)) represents (20). Higher values of $w$ increases $A(w)$, which shifts the flatter line up as indicated, and the equilibrium transfers shift from $\tau^*_0$ to $\tau^*_1$.

![Figure 1: Equilibrium Transfers](image)

The equilibrium is not completely described yet because we have to determine $q_0$. This value is set so that the marginal family that participates in marriage is the one that ensures equal measures participate on both sides. Before this is done, we note that $q_0$ is independent of $w$ which implies that, for any $q_0$ we have the following.

**Result 1.** In order to marry a male with higher earnings, the bridal family offers a greater $\tau^*_g$, a lower $\tau^*_b$, but no change in the total transfer, $\tau^*_g + \tau^*_b$.

As argued previously, the modernization process involves an increase in the earnings of some males (greater heterogeneity). In order for these males to be married, it becomes necessary for some bridal families to offer them greater property rights. In this way, the dowry
transformation is seen as an equilibrium response of the marriage market to the emergence of some wealthy males.

To complete the description of equilibrium, being by noting that the payoff to an unmarried female family is

$$U_f^u(W) = \max_{\tau_b} [u(W - \tau_b) + v(\tilde{w} + \tau_b)],$$  \hspace{1cm} \text{(21)}$$

whereas for a given $q_0$, the payoff from marriage is

$$U_f^f(W \mid q_0) = u(W - T^*(W)) + v(\alpha \cdot \beta \cdot w_0 - q_0 + (1 + \alpha \cdot \beta) \cdot \tilde{w} + (1 + \alpha) \cdot T^*(W)).$$ \hspace{1cm} \text{(22)}$$

**Lemma 1.** Both $U_f^u$ and $U_f^f$ are strictly increasing functions, with

$$\frac{\partial U_f^u}{\partial W} < \frac{\partial U_f^f}{\partial W}. \hspace{1cm} \text{(23)}$$

Thus, there exists a strictly decreasing function, $q_0(W)$, that satisfies

$$U_f^u(W) = U_f^f(W \mid q_0(W)), \hspace{1cm} \text{(24)}$$

such that $q_0 = q_0(W')$ implies a bridal family prefers marriage to remaining single if and only if $W \geq W'$.

The essence of the above result is depicted in Figure 2. The payoff to being married decreases $q_0$ increases from $q_0'$ to $q_0''$, and as indicated, this implies that the critical wealth level required for participation increases. Thus, there is a negative relationship between the cutoff wealth level and the ‘cost’ of entering the marriage market, $q_0$.

![Figure 2: Market Clearing](image)

If we let $W_0$ be the $N^{th}$ ranked wealth among female families, then the equilibrium value of $q_0$ is simply $q_0(W_0)$. By construction, all female families with a wealth greater than $W_0$ prefer
marriage and those with wealth less than $W_0$ prefer to remain single. Those with a wealth equal to $W_0$ are indifferent. Since $W_0$ is chosen to be the $N^{th}$ ranked wealth, we can be sure that the measure of female families choosing to participate equals the measure of male families choosing to participate.

### 3.3 An Explicit Solution

We can explicitly calculate $q_0^*$ in the case where $v$ is linear. Let $\tau_u(W)$ solve the problem faced by unmarried female families, and let

$$\Delta_0 \equiv \{u(W_0 - T^*(W_0)) + (1 + \alpha) \cdot T^*(W_0)\} - \{u(W_0 - \tau_u(W_0)) + \tau_u(W_0)\}.$$  \hspace{1cm} (25)

To interpret $\Delta_0$, consider an unmarried female family that is deciding how much to transfer to their daughter. Clearly, if this transfer attracted a positive return - i.e. if a female receives $(1 + \alpha) \cdot T$ for a given transfer $T$, where $\alpha > 0$ - then the family will be better off relative to the case in which $\alpha = 0$. The value of $\Delta_0$ is precisely this difference.

Given $\Delta_0$, and using (22), we have:

$$q_0^* = \alpha \cdot \beta \cdot [w_0 + \tilde{w}] + \Delta_0.$$  \hspace{1cm} (26)

That is, in order to make the marginal bridal family indifferent to participation they need to offer a quality that offsets the total gains from marriage. This includes a share of the additional resources available in marriage plus the additional payoff arising from the fact that transfers to daughters are more productive in marriage.

This can then be substituted into the expression for $A(w)$ to get:

$$A(w) = \alpha \cdot \beta \cdot [w + \tilde{w}] + \Delta_0.$$  \hspace{1cm} (27)

Furthermore, $T^*(W)$ (and therefore $\Delta_0$) are both unaffected by $\tilde{w}$ and $\beta$ when $v$ is linear.

**Proposition 1.** Suppose $v$ is linear. If a bride from a family with a wealth of $W$ marries a groom with earnings of $w$, then the equilibrium bridal transfer bundle $(\tau_g^*, \tau_b^*)$ is the unique solution to the following linear system:

$$\tau_g^* = \tau_b^*(W) - \tau_b^*$$  \hspace{1cm} (28)

$$\tau_g^* = \frac{A(w)}{1 + \alpha \cdot (1 - \beta)} - \frac{\alpha \cdot (1 - \beta)}{1 + \alpha \cdot (1 - \beta)} \cdot \tau_b^*$$  \hspace{1cm} (29)

where $A(w)$ is given by (27) and $\Delta_0$ is given by (25).

From here, a number of results emerge in addition to the previous result that a higher $w$ corresponds to a reallocation of a fixed total bridal transfer toward the groom and away from the bride.

**Corollary 1.** Equilibrium transfers are independent of $w_0$.

The reason is that if the lowest earning males began to earn more then the married female with the lowest payoff would be doing strictly better than the unmarried female with the highest payoff. To restore equilibrium, the price of entry to the marriage market, $q_0^*$, must increase.
to offset this. Therefore, property rights over marital transfers shift toward grooms as the earnings of all males are increased during the development process.

**Corollary 2.** An increase in female earnings, \( \bar{w} \), induces a reallocation of property rights toward the groom and away from the bride.

Since \( \bar{w} \) has the same effect on \( A \) as does \( w \), the geometric demonstration of this result is essentially that depicted in Figure 1. This result is somewhat counterintuitive if we think that higher bride earnings acts as a component of compensation to grooms, thereby making brides more attractive and shifting power and associated property rights toward the bride. The intuition is that higher female earnings raises the cost of entering the matching market since such earnings are more valuable to married females than to unmarried females. In order to clear the marriage market, a larger quality must be offered - thus the reallocation of property rights to the groom. This result indicates that the shift in property rights toward grooms does not depend on male earnings rising relative to female earnings.

**Corollary 3.** An increase in female bargaining power, \( \beta \), induces a reallocation of property rights toward the groom and away from the bride.

One intuition for this is that if female bargaining power increases then grooms have a stronger demand for property rights over transfers (since they anticipate that some of this will be conceded during bargaining). To attract wealthy males, female families find that they need to offer greater property rights to the groom. This result indicates that the shift in property rights toward grooms is only enhanced by the development process if this process is accompanied by an increased status of females.

Geometrically, \( \beta \) only influences the flatter curve. Specifically, an increase in \( \beta \) increases the intercept and flattens the curve. This is depicted in Figure 3.

![Figure 3: The effect of female bargaining power](image-url)

These three Corollaries, along with Result 1, all point to the same general conclusion: economic

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development, to the extent that it raises male and female earnings and strengthens the status of females, provides forces that shift property rights toward the groom.

Finally, a higher bridal family wealth raises total bridal transfers. Furthermore, this total increase is achieved by decrease in transfers to the groom and an increase in transfers to the bride. Thus, such a shift induces a shift in property rights toward to the bride. This is shown in Figure 4.

![Figure 4: The effect of bridal family wealth](image)

3.3.1 Existence

The above constitutes an equilibrium once we verify that the Nash bargaining solution is indeed interior. That is, we need to verify that $\tau_g \geq -w$ and $\tau_b \geq -\tilde{w}$. Solving the linear system gives

\begin{align}
\tau^*_g &= (1 + \alpha \cdot (1 - \beta)) \cdot \tau^*(W) - A(w) \quad (30) \\
\tau^*_b &= A(w) - \alpha \cdot \beta \cdot \tau^*(W). \quad (31)
\end{align}

For any $(w, W)$ pair, these both hold for sufficiently small $\alpha$.\(^{22}\) Intuitively, in the limit case as $\alpha$ goes to zero (so that there is no benefit to marriage) we have $\tau^*_g = 0$ and $\tau^*_b = \tau_u(W)$. These clearly satisfy the constraints.

**Proposition 2.** Suppose $v$ is linear. If $\alpha$ is sufficiently small that (30) and (31) hold, then an equilibrium exists in which the $N^m$ wealthiest brides and all males participate in the marriage market. Any one-to-one assignment of males to such females is supported in equilibrium, and the associated transfers are those given in Proposition 1.

As a side note, it is not the case that an equilibrium does not exist if these constraints are violated for some $(w, W)$ pair. In such a case, such a pair will not match. That is, an equilibrium

\(^{22}\)Note that $\lim_{\alpha \to 0} \Delta_0 = -\tilde{w}$. 

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with the same marriage market return function and actions may exist but with some restrictions placed on matching patterns. If the constraints do not hold for any \((w, W)\) pair, then the equilibrium as described will need to be adjusted to reflect the fact that competition will once again unfold via total investment - thereby reinstating positive assortative matching.

### 4 Further Results and Extensions

This section explores some further implications of the above analysis, focusing on the more ‘theoretical’ issues of equilibrium matching patterns, efficiency, and pre-marital investment.

#### 4.1 Equilibrium Matching Patterns: The non-robustness of positive assortative matching

As alluded to in Proposition 2, the equilibrium matching pattern is neither completely random nor positive assortative.\(^{23}\) 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’).

This departure from perfect positive assortative matching indicates one way in which an explicit consideration of property rights alters central predictions of how marriage markets work. Studies that skirt the issue of property rights by assuming that individuals consume according to an exogenous function of total marital resources (such as Peters and Siow (2002)) predict positive assortative matching in the marriage market. The reason is intuitive - since males consume according to a fixed (increasing) function of the bridal transfer, the only way to raise the attractiveness of a bride is to offer a greater total transfer. The marginal cost of making transfers is lower for wealthier bridal families (since their marginal utility of income is lower), and therefore wealthier brides will always ‘outbid’ poorer brides when competing for a given groom. As such, the wealthiest brides end up married to the most desirable (i.e. wealthiest) grooms.

The model introduced above recognizes that a bride need not offer greater resources in order to become more attractive in the marriage market: this can also be achieved by offering greater property rights over existing resources. The importance of the property rights dimension is underlined by the fact that, in equilibrium, brides make the same total transfer regardless of which groom they marry and therefore effectively compete for grooms purely on the basis of property rights.

#### 4.2 Efficiency

There are two aspects to efficiency. First, given a particular matching pattern, are transfers Pareto efficient? Second, given transfers, are marriages formed optimally?

\(^{23}\) Positive assortative matching just means that the wealthiest females marry the grooms with the highest earnings.
4.2.1 Efficient Transfers

Transfers are Pareto efficient if they solve:

\[
\max_{c^f, c^m, \tau_b, \tau_g} u(W - \tau_b - \tau_g) + v(c^f),
\]

subject to \(v(c^m) \geq \bar{v}\) and \(c^m \leq (1 + \alpha) \cdot [w + \bar{w} + \tau_g + \tau_b]\).

**Proposition 3.** Equilibrium marital transfers are Pareto efficient.

To see this, note that the Lagrangian can be written

\[
\mathcal{L} = u(W - \tau_b - \tau_g) + v(c^f) + \lambda \cdot [v(c^m) - \bar{v}] + \mu \cdot [(1 + \alpha) \cdot [w + \bar{w} + \tau_g + \tau_b] - c^f - c^m].
\]

Combining the first-order conditions for optimal \(\tau_b, \tau_g,\) and \(c^f\) reveals that a necessary and sufficient condition for Pareto efficiency, conditional on \(c^f\), is

\[
u'(W - \tau^*_b) = (1 + \alpha) \cdot v'(c^f).
\]

This holds in equilibrium at the equilibrium value of \(c^f\) - thus marital transfers are Pareto efficient *despite* the existence of ex-post bargaining.

4.2.2 Optimal Matching

The second aspect to efficiency is whether the equilibrium matching pattern is optimal. Here we think of the match surplus function as

\[
s(W, w) = u(W - \tau^*(W)) + v(c^f) + v(c^m).
\]

As is well-known, the optimal matching depends on the sign of \(s_{Ww}\). If it is positive, then positive assortative matching is optimal. If negative, then negative assortative matching is optimal. If it is zero, then any matching is optimal.

The sign of \(s_{Ww}\) is never positive; if \(v\) is linear it is zero and if \(v\) is strictly concave then it is negative. Since matching patterns are indeterminate in equilibrium, *matching is guaranteed to be efficient only in the case in which \(v\) is linear.* The linear case provides an interesting benchmark, since the strong efficiency result disappears when we consider premarital investment.

4.3 Premarital Investment

Suppose that there is no way to protect the bride’s property rights over transfers once they enter the groom’s household. Transfers can still be made in this setting via parental investment in the daughter’s human capital. For instance, we can think of \(\bar{w}\) as being endogenously determined by investments made by the bridal family prior to entering the marriage market.

Specifically, suppose that an investment of \(z \cdot \tau_b\) leads to bridal earnings of \(\bar{w} + \tau_b\). The parameter \(z\) captures the efficiency of human capital investments, where we assume that \(z\) is not too far from unity:

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

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Notice that \( z < 1 < \zeta \), and that \( z = 1 \) is equivalent to the analysis above. In this case, there is no efficiency advantage to making transfers in the form of investments or pure wealth transfers, and all the above results remain. However, if \( z < 1 \) then it is efficient to make transfers only in the form of human capital investments. Similarly, if \( z > 1 \) then it is efficient to make pure wealth transfers only. However, there are strategic disadvantages from making pure wealth transfers (the bride will be unable to acquire much consumption from this total), and from making pure human capital transfers (the bride will appear unattractive on the marriage market, only being able to attract a husband with low earnings). Thus, there is no reason to suspect that the efficiency results from the linear case will follow through here. To explore this, consider the first-order conditions:

\[
\begin{align*}
u' (W - z \cdot \tau_b^* - \tau_g^*) &= \nu'(c'(\tau_g^*, z \cdot \tau_b^*)) \cdot [a \cdot \beta \cdot (1 + m'(\cdot) \cdot (1 + \alpha \cdot (1 - \beta)))] \tag{37} \\
u' (W - z \cdot \tau_b^* - \tau_g^*) \cdot z &= \nu'(c'(\tau_g^*, \tau_b^*)) \cdot [(1 + \alpha \cdot \beta) + a \cdot \beta \cdot m'(\cdot) \cdot (1 - \beta)]. \tag{38}
\end{align*}
\]

This leads us to conclude that

\[
m'(q) = \frac{1 + (1 - z) \cdot \alpha \cdot \beta}{\alpha \cdot \beta \cdot [z + \alpha \cdot (1 - \beta) \cdot (z - 1)]}. \tag{39}
\]

The assumption on the range of \( z \) ensures that this is positive.

Consider the case where \( v \) is linear. If \( z < 1 \), then it is efficient for all the transfers to be made via parental investment. If \( z > 1 \), then it is efficient for all transfers to be made via direct wealth transfers.

**Proposition 4.** Let \( v \) be linear. The total transfer (direct transfers plus pre-marital investment) is too large when \( z > 1 \) and too little when \( z < 1 \).

To see this, note that when \( z < 1 \), the optimal parental investment satisfies

\[
u' (W - z \cdot \tau_b^*) \cdot z = 1 + \alpha. \tag{40}\]

If \( z > 1 \) then the optimal direct wealth transfer satisfies

\[
u' (W - \tau_g^*) = 1 + \alpha. \tag{41}\]

Let \( \tau^{**} = \tau_g^{**} + z \cdot \tau_b^{**} \) so that we can say the efficient \( \tau^{**} \) satisfies

\[
u' (W - \tau^{**}) = \frac{1 + \alpha}{\min[1, z]}. \tag{42}\]

From the first-order conditions and \( m'(q) \) we have

\[
u' (W - \tau) = \alpha \cdot \beta + (1 + \alpha \cdot (1 - \beta)) \cdot \frac{1 + (1 - z) \cdot \alpha \cdot \beta}{z + \alpha \cdot (1 - \beta) \cdot (z - 1)}. \tag{43}\]

The right side is a strictly decreasing function of \( z \) that equals \( 1 + \alpha \) at \( z = 1 \). If \( z > 1 \) then the right side is less than \( 1 + \alpha \), whereas the efficient investment requires

\[
u' (W - \tau^{**}) = \frac{1 + \alpha}{1} = 1 + \alpha. \tag{44}\]
Thus, there is too much investment when \( z > 1 \). Similarly, if \( z < 1 \), then the right side is larger than \( 1 + \alpha \). In this case, the optimal investment satisfies

\[
u'(W - \tau^{**}) = \frac{1 + \alpha}{z} > 1 + \alpha. \tag{45}\]

Thus, there is too little investment if

\[
\frac{1 + \alpha}{z} > \alpha \cdot \beta + (1 + \alpha \cdot (1 - \beta)) \cdot \frac{1 + (1 - z) \cdot \alpha \cdot \beta}{z + \alpha \cdot (1 - \beta) \cdot (z - 1)}, \tag{46}
\]

which holds for all \( z \in (z, 1) \).

Intuitively, the existence of ex-post bargaining provides incentives for bridal families to invest in the human capital of their daughter even when doing so provides a lower social return than a direct transfer. Similarly, the existence of ex-post bargaining provides incentives for bridal families to offer direct transfers to grooms even when doing so provides a lower social return than does human capital investments.

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.
Appendix

References


