The Economics of Consanguineous Marriages

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Abstract

This paper explains consanguineous marriages in developing countries. Consanguinity is related to dowry, both emerging from incomplete marriage contracts. A theoretical model describes families investing in a marriage, but patrilocal residence reduces the bride’s family’s incentive to invest after the marriage is contracted. Dowry transfers control rights from the bride’s family to the groom’s family. With credit constraints, consanguinity is an alternative to costly dowries as commitments for future transfers are then credible. Consequently, compared to bequests, dowries are less likely to be observed in consanguineous unions. Our empirical analysis based on Bangladesh data delivers results consistent with the model.

*JEL Classification Code:* J1, I1, O1

*Keywords:* Marriage, consanguinity, dowry, bequests, credit constraints
1 Introduction

Consanguineous marriage, or marriage between close biological relatives who are not siblings, is a social institution that is, or has been, common throughout human history (Bittles, 1994; Bittles et al., 1993; Hussain and Bittles, 2000).\(^1\) Although in the western world consanguineous marriages constitute less than 1 percent of total marriages, this practice has enjoyed widespread popularity in North Africa, the Middle East and South Asia (Maian and Mushtaq, 1994; Bittles, 2001).\(^2\) In India, consanguineous marriages constitute 16 percent of all marriages, but this varies from 6 percent in the north to 36 percent in the south (IIPS and ORC Macro International, 1995; Banerjee and Roy, 2002). Scientific research in clinical genetics documents a negative effect of inbreeding on the health and mortality of human populations, and the incidence of disorders and disease among the offspring of consanguineous unions (Bittles, 2001). To economists therefore, this contemporary incidence of consanguineous marriage is puzzling.

It is in this setting that this paper makes its contribution: to postulate that consanguinity is a rational response to a marriage market failure, rather than simply a consequence of culture, religion or preferences. The starting point of our analysis are the following two stylized facts commonly observed in large parts of South Asia and elsewhere: first, marriage celebrations are often associated with significant dowries, or transfers of assets from the bride’s family to the groom’s family. Second, enforcement mechanisms for informal contracts are stronger within kinship networks than outside.

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\(^1\) Despite the popularity of consanguinity in Europe, the genetic implications of this practice were often derided in other continents: for example, on 5 March 1810 in a letter to the Governor of New Hampshire John Langdon, Thomas Jefferson wrote, 'The practice of Kings marrying only in the families of Kings, has been that of Europe for some centuries. Now, take any race of animals, confine them in idleness and inaction, whether in a sty, a stable or a state-room, pamper them with high diet, gratify all their sexual appetites, immerse them in sensualities, nourish their passions, let everything bend before them, and banish whatever might lead them to think, and in a few generations they become all body and no mind; and this, too, by a law of nature, by that very law by which we are in the constant practice of changing the characters and propensities of the animals we raise for our own purposes. Such is the regimen in raising Kings, and in this way they have gone on for centuries' (Bergh, 1907). For further information on consanguinity in earlier European generations, see Bittles and Egerbladh (2005).

\(^2\) In Iraq for example, 46.4 percent of marriages are between first or second cousins (Al-Hamamy et al, 1986; Al-Hamamy and Al-Hakkak, 1989; also reported in the New York Times, September 23, 2003).
such networks.

The crux of our model views a marriage as a contract in which two families make a long-term commitment to support their offspring through gifts, bequests and so forth. These also enhance the value of the match, and consequently the social status of each family. This need for joint commitment, however, creates an agency or time-inconsistency problem: once links have formed and are costly to sever, each family may now prefer to invest in alternative opportunities, while free-riding on the other family’s investments. To overcome this time-inconsistency, early transfers between families are viewed as an ex-ante alternative when ex-post investment commitments are not credible. In South Asia, where marriage is characterized by patrilocal exogamy, we postulate the commitment problem to be on the bride’s side so that these early monetary transfers correspond to dowries. To this aspect, we add two extra features. First, the extent to which agents are time-inconsistent depends negatively on how closely related the partners are. Between cousins, ex-ante commitments are more credible arguably because informal contracts are easier to enforce within the extended family. Second, dowries are costly as they imply borrowing on the credit market in order to make payments at the time of marriage. Consequently, our model predicts that consanguinity and dowries substitute as instruments to overcome or mitigate the time-inconsistency problem. Our paper is closely related to the literature on dowry payments (see Anderson, 2007, for a thorough discussion) and on contracting problems in marriage markets (Caldwell, Reddy and Caldwell, 1983; Rao, 1993; Bloch and Rao, 2002; Jacoby and Mansuri, 2006; Botticini and Siow, 2003).

In addition, we emphasize that providing dowries is generally expensive.\(^3\) If parents are unable to afford the cost, their only options may be to either delay their daughter’s marriage (Anderson, 2008; Epstein, 1973:193), or else consider contracting a marriage with a relative with either reduced or non-obligatory dowry payments. Our model shows that it is this function — the alternative to high dowry payments in the presence of an agency problem— that plays a key role in motivating consanguinity in many parts of the world. Economic studies such as Becker (1981), for

\(^3\)Bloch and Rao (2002) provide evidence that in South Asia, the average dowry is six-times a family’s annual income. Anderson (2003) confirms this finding and also provides evidence that dowry payments are rapidly escalating in this area.
example, view these transfers as ex-ante compensations for ex-post loss of bargaining power. Building on this theory, Zhang and Chan (1999) argue that dowries have the exclusive property of increasing a wife’s bargaining power by raising her threat point. This view, however, does not explain why such transfers should be taking place at the time of marriage, rather than later on during married life, and most importantly does not deliver predictions concerning observed patterns of consanguineous marriages. Our paper shares with Peters and Siow (2002) the property that an increase in spousal investment commitment increases the quality of the match. In depicting a negative correlation between consanguinity and the payment of a dowry at the time of marriage, our findings are entirely consistent with earlier observations made by sociologists and demographers (Centerwall and Centerwall 1966; Reddy 1993). Thus, it is pertinent to note that our model does not provide a theory of dowry per se nor does it attempt concretely to predict dowry amounts. Rather, it links dowries, bequests and consanguinity in a theory of the optimal timing of marital transfers.

Our data tests the central idea that consanguinity may be an inexpensive way for families to deal with the problem of dowry costs in rural marriage markets. We use data on 4,364 households from the 1996 Matlab Health and Socioeconomic Survey, conducted in 141 villages in Bangladesh. We find that women in consanguineous unions are, on average, 6-7 percent less likely to bring a dowry at marriage, after controlling for other attributes at the time of marriage, suggesting that consanguinity and dowry are substitutes. We also find that women marrying their cousins are on average 4 percent more likely to receive any form of inheritances. The negative relationship between dowry and consanguinity on the one hand, and the positive relationship between bequests and consanguinity on the other, for us is strong evidence in favor of consanguinity affecting the timing of marital transfers. In further analysis, we examine the determinants of consanguineous marriages and the role of socio-economic status. Regression results are not inconsistent with the hypothesis that more stringent credit constraints will lead to lower dowry payments and the higher prevalence of consanguinity.

We review important facts and findings related to consanguinity in Section 2. In Section 3, we carefully present and solve our model, and also discuss alternative
economic and sociological explanations of consanguinity. Section 4 uses data from Bangladesh to test the main predictions of the theory. Section 5 concludes.

2 Consanguineous Marriages

In the field of clinical genetics, a consanguineous marriage is defined as “a union between a couple related as second cousins or closer, equivalent to a coefficient of inbreeding in their progeny of \( F \geq 0.0156 \)" (Bittles, 2001).\(^4\) This means that children of such marriages are predicted to inherit copies of identical genes from each parent, which are 1.56 percent of all gene loci over and above the baseline level of homozygosity in the population at large; the closer are the parents, the larger is the coefficient of inbreeding. A common concern is that consanguinity leads to higher levels of mortality, morbidity and congenital malformations in offspring due to the greater probability of inheriting a recessive gene (Schull, 1959, and Bittles, 1994). The existing research on consanguinity also shows that different kinds of consanguineous unions are favored by different sub-populations: for example, while Hindu women in South India typically marry their maternal uncles, Muslim populations favor first-cousin marriages (Iyer, 2002).

Historically in Europe, consanguineous marriage was prevalent until the 20th century, and was associated with royalty and land-owning families (Bittles, 1994).\(^5\) During the 19th and 20th centuries, consanguinity was practiced more in the Roman Catholic countries of southern Europe than in their northern European Protestant counterparts (McCollough and O'Rourke, 1986). Since the 16th century in England, marriage between first cousins has been considered legal. But close-kin marriages are not always legally permitted elsewhere. For example, in the United States, different

\(^4\)Genetically, the coefficient of inbreeding is the probability that two homologous alleles in an individual are identical by descent from a recent common ancestor.

\(^5\)Intermarriage among the aristocracy that occurred in Europe in previous centuries was not always in order only to retain land. As Annan (1999) documents carefully in his book on the social history of academic dons in Cambridge, Oxford and elsewhere in the UK, for several centuries, British academia was dominated by a handful of families suggesting that there were levels of intermarriage on an unprecedented scale in order to preserve power and influence on intellectual ideas. As Annan writes, this was responsible for sustaining an ‘intellectual aristocracy’ that gave not only social benefits to its members but power and influence over the history of ideas.
states have rulings on unions between first cousins: in some states such unions are regarded as illegal; others go so far as to consider first-cousin marriage a criminal offence (Ottenheimer, 1996). The overall prevalence of consanguineous marriage, especially in Western European countries like France, Germany, The Netherlands and the UK, is now likely to be of the order of 1-3 percent or more.\textsuperscript{6} Consanguineous marriage is particularly popular in Islamic societies and among the poor and less educated populations in the Middle East and South Asia (Hussain 1999, and Bittles, 2001).

The popularity of consanguineous marriage in some societies may be attributed to religious sanction that is provided to it. In Europe, Protestant denominations permit first-cousin marriage. In contrast, the Roman Catholic Church requires permission from a diocese to allow them. The general consanguinity prescriptions in Islam are similar to those of Judaism. Judaism permits consanguineous marriage in certain situations, such as for example, uncle-niece unions, but the general prescriptions are similar to those of Islam. For understanding consanguinity in Bangladesh (which is focus of Section 3 of this paper), Islam is important. According to the institutional requirements of Islam in the Koran and the Sunnah\textsuperscript{10}, "a Muslim man is prohibited from marrying his mother or grandmother, his daughter or granddaughter, his sister whether full, consanguine or uterine, his niece or great niece, and his aunt or great aunt, paternal or maternal". However, the Sunnah depict that the Prophet Mohammad married his daughter Fatima to Ali, his paternal first cousin; this has led researchers to argue that for Muslims in practice, first-cousin marriage follows the Sunnah (Bittles, 2001, and Hussain, 1999).

In South Asia more generally, consanguineous unions were very common in the past and are common even today (Caldwell et al., 1983, and Bittles et al., 1993). There are also a number of anthropological and biological surveys of consanguinity among selected communities in southern India (Dronamaraju and Khan, 1963, Centerwall and Centerwall, 1966, and Reddy, 1993). The practice also seems to vary by religion. In India, 23.3 percent of all Muslim marriages are consanguineous, compared to 10.6 percent of all Hindu marriages, 10.3 percent of all Christian marriages, and 17.1

\textsuperscript{6}We are grateful to Alan Bittles for these estimates.
percent of all Buddhist marriages (Bittles, 2003).

3 The Economics of Consanguinity

The model we present belongs to the class of “agency models of marriage”. Families are viewed as agents that invest in a joint project, the marriage of their offspring. However, the institution of marriage is characterized by two features: (i) dissolution (divorce) is costly, and (ii) marriage contracts are incomplete. The combination of these two features undermines the credibility of some ex-ante commitments on the part of the families. For example, in Jacoby and Mansuri (2006), the marriage contract is incomplete because the groom cannot commit ex-ante not to be violent towards his wife. Once the marriage takes place, he has incentives to engage in violent behavior to, among other things, extract rents from his in-laws (Bloch and Rao, 2002). The institution of *watta-satta* or exchange marriages then emerges to alleviate this market failure; when grooms cannot commit ex-ante not to be violent vis-à-vis their bride-to-be, marrying the groom’s sister to the bride-to-be’s brother provides a credible retaliation threat that in turn makes the initial non-violence claim incentive-compatible. In the same class of models, Botticini and Siow (2003) argue that in patrilocal societies, daughters cannot commit to manage parental assets with the same care as their male siblings do once they get married. This implies that parental transfers will optimally take the form of dowries for daughters and bequests for sons. Another illustration applies to societies in which women inherit land, as marriages often lead to loss of control over land - i.e. power - by the bride’s family. Thus, it is widely believed that consanguineous marriages among the wealthy are used to keep land and other productive assets within the extended family (Goody, 1986, Agarwal, 1994, Bittles, 2001, *The New York Times*, 23 September 2003).

In our model, altruistic parents make transfers to their children once they are married, and this also enhances the value of the match. At the time of marriage, however, they are unable to contract on such future transfers, and as marriages are costly to dissolve, ex-ante commitments are no longer credible. In a patrilocal society, where a bride migrates to the home of her husband after marriage, the incentive to renege
is likely to be particularly strong for the bride’s parents, since they may prefer to
direct their transfers to co-resident sons. As in Botticini and Siow (2003), dowries (or
bride-prices) then become the second-best solution to this time-inconsistency prob-
lem. Finally, our model also demonstrates that social distance between the families
of the bride and the groom can significantly influence the terms of the marriage con-
tract. On the one hand, we assume that ceteris paribus social distance enhances the
outcomes of marriage: families can diversify genes, hedge risks, smooth consumption
or simply integrate their social networks (Rosenzweig and Stark, 1989; La Ferrara,
2003). On the other hand, shorter social distance acts as social capital by making
ex-ante contracting between families easier: close relatives have more (verifiable) in-
formation about each other, are more likely to exert effort in economic activities, are
less likely to engage in opportunistic behavior and are likely to show higher levels
of trust, cooperation and altruism to both their natal and marital families (Putnam,
2000; Durlauf, 2000; Dasgupta and Serageldin, 2000).

Our model thus delivers prediction on the optimal timing of marital transfers
(dowries versus bequests) rather than on their sizes. Note that our argument is also
couched in terms of a discussion of dowry for the sake of simplicity. We do emphasize,
however, that our model could easily be applied to making predictions about bride-
prices as well. Given that we are primarily modeling marriage markets in South Asia,
however, we make our argument in terms of dowry as the main form of transfer during
marriage. We now proceed to a formal description of the forces at play.

3.1 The Model

Consider a continuum of potential spouses. Grooms and brides are assimilated to
their families and are labeled $i \in I$, and $j \in J$ respectively. Spouse $k \in \{i, j\}$
comes from a family endowed with wealth $w_k$. A pair $(i, j)$ is characterized by social
distance $d_{ij} \in [0, 1]$. To abstract from marriage market squeeze issues (Rao, 1993),
we assume that brides’ and grooms’ families are in equal number and have identical
wealth distributions. The support of the wealth distribution is the interval $(0, w_{\text{max}}]$.
For each individual with wealth $w$, there exists a potential match who is at distance
$d$, for all $d \in [0, 1]$.

The timing of the economy is as follows:

- $T = 0$: Families choose a partner for their offspring by first designating a desired match. Couples $(i, j)$ form when two families have elected each other. A marriage contract is then signed between the respective families. Ex-ante transfers $(D_i, D_j)$ respectively from $i$ to $j$ (bride prices) and $j$ to $i$ (dowries) are made.

- $T = 1$: Ex-post transfers $(z_i, z_j)$ respectively from $i$ to $j$ and $j$ to $i$ are made. Such transfers can for example be wealth transfers during parents' lifetime or bequests. Families invest $(K_i, K_j)$ in the marital production function, output is realized and consumption takes place.

We make the assumptions that (i) marriage is always preferred to remaining single, and (ii) at $T = 1$, separation is too costly to be considered. Before completing the description of the marriage economy, here is the intuition for what will be modeled subsequently. At $T = 1$, once the marriage is celebrated, families hold each other up, and have an incentive to free ride on one's in-laws to contribute to the marital production function. In other words, each family will prefer that the other family divert resources to the married couple, and that they themselves divert their own resources towards more attractive investment or consumption opportunities. Thus, when enforcement is imperfect, it is not credible to pledge future transfers (in the form of wealth support or bequests) at $T = 0$. We therefore perceive dowries and bride prices as $T = 0$ transfers that mitigate the effects of such hold-up problem. Thus, in this model, dowries and bride prices do not capture the entire value of the transaction, but only the fraction to be paid upfront.

**Marital Production Function** We make the simplifying assumption that a marriage is a joint project characterized by a constant-returns-to-scale technology in which both families invest:

$$ R(K|w_i, w_j, d_{ij}) = A(w_i, w_j, d_{ij}) K, $$

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7 Individuals and their families can be thought of as being densely distributed over a cylinder, such that the vertical axis represents individuals' wealth $w$, and the angle between two individuals measures their distance (normalized by $2\pi$). The wealth interval is open on the left. This technical requirement is addressed in the Appendix.
where $K$ is the aggregate amount invested. We assume that the productivity parameter $A(w_i, w_j, d_{ij})$ is continuously differentiable and increasing in $w_i$ and $w_j$ with positive cross-partial derivatives (as in Becker, 1973) and increasing and concave with respect to $d_{ij}$. In addition to monetary transfers, parents transmit social status to their children, share their social networks and political connections, which we assume to have a direct effect on their offspring’s productivity; this effect is captured by the positive dependence of $A(.)$ on parental wealth. Second, $A(.)$ being a function of $d$ is central to our paper, and models the idea that when spouses are further away, they can diversify genes, hedge risks, integrate their social networks, and so forth. Finally, agents have access to a storage technology with returns normalized to 1. This storage technology proxies for all investment or consumption opportunities outside the marital production function.

**Marriage Contracts and the Cost of Equity** A marriage contract specifies an investment commitment $(z_i, z_j)$ and prior transfers $(D_i, D_j)$ between the parents of the bride and groom. When an investment commitment is made, it is binding. However, due to contract incompleteness, parents cannot commit beyond the amount $(1 - d_{ij})w_k$ where we recall that $d_{ij}$ is the social distance between $i$ and $j$. Such an assumption captures the idea that depending upon social distance, wealth in family $j$ can be more difficult to observe for family $i$, and hence more difficult to pledge. When spouses are close ($d_{ij} = 0$), they can commit their entire wealth ex-ante, while when they are very far away ($d_{ij} = 1$), no commitment is credible. Thus, for each couple $(i, j)$, a feasible marriage contract $(z_i, z_j, D_i, D_j)$ must satisfy for $k \in \{i, j\}$,

\[
\begin{align*}
  z_k &\in [0, (1 - d_{ij})w_k] \\
  z_k + D_k &\in [0, w_k]
\end{align*}
\]

We also assume that the payment of dowries is costly. If a positive amount $D$ is transferred by family $k$, $\gamma(w_k)D$ is lost in the transaction. $\gamma(.)$ is a decreasing function of wealth. $\gamma(w)$ can be viewed as the interest rate charged when borrowing money to make a transfer. Richer families can pledge collateral more easily, hence they enjoy lower interest rates. We can think of $(D_i, D_j)$ as mutual gift exchanges or
dowry and bride prices, so consider the net transfer from $j$ to $i$:

$$D_{ij} = D_j [1 - \gamma (w_j)] - D_i [1 - \gamma (w_i)].$$

At the beginning of time $T = 1$, families thus have total wealth equal to $w_k + D_{-k} [1 - \gamma (w_{-k})] - D_k$ that they can choose to either save, or invest in the marital production function.

**Preferences** We implicitly assume some form of altruism on the part of the parents who value their offspring’s marital product. We could also relax that assumption and invoke alternative rationales whereby parents value marital output because higher output implies higher transfers from their children or higher social status. However, we postulate that families do not capture the same share of the marital output. We assume that the output is divided between brides’ and grooms’ families according to exogenous shares $(1 - \alpha, \alpha)$, that are identical for all brides and grooms. Alternatively, the assumption can be interpreted as a divergence between the two families on the perceived value of marriage. Patrilocality or matrilocality are plausible institutional reasons why there might be a divergence between how much brides’ parents and grooms’ parents value marital production output.

In sum, the important reduced-form assumption of this model is (i) parents value marital output, and (ii) brides’ parents and grooms’ parents value such output differently. To a large extent, this assumption is also at the heart of the existence of dowries in Botticini and Siow (2003). We will write $\alpha_i \equiv 1 - \alpha$, and $\alpha_j \equiv \alpha$. For a given match $(i,j)$, transfers $(D_i, D_j)$ are made, and parents choose $T = 1$ investment levels $(K_i, K_j)$ so that the payoffs are given by

$$U_k (K_i, K_j, D_i, D_j) = \alpha_k A (w_i, w_j, d_{ij}) (K_i + K_j) - K_k + \{w_k + D_{-k} [1 - \gamma (w_{-k})] - D_k\},$$

where $k \in \{i, j\}$ and $-k$ denotes $k$’s spouse. Families’ utilities are linear in wealth.

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8In Botticini and Siow (2003) however the divergence is between the bride’s parents and their daughter (in the form of cost of effort). Viewed from that perspective, our model stipulates an agency problem between the two families without specifying whether it is between parents on both sides, or between parents and children.
Each family $k$ captures a share $\alpha_k$ of the marital output, while enjoying their endowment $w_k$ net of investment $K_k$ and transfers (received and made). Besides, we assume that

$$A(0,0,0)[1-\gamma(0)] > 1,$$  

(2)
a sufficient condition for investment in the marital production function to be socially optimal.

### 3.2 Optimal and Constrained-Optimal Marriage Outcomes

In our economy, there is a potential divergence of preferences between the two families after the marriage is contracted: each family has the incentive to divert their own resources elsewhere and rely on their child’s in-laws to make transfers instead. Contract incompleteness prevents the Coase theorem from holding. We therefore describe the first-best outcome of the economy. Then, we let agents invest according to their preferences at time $T = 1$ and discuss the optimal matching profile with associated marriage contracts.

**Optimal marriage outcome** The first-best outcome maximizes aggregate payoffs of all the families. On the intensive margin, as $T = 0$ transfers are costly, $D_i^* = D_j^* = 0$ and (2) implies that $K_k^* = w_k$ for every $k \in I \cup J$, so that $K_{ij}^* = w_i + w_j$. Any match $(i,j)$ is therefore characterized by aggregate payoffs

$$U_i^* (w_i, w_j, d_{ij}) + U_j^* (w_i, w_j, d_{ij}) = A(w_i, w_j, d_{ij}) (w_i + w_j).$$

Individuals invest their entire endowment in the marital production function. Turning to the extensive margin, strategic complementarity implies that assortative mating is the first-best outcome. Every “first-best” couple $(i,j)$ is characterized by $w_i = w_j$ and $d_{ij}^* = 1$.

**Constrained-optimal marriage outcome** We now restrict to outcomes for which investments are $T = 1$ incentive compatible. To characterize the constrained-first-best outcome, we solve the game backward. We look at parental behavior at $T = 1$, once
couples have formed and signed a feasible marriage contract of the form \((z_i, z_j, D_i, D_j)\). Parents invest an amount \(K\) so as to maximize their reduced form payoff

\[
V_k(K) = \alpha_k A(w_i, w_j, d_{ij}) (K + K_k) - K
\]

subject to

\[
z_k \leq K \leq w_k - D_k + D_{-k} \left[ 1 - \gamma (w_{-k}) \right]
\]

The second constraint is the budget requirement: agents can invest their endowment net of transfers made or received. The first constraint indicates that parental transfers need to be at least as large as the committed amount \(z\), determined at signature of the marriage contract. For \(k = i, j\), full investment will take place if and only if

\[
\alpha_k A(w_i, w_j, d_{ij}) \geq 1
\]

otherwise families will invest the minimum committed amount \(K_k^{**} = z_k\). Thus, depending on the values of \(\alpha\), we potentially have the following cases:

- case I: the marital production function is attractive enough for both families to be willing to invest their entire wealth.
- case II: the groom’s family invests all the endowment net of transfers received and made, while the bride’s family is not willing to go beyond the pre-committed amount.
- case III: the reverse holds
- case IV: neither of the two families has any incentive to invest in the marital production function, so that investments are strictly equal to commitment levels.

The institutional setting we aim at describing is characterized by patrilocal virilocality, wherein brides live with, or close to, the family of their husbands after marriage. Therefore, brides’ parents might not value or perceive marital output as much as the in-laws of their daughter. They may have a strong incentive to divert resources from their married daughters to their co-resident married sons. Presumably, this is because
they have more control over the transfers to their co-resident sons and reap greater returns from these transfers. In terms of parameters of our model, this translates in relatively lower values of $\alpha$. The specific institution of dowry will emerge when we assume that $\alpha$ is low enough, corresponding to case II.\footnote{Namely, $(1 - \alpha)A(0, 0, 0) \geq 1$ and $\alpha A(w_{\text{max}}, w_{\text{max}}, 1) \leq 1$.}

The optimal marriage contract thus consists of maximizing total investment by spouses. This implies that $D_i^{**} = 0, D_j^{**} = d_{ij}w_j$ and $z_j^{**} = (1 - d_{ij})w_j$. Under such an arrangement, a net dowry $D_{ij} = d_{ij}w_j [1 - \gamma(w_j)]$ is transferred from the bride’s family to the groom’s family so that parental aggregate payoffs are given by

$$U_i^{**}(w_i, w_j, d_{ij}) + U_j^{**}(w_i, w_j, d_{ij}) = A(w_i, w_j, d_{ij}) [w_i + w_j - \gamma(w_j)d_{ij}w_j].$$

Constrained-optimal investment levels are characterized by full-investment in the marital production function, but as opposed to the first-best solution, transfer costs are lost when the dowry is paid to the groom’s family. As $\gamma(\cdot)$ is a decreasing function of wealth, assortative matching is still optimal. The institution of dowry is then seen as an instrument to overcome the limited commitment ability of families. However, as social distance now determines dowry amounts, the constrained-first-best is characterized by an optimal distance $d(w)$ such that for each couple $(i, j)$ with wealth levels $w_i = w_j = w$, we have,

$$d(w) \in \arg \max_{d \in [0, 1]} A(w, w, d) [2w - \gamma(w) dw].$$

The first-order condition for an interior solution gives

$$\frac{\partial A(w, w, d)}{\partial d}[2 - \gamma(w)d(w)] = \gamma(w) A(w, w, d),$$

which is necessary and sufficient as the reduced-form payoff function is concave in $d$.

### 3.3 Time-Inconsistency and the Rationale for Dowries

The outcomes described previously were essentially normative and serve as benchmarks for further discussion. We now turn to the equilibrium analysis of the mar-
riage market. We will show that there exists one equilibrium of the marriage market which is \textit{as if} each spouse $k$ faced a matching function $W_k(x)$ where $W_k(x)$ is the marriage endowment level of $k$’s spouse, when $k$ credibly contributes a total of $x$ into the relationship. Contribution $x$ is divided between a commitment $z$, and a ex-ante transfer $D$. We will show that such an equilibrium exists, but for now, we assume for simplicity that it does. For both the groom and the bride, the time-inconsistency problem is inherently the same, but it is just not binding for grooms as long as $W_i(.)$ is non-decreasing, which we assume for now, but will prove later on (see Proposition below). We thus pay attention exclusively to the optimization problem on the bride’s side. To better convey our intuition, we further suppose that $W_j(.)$ is differentiable with respect to $x$ and 

\[ 1 - \gamma (w_j) + W_j'(x) \geq 1 \] in the neighborhood of $x_j = w_j$.\footnote{$W_k(.)$ are generally not differentiable, but the proof of the Proposition in the appendix shows that the argument discussed here is still valid.}

At $T = 0$, brides’ families take $W_j(.)$, and grooms’ investment strategies as given, and propose a feasible marriage contract $(z_j, D_j)$ to groom $i$ such that

\[
\{ z_j, D_j \} \in \arg \max_{0 \leq z \leq (1-d_{ij})w_j} \alpha A (W_j(z + D), w_j, d_{ij}) \left[ W_j(z + D) + z + D - \gamma (w_j) D \right] - z - D
\]

At the equilibrium point, i.e. when $W_j(w_j) = w_j$ and social distance $d(w_j)$ is opti-
mally chosen, the first-order conditions for interior solutions can be written as

\[
\alpha A_j \left[ 1 - \gamma (w_j) \right] + \alpha W_j'(w_j) \left\{ A_j \right\} + \left[ 2w_j - \gamma (w_j) D \right] \frac{\partial A_j}{\partial w_i} = 1 \quad (5)
\]

where $A_j \equiv A(w_j, w_j, d(w_j))$ for simplification. The optimal contribution level trades off the opportunity cost of storage (normalized to 1) against the benefits from being matched with a wealthier groom.\footnote{The envelope theorem implies that the effect of changes in the choice of the optimal social distance is of second-order.} The left-hand side of (5) captures such benefit. The first term, $\alpha A_j \left[ 1 - \gamma (w_j) \right]$, is the intensive margin effect, similar to (3) at the difference that there is an extra $\left[ 1 - \gamma (w_j) \right]$ term because the marginal
dollar transferred takes the form of a dowry. The second term, absent from (3), captures the extensive margin effect and the rationale underlying the existence of dowries: an increase in the overall contribution of the bride, allows her to increase the wealth of her match by \( W'_j(w_j) \). The benefit is then direct through an increased investment \( \alpha W'_j(w_j) A_j \) – a “quantity” effect, and indirect through an increased productivity coefficient \( \alpha W'_j(w_j) \frac{\partial A_j}{\partial w_i} \) – a “quality” effect. Under the assumption that \( \alpha [1 - \gamma(w_j) + W'_j(w_j)] \geq 1 \), the solution hits a corner, and brides want to pre-commit \( z_j + D_j = w_j \), so that the investment is constrained-optimal.

Comparing with the \( T = 1 \) problem, we see that the bride’s family would like to commit at \( T = 0 \) an amount that they will however not be willing to disburse at \( T = 1 \). To overcome this time-inconsistency problem, the bride’s family at the time of marriage, transfers control rights of part or all of their assets to the groom’s family, as they cannot commit to make such a transfer after the marriage is celebrated. We therefore view dowries as an ex-ante transfer of control rights when ex-post investment incentives are distorted.

**Proposition:** There exists an equilibrium of the marriage market which is constrained-optimal, and such that off-equilibrium strategies support a reduced-form game in which families maximize payoffs, taking the matching functions \( W_i(.) \) and \( W_j(.) \) described above as given.

Though the matching function \( W_j(.) \) is not generally differentiable in \( w_j \), the Proposition shows that in the general case, any small reduction \( h \) in the aggregate contribution of bride \( j \) decreases the wealth of her match by at least \( \beta h \), where \( \beta \) is a positive constant. The tradeoff captured by (5) hence applies similarly and leads to a corner solution when \( \beta \) is large enough.

### 3.4 Credit Constraints, Wealth and Consanguinity

Another dimension that needs investigation is social distance. The Proposition established that there exists an equilibrium such that the social distance \( d(w) \) between
spouses of wealth \( w \) is given by (4):

\[
\frac{\partial A(w, w, d)}{\partial d} \left[ 2 - \gamma(w) d(w) \right] = \gamma(w) A(w, w, d) + \text{dowry transfer cost} + \text{opportunity cost of investment} + \text{marginal agency cost}.
\]

The left-hand side of (6) measures the marginal cost of consanguinity. By construction, we assumed that marrying close kin would have a direct negative effect on payoffs because families cannot diversify genes thus increasing the risk of congenital diseases, having more limited ability to hedge risks across families (Rosenzweig and Stark, 1989), or for example, by amalgamating their social networks for better access to credit or labor markets (La Ferrara, 2003). The right-hand side of (6) may be termed the agency cost. Wealth is imperfectly observed and thus it translates into an agency problem. Increasing the distance between spouses increases the agency problem, requiring a larger dowry to be paid. This implies a larger dowry transfer cost, therefore cannot be invested and so translates into an opportunity cost of investment.

In summary, we have so far described a marriage market failure for which consanguinity and dowries are two distinct mitigating practices that act as substitutes. Dowries are an ex-ante transfer of control over assets to palliate a lack of ex-post incentives to invest. Consanguinity is a practice that directly reduces the agency problem. In so doing, (6) determines the optimal tradeoff between the two. One immediate implication relates to the prevalence of consanguinity when credit constraints are more stringent. Applying the implicit function theorem to (6) shows that for every wealth level \( w \), the equilibrium distance \( d(w) \) verifies

\[
\text{sgn} \left[ \frac{\partial}{\partial \gamma(w)} d(w) \right] = -\text{sgn} \left[ d(w) \frac{\partial A(w, w, d)}{\partial d} + A(w, w, d) \right] \leq 0.
\]

The intuition underlying (7) is straightforward. When credit constraints are more stringent \textit{ceteris paribus}, dowries are more costly relative to close-kin marriage, so that the equilibrium social distance decreases with the cost of equity.
A second implication of the analysis conducted so far is a comparative statics exercise with respect to wealth. Related to result (7), our model assumes that at low levels of wealth, the dowry transfer cost is large because credit constraints are more stringent, making consanguineous marriage an attractive alternative to dowry payments. However, if we re-examine the right-hand side of (6), the tension between costs and benefits is also driven by the opportunity cost of investment. To see this more formally, and given that the second-order condition holds, we can determine the slope of the correspondence between distance and wealth levels by applying the implicit function theorem to (6):

$$sgn \left[ d'(w) \right] = sgn \left\{ \varepsilon_\gamma (w) \left[ 1 + \varepsilon^d_A(w, d) \right] - \varepsilon^w_A(w, d) \right\}$$

where the elasticities are defined by $$\varepsilon_\gamma (w) \equiv -w^{\gamma'(w)} \gamma'(w)$$, $$\varepsilon^w_A(w, d) \equiv w \left( \sum_{k=i,j} \frac{\partial}{\partial w} A(w, w, d) \right)$$, and $$\varepsilon^d_A(w, d) \equiv d \frac{\partial A(w, w, d)}{\partial (w, w, d)}$$. $$\varepsilon_\gamma(.)$$ captures the aforementioned cost-of-equity effect, while $$\varepsilon_A(w, d)$$ measures the opportunity-cost effect at the equilibrium point.\(^{12}\)

The relative importance of these two effects will shape the behavior of social distance along the wealth dimension. There are two cases of interest. First, when the elasticity $$\varepsilon^w_A(w, d)$$ of the productivity parameter is low enough and is dominated by $$\varepsilon_\gamma (w)$$, then equation (8) predicts that social distance increases with wealth.\(^{13}\) The intuition here has been discussed on several occasions above. When (6) is mostly driven by the dowry transfer cost, poorer people are assumed to face more stringent credit constraints, translating into a larger cost of equity. Thus, poorer families will opt for consanguineous marriages as a viable alternative to dowries. Second, an augmented scenario consists of assuming that the opportunity-cost-of-investment effect binds at higher levels of wealth.\(^{14}\) Then, at low levels of wealth, (8) is mostly

\(^{12}\)To avoid any interference due to the interaction between $$d$$ and $$w$$ through $$A(w, w, d)$$, we assume that $$A(.)$$ is separable in $$d$$ and $$w$$.

\(^{13}\)A sufficient condition is for example $$\varepsilon_\gamma (w) \geq \varepsilon^w_A(w, d)$$ for every $$w$$ and $$d$$.

\(^{14}\)Sufficient conditions could for example be that $$\varepsilon^d_A(.)$$ is bounded, so that there exists $$(m, M)$$ such that for any $$w$$ and $$d$$, $$\varepsilon^d_A(.) \in [m, M]$$, and (i) $$\lim_{w \to - \infty} \frac{\varepsilon^w_A(w, d)}{\varepsilon_\gamma (w)} < m$$, uniformly with respect to $$d$$: the interest rate curve is relatively steeper at low levels of wealth, and (ii) $$\lim_{w \to + \infty} \frac{\varepsilon^w_A(w, d)}{\varepsilon_\gamma (w)} > M$$, uniformly with respect to $$d$$: the productivity curve is relatively steeper at high levels of wealth. Functions $$\gamma (w) = \gamma_0 / w^\gamma$$, with $$\gamma > 0$$, and $$A(w_i, w_j, d) = e^{w_i} + e^{w_j} + d^\theta$$, $$\theta < 1$$, would satisfy such requirements.
driven by $\varepsilon_\gamma$ or cost of equity: poor families face very steep losses when raising cash to pay for the dowry, and thus the gains to marrying close relatives are large. However, when wealth levels increase, $\varepsilon'_w$ eventually dominates: even though the loss from dowry transfers is lower, it translates into large opportunity costs of investment that call for narrower social distance between spouses. Thus, consanguinity might be more prevalent at the two extremes of the wealth distribution suggesting that the relationship between social distance and wealth may be inverted-U shaped.

3.5 Summary of Testable Implications and Alternative Explanations

We have presented and analyzed a general equilibrium model of the marriage market characterized by positive assortative matching. In this market, parents commit wealth, which determines spousal “market value”. However, marriage contracts are incomplete, so that wealth commitments might not be credible. Thus, the institution of dowry emerges as a solution to time-inconsistency: parents pay ex-ante in the form of dowry what they cannot commit to transfer ex-post in the form of gifts, or bequests, etc. Our agency theory delivers predictions not as much on the size of transfers between families, as on the timing of such transfers. Because we stipulate that contract incompleteness is less severe among close-kin, consanguineous marriages are a viable alternative when the payment of dowries comes at a high cost. Thus, our model predicts that dowry and consanguinity are substitutes:

- **PREDICTION 1:** Dowry levels are lower in consanguineous marriages.

  Symmetrically, if ex-ante payments are lower in consanguineous marriages, we should expect larger ex-post transfers.

- **PREDICTION 2:** Bequests or gifts to daughters are larger when they marry close kin.

  How well consanguinity substitutes for dowries in part depends on the cost of dowry transfers. If credit constraints are stringent, then one might expect the consanguinity option to be more attractive.
• **PREDICTION 3:** Consanguinity is more prevalent in environments with more severe credit constraints.

We concluded our analysis with an investigation of the relationship between consanguinity and wealth. At low levels of wealth, credit constraints bind so we should observe higher prevalence of consanguineous marriages. At high levels of wealth, the convexity of the aggregate marital function might induce families to seek consanguineous unions to mitigate the opportunity costs of investments.

• **PREDICTION 4:** At low levels of wealth, consanguineous unions are less prevalent as couples’ wealth increases. This pattern might be reversed at high levels of wealth.

We have argued theoretically that agency-related explanations of consanguinity are crucial in explaining why this phenomenon continues to occur in poor countries. Yet we acknowledge that this explanation might not be the only reason why economists might value understanding and studying consanguinity more, and so we now outline these alternative channels and discuss their empirical implications.

A first explanation for consanguinity is that it is the outcome of personal preference that is mediated by the influence of religion or cultural practice. As discussed in Section 2, much of the literature from sociology and biological anthropology is predicated on this assumption about consanguinity. The argument here is that because consanguinity is a practice that has enjoyed much support historically in certain populations, it continues to be popular among these communities to the present day. The basis for this support for consanguinity is the religious sanction that is provided for it. Yet this explanation does not explain sufficiently why this practice should continue even with changes in religious and cultural practices concerning marriage, or why this practice is unaffected by recent scientific evidence that suggests that undertaking such a marriage can increase the likelihood of congenital birth defects in the children of such unions. Therefore something other than culture is having an appreciable impact in sustaining this phenomenon in present day developing societies.

A second explanation is a natural implication of Rosenzweig and Stark (1989), whereby marriage is driven by an insurance motive. In an incomplete marriage market
setting, kinship might offer a larger set of insurance contracts than non-kin marriages. Alternatively, if shocks within the extended family are more likely to be correlated, risk diversification would suggest that more risk-averse households will seek mates at further social distance.

A third explanation for consanguinity is that it may be a favored form of marriage simply because it can significantly reduce the costs of searching for a suitable partner. The central idea here is that since the bride and groom are generally known to each other prior to marriage, consanguineous marriages do not require families to screen each other, or perform any sort of ‘due diligence’ on each other’s socio-economic status, kinship networks and reputation in the community. In many rural societies, this process can take considerable time as well as resources (Sander, 1995). Moreover, parents in consanguineous unions know their future selves-in-law and their families, reducing the uncertainty about the compatibility of spouses and families.

These alternative stories have some appeal in explaining the prevalence of consanguinity, but are mute on the interaction between consanguinity, bequests and dowries altogether. More specifically, one would expect that these models would predict that a positive (or negative) relationship between consanguinity and dowries should also predict a positive (or negative) relationship between consanguinity and bequests. These are the predictions that contrast with Predictions 1 and 2 taken together that emphasize that dowries and bequests are optimally-timed transfers: a negative relationship between consanguinity and dowries is associated with a positive relationship between consanguinity and bequests.

We now move to the empirical section to test the predictions of our model, and discuss whether the alternative mechanisms presented above can be ruled out.

4 Empirical Evidence from Bangladesh

We use cross-sectional data from rural Bangladesh for our empirical analysis. It is important to note that the central goal of our analysis is to highlight key correlations between variables that are emphasized by the model, rather than to identify clear causal connections.
The data are drawn from the 1996 Matlab Health and Socioeconomic Survey (MHSS).\footnote{This survey is a collaborative effort of RAND, the Harvard School of Public Health, the University of Pennsylvania, the University of Colorado at Boulder, Brown University, Mitra and Associates and the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).} We also supplement these data with that on climate data on annual rainfall levels in the Matlab area for the period 1950-1996.\footnote{The “University of Delaware Air and Temperature Precipitation Data” are provided by the NOAA-CIRES Climate Diagnostics Center, Boulder, Colorado, USA, from their Web site at http://www.cdc.noaa.gov/.} The 1996 MHSS contains information on 4,364 households clustered in 2,687 baris in 141 villages.\footnote{The bari is the basic unit of social organization in Matlab (Fauveau, 1994). Bari literally means “homestead”, but commonly refers to a cluster of households in close physical proximity. The households are generally located around a common yard and may share resources such as a tube-well, a cowshed, latrine, and/or several jointly owned trees.} Matlab is an Upazila (subdistrict) of Chandpur district, which is about 50 miles South of Dhaka, the capital of Bangladesh. 85 percent or more of the people in Matlab are Muslims and remainders are Hindus. Although it is geographically close to Dhaka, the area has been relatively isolated and inaccessible to communication and transportation. The society is predominantly an agricultural society, although 30 percent of the population reports being landless. Despite a growing emphasis on education and increasing contact with urban areas, the society remains relatively traditional and religiously conservative (Fauveau, 1994).

For the purpose of understanding the incidence of consanguineous marriage in the MHSS data, we rely on the section of the survey that asked men and women retrospective information about their marriage histories. The complete sample includes 5083 married men, and 6068 married women at the time of the survey. Information on first marriages was considered.\footnote{There were 15 percent of men and about 7 percent of women reported that they have had more than one marriage. This difference is driven by the fact that while divorced and widowed men typically remarry, most women in these same circumstances do not (Joshi, 2004).} For the purpose of our empirical tests however, we restrict our attention to a sub-sample of 4087 married women and 3358 married men who provided complete information on age and education, marriage (including age at marriage, relationships to their spouses, and payments of dowry), parental characteristics, parental assets, inheritances and inherited assets, numbers of brothers and sisters (as well as their ages). Descriptive summary statistics of the variables of interest for our subsample are provided in Table 1. A quick glance at the table does not...
reveal systematic differences in characteristics between the male and female samples. Admittedly, when looking at individual characteristics, males are more educated, and, by construction of the data set, are older.

Of all the female respondents in our sample, 10 percent married a first-cousin, 8 percent had married a relative other than a first-cousin and 14 percent had married a non-relative in the same village. It is interesting that 36 percent of women and only 18 percent of men report the payment of a dowry at the time of marriage. We believe the difference is in psychological biases in the interpretation of gifts and transfers as “dowries” between the giver (the bride) and the receiver (the groom): since women want their dowries to improve their status and acceptance in their new home, they will have a tendency to interpret all gifts given at marriage as dowry. Men on the other hand, do not want to interpret all gifts as dowry, since doing so would reduce their bargaining position with the new bride. For the remainder of this paper, we use the female sample to carry out our analysis, and thus include in our definition of the dowry, all transfers that were paid at the time of marriage.\textsuperscript{19}

\section*{4.1 Consanguinity and Dowries}

A first test of the theoretical model involves examining the simple correlations between the payment of dowries and first-cousin marriages (Prediction 1). We look at the conditional correlation between dowry payment and consanguinity by correlating the dummy variable \textit{Dowry} with the various measures of consanguinity that were considered previously and condition on age, education, and socioeconomic status at the time of marriage. We also condition on bari, year-of-marriage fixed effects and deviations of rainfall from average values when the woman was of marriageable age.\textsuperscript{20,21}

\begin{flushright}
\textsuperscript{19}The dowry question was asked in two ways: respondents were asked whether or not they paid a dowry at the time of marriage (this is a binary variable) and whether this took the form of bride-wealth or gifts and transfers to the woman’s in-laws. Respondents were also asked to provide an estimate of the dowry’s value. In the analysis ahead, we use both the binary indicator as the logarithm of the dowry values. In constructing the series of the logarithm of the dowry value, we assign a value of 1 taka in cases where no dowry transfer is reported.
\textsuperscript{20}Since age at marriage and year of marriage are often not remembered with great precision, we define fixed-effects over 5 year windows.
\textsuperscript{21}In order to control for local marriage market conditions (e.g. market squeeze) that might affect the marriage market independently of the mechanism we are investigating.
\end{flushright}
The results are presented in the first three columns of Table 2. They indicate that compared to women who marry non-relatives, women who marry their first-cousins are 5.1 percentage points less likely to bring a dowry, and this effect is robust to controlling for individual characteristics (age, years of schooling, religion and birth order), family characteristics (mother and father were alive at the time of marriage, number of brothers and sisters at the time of marriage and father’s landholdings), and rainfall at the time that a woman was of marriageable age. Considering that in this population, about 35 percent of all women report the payment of a dowry at the time of marriage, this is a substantial and important difference. The results are similar at 4.3 percentage points if we expand the definition of consanguinity to include marriages between second-cousin and other types of marriages between relatives. Marriage to other kin as well as marriages to non-kin within a village are also associated with a 3.5 percentage point lower likelihood of dowry payment. The relationship between dowry and social distance is strongest in the case of cousins. This is consistent with our theory: dowries are predicted to become more likely as social distance between the families of a bride and groom increases.

In an additional test, we use the logarithm of the dowry values as a dependent variable and obtain similar results for marriages at different social distances (Table 2, columns 4-6). After controlling for individual, household characteristics and year of marriage fixed-effects, the results show 7.6, 10.5 and 7.5 percent lower dowry values when the two spouses are first cousins, relative other than first cousins and non-relative in the same village, respectively.

The relationship between dowry and consanguinity over time can be observed in Figure 1. Dowries in Matlab have been increasing, while the practice of first-cousin consanguineous marriages has been falling. Our model tells a story consistent with the observed trends: in a setting where improvements in transportation and communication allow individuals to search over greater geographic distances for matches at

\(^{22}\)We include the rainfall variable to control for the shocks to household savings at the time when they are most likely to affect a girl’s dowry, i.e. when she is of marriageable age. Even though the whole region remains at risk of flooding each year, the actual patterns of rainfall can be heterogeneous and some villages get more flooded than others, with greater damage to movable as well as immovable property that may impact the demand as well as supply of dowries. This heterogeneity is not completely absorbed by year-of-marriage or village fixed effects.
larger social distances, the problem of ex-ante commitment becomes greater, calling for the payment of higher levels of dowry in marriages between individuals who are outside the family network.

4.2 Consanguinity and Bequests

At the heart of our model, there is an intertemporal shift of transfers: what cannot be committed to be paid ex-post (in the form of gifts and bequests) will be transferred ex-ante (in the form of dowries). Thus, the model predicts higher bequests to women in consanguineous unions (Prediction 2). To test this prediction, we examine the relationship between inheritance and social distance within marriages. Though we are mainly interested in the correlation between these variables, we explore the correlations in a series of regressions. We define inheritance as a binary variable that takes value 1 if the respondent reports that she has inherited, or expects to inherit anything from his or her parents. We also define three specific types of inheritance: farmland, homestead land and money. Among our key independent variables, we then consider three mutually exclusive forms of marriages in decreasing order of social distance: marriages to first-cousins, marriages to relatives other than first-cousins, and marriages to non-relatives from within the village. Our regressions also employ our standard set of controls for individual, household, family and climate characteristics.

Table 3A (columns 1–4) reports the results of the regressions. The positive and significant estimates for the variable Married a cousin are consistent with Prediction 2: women in consanguineous unions are more likely to receive or expect to receive transfers from their parents. The level of bequests received by women who marry other relatives or non-relatives in the same village is not always statistically significant. This is consistent with the predictions of our theory: the commitment to bequeath their assets to their daughters is likely to be weaker when she marries more distant relatives or non-kin in a village, since the costs or consequences of non-payment are likely to be smaller in such relationships.

When we focus on the male sample (Table 3A, columns 5–8), the coefficients for the variable Married a cousin are negative, although the coefficients are rarely statistically significant (Table 3, columns 5–8). In the case of males, our theory
predicts that no association should be found between inheritance and consanguinity. The negative sign reflects a wealth effect whereby consanguineous marriages are also more likely to be observed among poorer communities (see next section).

In the first four columns of Table 3B, we regress inheritance variables on the dowry variable for the female sample. The relationship between inheritance and dowry is not as clear cut because wealthier families leave large bequests and are more likely to pay larger dowries, everything else remaining constant. The wealth effect suggests a positive correlation between dowries and bequests, while our theory predicts a negative correlation. The net effect is thus uncertain. The results in columns 1 to 4 suggest that women who bring higher levels of dowry into their marital homes do not necessarily receive lower levels of inheritances from their own parents. Columns 5–8 of Table 3B present the results from the sample of adult men. The results indicate that the wealth effect dominates: larger dowries are associated with a higher likelihood of receiving bequests. In a marriage market characterized by positive assortative matching, higher dowries offered by the bride are expected to be matched by higher promises of bequests offered by the groom.

The two results obtained previously — the negative relationship between dowry and consanguinity, and the positive relationship between bequests and consanguinity — together provide strong support for our model. As we have emphasized several times in this paper thus far, the key implication of our model concentrates more on the timing of transfers rather than their overall magnitude. An agency-theory of marriage predicts that the negative relationship between dowry and consanguinity is associated with a positive relationship between bequests and consanguinity.

It is important to note that the two empirical findings presented in this section can provide sufficient ground to rule out alternative models of consanguinity. Recall the two alternative mechanisms we proposed at the end of Section 3: (i) consanguinity may be the outcome of preferences, cultural or religious norms; and (ii) consanguinity may help alleviate the search time and search costs in marriage markets. Both explanations may suggest that a bride’s family may pay higher transfers (in the form of bequests or dowries) to a daughter who marries a cousin, presumably because they value the match more, or pass on the savings from reduced search costs. However, we
could expect the same from the groom’s family, making the total effect ambiguous. But even if the direction of the effect could be resolved, the prediction for consanguinity and transfers would apply to total transfers to the married couple, with no distinction between dowries and bequests. In other words, these two alternative theories could well predict a negative relationship between dowry and consanguinity (Prediction 1), but would then also predict a negative relationship between bequests and consanguinity, which contradicts Prediction 2 and the empirical findings supporting it. In that sense, the joint empirical relevance of Predictions 1 and 2 are a unique feature of agency theories of consanguineous marriages.

4.3 The Determinants of Consanguineous Marriages

Our next step examines the determinants of consanguinity and dowry payment. When marriage takes place at an early age, parents might face steeper cash constraints as they have had less time to accumulate assets.\(^{23}\) In this case, Prediction 3 suggests that a consanguineous union might be chosen instead. To test this hypothesis, we look at the correlation between age of marriage and consanguinity (columns 1-2) and age of marriage and dowry payment (columns 3-4). We find that consanguineous marriages are more likely to be early marriages, while no such association is found with respect to dowry payment. Admittedly, age at marriage, dowry and consanguinity are joint decisions, so that the results need to be interpreted with caution. We attempted also to use the age at menarche as an instrument for the age at marriage (Field and Ambrus, 2008), but the results are not robust, possibly because socio-economic factors that affect nutrition are likely to influence the onset of puberty, or because other things might be happening at the time of menarche (e.g. girls are withdrawn from school by their parents), invalidating the proposed instrumental variable.\(^{24}\) Another source of variation in credit is the number of brothers and sisters alive at the time of marriage: a larger number of sisters (or symmetrically a smaller number of brothers)

\(^{23}\)Note that most marriages in rural Bangladesh are contracted at or shortly after puberty. The timing of marriage is driven by the onset of puberty.

\(^{24}\)We have also considered using rainfall data to construct an instrumental variable (rainfall shocks affecting wealth and credit access), but the lack of significance in the first stage did not allow us to pursue this strategy further. This is probably due to a lack of geographical variation and limited sample size.
would increase the financial burden on the child to be married, so that consanguineous marriage is a more likely option to large dowry payments (Prediction 3). The results presented in Table 4 are consistent with that hypothesis: an additional male sibling at time of marriage is associated with an almost 1 percentage point lower likelihood that a girl marries a first-cousin. The effect is symmetric when we look at dowry payment.

We now turn to the role of wealth in contracting consanguineous marriages. We begin by examining the bivariate relationships between consanguineous marriage, dowry and measures of wealth at the time of marriage. Since MHSS is a cross-sectional survey, information on pre-marital wealth levels is rather limited. Our proxy is simply the value of father’s landholdings. Since land markets in rural South Asia are known to be thin (UNDP, 2000), we rely on measures of current landholdings (or landholdings at the time of father’s death) as a proxy for past landholdings.²⁵

The robustness of these relationships is econometrically explored in Table 4. The results in Table 4 confirm that the incidence of consanguineous marriage decreases with the increase in the value of father’s farmland (the results are statistically significant at the 10 percent level). In other words, consanguineous marriages are more common among poorer (and likely credit-constrained) households (Prediction 3). Panel B estimates the same functional form, with dowry measures on the left-hand side instead. As expected, the coefficients have opposite signs, consistently with the negative association between consanguinity and dowry payments (Prediction 1). The non-monotonic relationship between dowry and assets is weaker, probably due to the wealth effect we mentioned in the previous section, or the need to keep large landholdings within the family.²⁶

Overall, the results of Table 4 suggest that as families get wealthier (starting from an initial condition of low levels of wealth), credit constraints may weaken and the family is able to search for a groom outside the kinship network by providing higher

²⁵As a robustness check, we use additional measures of socio-economic status, such as current household assets and value of agricultural and non-agricultural assets. In most cases, our results are robust to the use of these variables instead of father’s landholdings.

²⁶In results not shown here, we perform an additional robustness check for these results by performing the regression analysis separately for the Muslim sample. The results remain robust, suggesting that the results are not driven by omitted variables pertaining to cultural differences between Hindus and Muslims.
levels of dowries for their daughters. These results are also consistent with the results of Mobarak, Kuhn and Peters (2006), who use a difference-in-differences framework to postulate that the construction of an embankment in Matlab several years prior to the 1996 data created a positive wealth shock for some households, who were then able to pay higher dowries for their daughters and were less likely to enter into consanguineous marriages.

These empirical findings on the relationship between wealth and consanguinity are consistent with the observation cited previously that consanguineous marriages have often been favored by the wealthiest (and also poorest) segments of society. As mentioned in section 3, much research has speculated that consanguineous marriages are favored by wealthy families as a means of keeping assets within a single family, and thus enhancing the power and social status of the family. Our model is also consistent with such patterns under some mild structural assumptions (Prediction 4). In any case, our findings are consistent with the broader class of agency models of marriage, whereby consanguinity offers the social capital necessary to sign contracts that otherwise would not be enforced.

Overall, our empirical analysis confirms the main predictions of our theoretical model, and helps us rule out other plausible mechanisms that have been viewed as central explanations for consanguinity. While we are unable to identify clear causal relationships between variables, we nevertheless believe that the observed correlations lend support to the theory, open up a new set of questions for future research and most of all, highlight the need to gather more data on forms of marriage, marriage transactions, bequests and marriage market considerations. Such decisions have enormous implications on patterns of saving, investment, bequests and transfers between households in developing countries.

5 Conclusion

This paper has argued that consanguinity is a response to a marriage market failure in developing countries. The starting point of our analysis is the recognition that dowries exist across many societies, and that consanguinity is also pervasive across many parts
of the world. We propose a theoretical model of the marriage market to reconcile the existence of these two facts. We argue that these two social practices together address an agency problem between spouses’ families and then provide empirical evidence that does not contradict the central predictions of the model. By focusing on the economic underpinnings of consanguineous marriage, we help explain the seeming puzzle of why consanguineous marriage continues to take place in modern times in developing countries, despite the pervasive knowledge that such marriages may lead to a greater likelihood of congenital birth defects. In so doing, we encourage a reappraisal of marriage markets in such contexts.

6 References


**Appendix**

Before we outline our proofs, we first formally define the game, the strategies and the equilibrium concept. As we require equilibria to be subgame perfect, we only consider
the $T = 0$ reduced-form game, as sub-game strategies have been discussed at length previously.

**Timing and Strategies:** Each family $i$ and $j$ announce a choice $j(i)$ and $i(j)$ respectively, and a couple $(i, j)$ forms when $i = i(j)$ and $j = j(i)$. Each family $k$ proposes a contract profile $\{z_k, D_k\}_{k \in I \cup J}$, where $z_k$ is the amount committed by $k$, and $D_k$ is the transfer made from $k$ to $-k$. By convention, when no offer is made, we write $\{z, D\} = \emptyset$. We furthermore restrict ourselves to feasible contracts defined by (1) only. If an individual fails to find a spouse, his or her payoff is set to $-\infty$. Once marriage is celebrated, transfers $(D_i, D_j)$ take place but spouse $k$ only receives $D_k [1 - \gamma (w_k)]$ as a result of transaction costs. Payoffs for each couple $(i, j)$ are then

\[
U_i (z_i, z_j, D_i, D_j|d_{ij}, w_i, w_j) = \alpha_i A (w_i, w_j, d_{ij}) [w_i + z_j + D_j (1 - \gamma (w_j)) - D_i], \quad (9)
\]

and

\[
U_j (z_i, z_j, D_i, D_j|d_{ij}, w_i, w_j) = \alpha_j A (w_i, w_j, d_{ij}) [w_i + z_j + D_j (1 - \gamma (w_j)) - D_i]
+ D_i [1 - \gamma (w_i)] + (w_j - z_j - D_j).
\]

**Equilibrium definition:** A match profile $\{(i, j)\}_{i \in I, j \in J}$ with associated marriage contract profile $\{(z_k, D_k)\}_{k \in I \cup J}$ is an equilibrium if there exists $\nu > 0$, such that there is no pair of couples $(i, j)$ and $(\hat{i}, \hat{j})$ respectively characterized by wealth endowments $(w_i, w_j)$ and $(\hat{w}_i, \hat{w}_j)$, social distance $d_{ij}$ and $\hat{d}_{ij}$, who signed a feasible contract $\{(z_k, D_k)\}_{k \in i, j}$ and $\{\hat{(z_k, D_k)}\}_{\hat{k} \in \hat{i}, \hat{j}}$ and: (i) either $i$ proposes to $j$ a feasible contract $\{(\hat{z}_k, \hat{D}_k)\}_{k \in i, j}$ such that

\[
|\hat{z}_j + \hat{D}_j - (z_j + D_j)| < \nu \quad \text{and} \quad |\hat{z}_i + \hat{D}_i - (z_i + D_i)| < \nu,
\]

\[
U_i (\hat{z}_i, \hat{z}_j, \hat{D}_i, \hat{D}_j|d_{ij}, w_i, w_j) \geq U_i (z_i, z_j, D_i, D_j|d_{ij}, w_i, w_j),
\]
and
\[ U_j \left( \hat{z}_i, \hat{z}_j, D_i, D_j | d_{ij}, w_i, w_j \right) \geq U_j \left( z_i, z_j, D_i, D_j | d_{ij}, w_i, w_j \right) \]

with one inequality holding strictly, (iii) or the reverse: \( j \) proposes \( i \) a feasible contract such that \( |\hat{z}_j + D_j - (z_j + D_j)| < v \) and \( |\hat{z}_i + D_i - (z_i + D_i)| < v \), and that does not make any them worse-off, while making one of the two strictly better-off.

In other words, an outcome is an equilibrium if it is locally optimal for every agent in the economy. We finally define for each \( w, d(w) \), the solution to \( \max_{d \in [0,1]} A(w, w, d) [2w - \gamma(w) \, dw] \). Concavity with respect to \( d \) implies that \( d(w) \) is well-defined and \( d(w) \in (0, 1) \).

**Proof of Proposition:** Let’s consider the following strategies. Every groom \( i \in I \), chooses \( j \) (i) such that \( w_i = w_{j(i)} \) and \( d_{ij(i)} = d(w_i) \) as defined by (4). Similarly, \( j \) chooses \( i \) (j) such that \( w_j = w_{i(j)} \) and \( d_{i(j)j} = d(w_j) \). On and off equilibrium transfers are given by \( \{z_i, D_i\} = \{(1 - d_{ij}) w_i, 0\} \) and \( \{z_j, D_j\} = \{(1 - d_{ij}) w_j, d_{ij} w_j\} \) for grooms and brides respectively. Such strategy profile leads to a constrained-optimal marriage outcome as described in section 3.2. To see that this is an equilibrium, let’s characterize brides and grooms response functions. First, if the distance between the two families is not characterized by (4) there are strict Pareto gains to form different pairs. Moreover, contracts are not binding as far as grooms are concerned. However, if we suppose that grooms can credibly commit to invest less in a relationship than their entire wealth, for every groom \( i \in I \), we define \( W_i(x) \) the wealth of \( i \)'s match if \( i \) ends up investing \( x \) in the relationship.

\[ \Gamma_i(x) = \{ j \in J, A(w_i, w_j, d_{ij}) [x + w_j - [1 - \gamma(w_j)]] \geq A(w_j, w_j, d(w_j)) [2w_j - [1 - \gamma(w_j)] d(w_j) w_j] \} \]

is such that
\[ \Gamma_i(x) \subseteq \Gamma_i(x') \] if and only if \( x \leq x' \)

so that \( W_i(x) \) is non-decreasing. Furthermore, we have \( W_i(w_i) = w_i \). The maximization of (9) subject to matching function \( W_i(.) \) implies that a groom’s family always announces the highest possible commitment. Now take a bride \( j \in J \), with wealth \( w_j \). The case we need to consider is when a bride \( j \) with wealth \( w_j \) prefers to marry of groom \( i \) with wealth \( w_i < w_j \) but in exchange can obtain a lower level of marital commitment. Suppose that \( j \) decides to reduce her commitment by an amount
0 < h < w_j, so that her contribution is now \( x = w_j - h \). As \( w_j \in (0, w_{\text{max}}) \), h exists. This reduction will be a reduction in the dowry, as it is relatively more expensive. For any potential \( i \in I \), the net investment made in the relationship is equal to

\[
w_i + w_j - \gamma (w_j) d_{ij} w_j - h [1 - \gamma (w_j)] .
\]

We want to determine \( \beta \) such that groom \( i \) with wealth \( w_i = w_j - \beta h > 0 \) will refuse an offer from \( j \). First, we can see that \( \beta < 1 \), so that such groom \( i \) is well-defined. Second, the equilibrium payoff of family \( i \) is given by \( U^{eq} (w_j, \beta, h) = A^{eq} (w_j, \beta, h) K^{eq} (w_j, \beta, h) \), where \( A^{eq} (w_j, \beta, h) = A (w_j - \beta h, w_j - \beta h, d (w_j - \beta h)) \), and \( K^{eq} = 2w_j - 2\beta h - \gamma (w_j - \beta h) d (w_j - \beta h) (w_j - \beta h) \), while the payoff of family \( i \) if she accepts the offer from \( j \) is \( U^{dev} (w_j, \beta, h) = A^{dev} (w_j, \beta, h) K^{dev} (w_j, \beta, h) \), where \( A^{dev} (w_j, \beta, h) = A (w_j - \beta h, w_j, d (w_j, \beta h)) \) and \( K^{dev} (w_j, \beta, h) = 2w_j - \beta h - h - \gamma (w_j) (d (w_j, \beta h) w_j - h) \), in which \( d (w_j, \beta h) \) is the optimal distance between \( i \) and \( j \). A Taylor expansion around \( w_j \) gives

\[
K^{eq} (w_j, \beta, h) = K^{dev} (w_j, \beta, h) + h [1 - \beta - \gamma (w_j) (1 - \beta d (w_j - \beta h)) + \beta \gamma' (w_j) d (w_j - \beta h) w_j] + o (h),
\]

where \( o (h) \) is a continuous function of \( h \) such that \( \lim_{h \rightarrow 0} \frac{1}{h} o (h) = 0 \). Note that the envelop theorem implies that \( d (w_j, \beta h) = d (w_j - \beta h) + o (h) \). Similarly, looking at the productivity coefficient,

\[
A^{eq} (w_j, \beta, h) = A^{dev} (w_j, \beta, h) - h \left[ \beta \frac{\partial A^{eq} (w_j, \beta, h)}{\partial w_j} \right] + o (h).
\]

Combining these equalities, we obtain

\[
U^{eq} (w_j, \beta, h) = U^{dev} (w_j, \beta, h) + h \left[ A^{dev} (w_j, \beta, h) \Theta (\beta) - \beta \frac{\partial A (w_j, \beta h)}{\partial w_j} K^{dev} (w_j, \beta, h) \right] + o (h)
\]

where \( \Theta (\beta) = 1 - \beta - \gamma (w_j) [1 - \beta d (w_j - \beta h)] + \beta \gamma' (w_j) d (w_j - \beta h) w_j \).

An additional Taylor expansion around \( w_j \) yields

\[
U^{eq} (w_j, \beta, h) = U^{dev} (w_j, \beta, h) + h \left[ A (w_j, w_j, d (w_j)) \Theta (\beta) - \beta \frac{\partial A (w_j, w_j, d (w_j))}{\partial w_j} (2w_j - \gamma (w_j) d (w_j) w_j) \right] + o (h)
\]

Thus,

\[
U^{eq} (w_j, \beta, h) > U^{dev} (w_j, \beta, h)
\]
if and only if
\[ \beta < \beta_j \equiv \frac{1 - \gamma(w_j)}{\frac{\partial A(w_j, w_j, d(w_j))}{\partial w_j} (2 - \gamma(w_j) w_j) + 1 - \gamma(w_j) d(w_j) - \gamma'(w_j) d(w_j) w_j}. \]

Thus, for every \( j \in J \), \( \lim_{h \to 0} \frac{W_j(w_j) - W_j(w_j - h)}{h} \leq \beta_j \). From the expression above, we can see that \( \beta_j > 0 \) for all \( j \in J \) and \( \lim_{w_j \to 0} \beta_j > 0 \). The tradeoff captured in (5) can now be written given that the bride’s family chooses \( h \) to maximize (10) so that

\[ \max_{h > 0} \max_{d \in [0,1]} \alpha [A(W_j(w_j - h), w_j, d) (W_j(w_j - h) + w_j - h - \gamma(w_j) [dw_j - h])] + h \]

A sufficient condition for the constrained-optimal outcome to be an equilibrium is that for any \( \varepsilon > 0 \), there exists \( \eta > 0 \) such that for any \( h \leq \eta \),

\[ \alpha A(w_j, w_j, d(w_j)) [1 - \gamma(w_j)] + \alpha \beta_j \left[ A(w_j, w_j, d(w_j)) + \frac{\partial A(w_j, w_j, d(w_j))}{\partial w_i} \right] \geq 1 + \varepsilon \]

The marginal benefit of investing \( h \) outside the relationship needs to be higher than the rate of savings normalized to 1; we therefore make the sufficient assumption on \( \alpha \) that for every \( j \in J \), \( \alpha [1 - \gamma(w_j) + \beta_j] > 1 \), which implies that the optimal solution for \( j \) is to choose \( h = 0 \). QED.
Tables and Figures

Figure 1: Prevalence of cousin marriage (solid line), and dowry (dashed line) over time (1935-2000). Results are based on the sample of adult women.
Table 1: Summary statistics for key variables used in regression analysis. Note: (i) The variable “Married a Cousin” includes marriages to first-cousins; (ii) The variable “Married a Relative” includes marriages to all relatives other than first cousins; (iii) The variable “Rainfall dev when mother was aged 11” was calculated as the deviation of rainfall from the average (of the area) when the mother was aged 11.
Table 2: Relationship between dowry and social distance

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<tr>
<th></th>
<th>Dowry</th>
<th>Log of Dowry Value</th>
</tr>
</thead>
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<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td>Married a cousin</td>
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<td>-.0544</td>
</tr>
<tr>
<td></td>
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<td>(.0203)***</td>
</tr>
<tr>
<td>Married a relative</td>
<td>-.0433</td>
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<tr>
<td></td>
<td>(.0231)*</td>
<td>(.0233)**</td>
</tr>
<tr>
<td>Married a non-relative within village</td>
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<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Age</td>
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<tr>
<td></td>
<td>(.0084)***</td>
<td>(.0084)***</td>
</tr>
<tr>
<td>Age squared</td>
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<td>.0021</td>
</tr>
<tr>
<td></td>
<td>(.0011)*</td>
<td>(.0011)*</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>-.0119</td>
<td>-.0120</td>
</tr>
<tr>
<td></td>
<td>(.0024)***</td>
<td>(.0024)***</td>
</tr>
<tr>
<td>Muslim</td>
<td>-.2405</td>
<td>-.2382</td>
</tr>
<tr>
<td></td>
<td>(.0201)***</td>
<td>(.0201)***</td>
</tr>
<tr>
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<td>.0009</td>
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<tr>
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<td>(.0042)</td>
</tr>
<tr>
<td>Mother alive at marriage</td>
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</tr>
<tr>
<td></td>
<td>(.0251)</td>
<td>(.0251)</td>
</tr>
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<td>Father alive at marriage</td>
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<td>.0189</td>
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<tr>
<td></td>
<td>(.0176)</td>
<td>(.0176)</td>
</tr>
<tr>
<td>Number of brothers alive at marriage</td>
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<td>.0127</td>
</tr>
<tr>
<td></td>
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<td>(.0050)***</td>
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<tr>
<td>Number of sisters alive at marriage</td>
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<td>.0023</td>
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<td>(.0052)</td>
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<tr>
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<td>-.1547</td>
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<tr>
<td></td>
<td>(.0764)***</td>
<td>(.0763)***</td>
</tr>
<tr>
<td>Father attended school</td>
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<td>-.0344</td>
</tr>
<tr>
<td></td>
<td>(.0142)**</td>
<td>(.0142)**</td>
</tr>
<tr>
<td>Log of parents farmland</td>
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<td>.0036</td>
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<tr>
<td></td>
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<td>(.0013)***</td>
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<tr>
<td>Parents farmland missing</td>
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</tr>
<tr>
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<tr>
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</tr>
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</tr>
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<tr>
<td>N</td>
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<td>4095</td>
</tr>
<tr>
<td>R-squared</td>
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<td>.3388</td>
</tr>
</tbody>
</table>

Table 2: Relationship between dowry and social distance. Notes: The variable Log of dowry value assumes a dowry value of 1 taka if no dowry was paid; (ii) Standard errors—shown in parentheses—are clustered at the bari-level, * denotes significance at 10% level, ** significance at 5% level; and *** significance at 1% level.
## Table 3A: Relationship between consanguinity and inheritances

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<th>Female Sample</th>
<th>Male Sample</th>
<th>Female Sample</th>
<th>Male Sample</th>
</tr>
</thead>
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<td>Any Inheritance</td>
<td>Type of Inheritance</td>
<td>Money</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
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<tr>
<td>Married a cousin</td>
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</tr>
<tr>
<td></td>
<td>(0.0148)**</td>
<td>(0.0116)**</td>
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<td>Married a relative</td>
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<tr>
<td></td>
<td>(0.0168)</td>
<td>(0.0131)</td>
<td>(0.0095)* **</td>
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<td>0.0043</td>
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<tr>
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<td>-0.0040</td>
</tr>
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<td></td>
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<td>(0.0048)</td>
<td>(0.0035)</td>
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<td>Age squared</td>
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<td>0.0005</td>
<td>0.0009</td>
</tr>
<tr>
<td></td>
<td>(0.0008)*</td>
<td>(0.0006)</td>
<td>(0.0005)**</td>
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<tr>
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<td>(0.0024)***</td>
<td>(0.0017)***</td>
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<td>(0.0029)***</td>
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<td>0.0037</td>
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<td>(0.0007)***</td>
<td>(0.0005)***</td>
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<td>(0.0128)***</td>
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### Notes:
1. Standard errors—shown in parentheses—are clustered at the bari-level, * denotes significance at 10% level, ** significance at 5% level; and *** significance at 1% level.
Table 3B: Relationship between dowry and inheritances

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<tbody>
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</tr>
<tr>
<td>Sisters at time of marriage</td>
<td>-.0157</td>
</tr>
<tr>
<td>Log of parents farmland</td>
<td>.0035</td>
</tr>
<tr>
<td>Parents farmland data missing</td>
<td>-.0079</td>
</tr>
<tr>
<td>Rainfall dev when woman was age 11</td>
<td>-.0042</td>
</tr>
<tr>
<td>Rainfall dev when woman was age 12</td>
<td>-.0156</td>
</tr>
<tr>
<td>Rainfall dev when woman was age 13</td>
<td>-.0068</td>
</tr>
<tr>
<td>N</td>
<td>4095</td>
</tr>
<tr>
<td>R-squared</td>
<td>.0896</td>
</tr>
</tbody>
</table>

Table 3B: Relationship between consanguinity and inheritances. Standard errors—shown in parentheses—are clustered at the bari-level, * denotes significance at 10% level, ** significance at 5% level; and *** significance at 1% level.
### Table 4: Relationship between consanguinity, dowry, assets and age at marriage

<table>
<thead>
<tr>
<th></th>
<th>Dependent Variable: Married a Cousin</th>
<th>Dependent Variable: Paid a Dowry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) (2)</td>
<td>(3) (4)</td>
</tr>
<tr>
<td>Age at marriage</td>
<td>-.0042 (0.0010)**</td>
<td>-.0087 (0.0019)**</td>
</tr>
<tr>
<td>Number of brothers alive at marriage</td>
<td>-.0096 (0.0033)**</td>
<td>.0109 (0.0048)**</td>
</tr>
<tr>
<td>Number of sisters alive at marriage</td>
<td>-.0046 (0.0037)***</td>
<td>-.0021 (0.0053)**</td>
</tr>
<tr>
<td>Log of parents farmland</td>
<td>.0020 (0.0012)*</td>
<td>.0020 (0.0016)***</td>
</tr>
<tr>
<td>Log of parents farmland squared</td>
<td>-.0015 (0.0005)***</td>
<td>-.0016 (0.0006)*</td>
</tr>
<tr>
<td>Age</td>
<td>-.0106 (0.0074)***</td>
<td>-.0276 (0.0094)***</td>
</tr>
<tr>
<td>Age squared</td>
<td>.0010 (0.0009)*</td>
<td>.0019 (0.0010)*</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>-.0016 (0.0018)***</td>
<td>-.0114 (0.0027)***</td>
</tr>
<tr>
<td>Muslim</td>
<td>.1211 (0.0069)***</td>
<td>-.2468 (0.0238)***</td>
</tr>
<tr>
<td>Mother alive at marriage</td>
<td>.0057 (0.0194)</td>
<td>-.0305 (0.0228)</td>
</tr>
<tr>
<td>Father alive at marriage</td>
<td>-.0225 (0.0143)</td>
<td>.0182 (0.0172)</td>
</tr>
<tr>
<td>Birth order</td>
<td>-.0052 (0.0031)*</td>
<td>.0012 (0.0043)</td>
</tr>
<tr>
<td>Mother attended school</td>
<td>-.0573 (0.0526)</td>
<td>-.1525 (0.0977)</td>
</tr>
<tr>
<td>Father attended school</td>
<td>-.0069 (0.0111)</td>
<td>-.0321 (0.0144)***</td>
</tr>
<tr>
<td>Rainfall dev when mother aged 11</td>
<td>-.0097 (0.0147)</td>
<td>-.0104 (0.0187)</td>
</tr>
<tr>
<td>Rainfall dev when mother aged 12</td>
<td>.0068 (0.0150)</td>
<td>-.0032 (0.0188)</td>
</tr>
<tr>
<td>Rainfall dev when mother aged 13</td>
<td>-.0009 (0.0137)</td>
<td>.0295 (0.0186)</td>
</tr>
<tr>
<td>N</td>
<td>4087</td>
<td>4087</td>
</tr>
<tr>
<td>R-squared</td>
<td>.009</td>
<td>.0315</td>
</tr>
</tbody>
</table>

Table 4: Notes: (i) All regressions have year of marriage fixed-effects where year of marriage is coded as 5-year, or half-decade, intervals; (ii) Standard errors—shown in parentheses—are clustered at the bari-level, * denotes significance at 10% level, ** significance at 5% level; and *** significance at 1% level.