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# The Economics of Consanguineous Marriages*

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**Abstract**

The institution of consanguineous marriage—a marriage contracted between close biological relatives—has been a basic building block of many societies in different parts of the world. This paper argues that the practice of consanguinity is closely related to the practice of dowry, and that both arise in response to an agency problem between the families of a bride and a groom. When marriage contracts are incomplete, dowries transfer control rights to the party with the highest incentives to invest in a marriage. When these transactions are costly however, consanguinity can be a more appropriate response since it directly reduces the agency cost. Our model predicts that dowry transfers are less likely to be observed in consanguineous unions. We also emphasize the effect of credit constraints on the relative prevalence of dowry payment and consanguinity. An empirical analysis using data from Bangladesh delivers robust results consistent with the predictions of the model.

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# 1 Introduction

Consanguineous marriage, or marriage between close biological relatives, is a social institution that is, or has been, common throughout human history (Bittles, 1994, Bittles et al., 1993, and Hussain and Bittles, 2000). 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).[1] 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). In India, data from the 1992-93 National Family Health Survey show that 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). More widely, evidence from South Asia suggests that consanguineous marriage occurs in rural areas (Rao and Inbaraj, 1977, and Reddy, 1993), irrespective of religious groups and economic classes (Bittles 2001, and Iyer, 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). But a key gap in all these studies is that the economic dimensions of the prevalence of consanguineous marriage are comparatively unexplored.

It is in this setting that this paper makes its contribution: to postulate that consanguinity is a response to a marriage market failure in developing countries, 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. On the one hand, marriage celebrations are often associated with monetary transfers between families. If such transactions take place early on rather than at later stages in marital life, it suggests that they might be a response to time-inconsistent behavior on the part of one of the individuals or families involved in the marriage contract. On the other hand, as briefly discussed previously, consanguineous marriages can be a very widespread practice in some communities. This prompts us to wonder what the benefits of marrying close kin are. The presumption that informal enforcement mechanisms are more likely to be available to relatives induces us to think that consanguinity mitigates the costs associated with incomplete contracts.

This paper is an attempt to elucidate these two issues in both theoretical and empirical contexts. We reconcile the existence of dowries and the prevalence of consanguinity in marriages within a single theoretical framework. When the marriage market is characterized by positive assortative mating, each party wants to commit *ex-ante* to largely contribute to household production as this will result in an increase in the value of the match. However, once links have formed and are costly to sever, one family holds the other up, and may now prefer to invest in alternative opportunities, while free-riding on in-laws' investments. To overcome this time-inconsistency, ex-ante transfers

[1] Although this practice enjoyed widespread popularity in Europe, the genetic implications of this practice was 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 stye, 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).

between families are hence viewed as the renunciation of ownership rights over assets in order to make investment commitments credible. We thus view marriage as joint production between two families with a transfer of control rights to the family with the highest incentives to invest. In our context, we postulate the commitment problem to be on the bride's side, so that 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 partners are. Between cousins, *ex-ante* commitments are more credible, arguably because informal contracts are easier to enforce within the extended family. Conversely, when spouses are further apart, the role of the dowry is crucial as it becomes easier to renege on a contract. Thus, close-kin marriages require smaller dowry payments. *Second*, dowries are costly, as they imply borrowing on the credit market in order to make payments at the time of marriage. Our model then predicts that consanguinity and dowries are substitutes as instruments to overcome or to mitigate the aforementioned time-inconsistency problem. The relative use of these two devices will depend on the associated costs. When marrying close kin, families forgo the benefits of gene diversification, risk hedging, or social network integration. On the other hand, costly dowry transfers are lost, hence not invested.

We test our predictions using data on 4,364 households from the 1996 Matlab Health and Socio-economic 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. Looking at the effects of credit constraints on the prevalence of consanguineous marriages, we observe a negative relationship between cousin marriage and parental socio-economic status. An alternative test consists of examining the relationship between consanguinity and the age at marriage. Admittedly, if women and men are married at earlier ages, their respective families have then less time to accumulate assets, exposing themselves to more stringent credit constraints. Our results lend support to this argument. We find that a one-year higher age at marriage increases the value of a dowry by nearly 50 percent, while decreasing the likelihood of consanguineous marriage by approximately 3 percent.

In depicting a negative correlation between consanguinity and the payment of a dowry at the time of marriage, our findings are entirely consistent with existing sociological and demographic studies conducted on this issue (Centerwall and Centerwall 1966; Reddy 1993). Furthermore, our paper adheres to the economics literature on marriage markets in developing countries. It shares with Peters and Siow (2002) the property that an increase in spousal investment commitment increases the quality of the match. However, our analysis does not focus on pre-marital investments but on the time-inconsistency problem associated with the inability to pre-commit to a given course of action. Bloch and Rao (2002) and Jacoby and Mansuri (2006) models are, in that respect, germane to ours. In Bloch and Rao (2002), husbands cannot commit to reveal their true satisfaction once married, so that violence becomes a credible signal of dissatisfaction, a trigger of compensation on the part of the bride's family. Jacoby and Mansuri (2006) argue that the custom of *watta-satta* in rural Pakistan addresses yet another contracting problem: by marrying each other's sister, two husbands expose themselves to retaliation on their sisters, in the event of domestic abuse on their part. This then constitutes a credible commitment to non-violence. Closer to our approach as it deals with wealth and investment rather than domestic violence, Botticini and Siow (2003) explicitly take the view that dowries address an *inter-generational* time-inconsistency problem: before marriage, daughters cannot commit to manage parental assets as efficiently as their male siblings once they get married, inducing altruistic parents to provide dowries for their daughters, while leaving bequests to sons. We instead model an *inter-familial* principal-agent problem, in which grooms' families are principals and brides' families are agents. Becker (1981) gives an alternative rationale underlying the existence of dowries and bride prices. He views 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. Moreover, all of these papers remain entirely silent on the subject of consanguineous marriage.

The social science literature on dowries far exceeds that on consanguineous marriages. To partially offset this imbalance, we review important facts and findings related to consanguinity in Section 2. We present our model in Section 3, and 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).[2] 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 the parents, the larger 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). According to Bittles (2001), the highest level of inbreeding has been recorded in the South Indian city of Pondicherry, in which 54.9 percent of marriages were consanguineous, corresponding to a mean coefficient of inbreeding of 0.0449, considered very high by the standards of other populations. The existing research on consanguinity also shows that different kinds of consanguineous unions are favoured by different sub-populations: for example, while Hindu women in South India typically marry their maternal uncles, Muslim populations favour first-cousin marriages (Iyer, 2002).[3] Amongst immigrant populations in the UK, those of Pakistani origin display a preponderance of consanguineous marriage, estimated to be as high as 50 to 60 percent of all marriages in this community (Modell, 1991).

Historically in Europe, consanguineous marriage was prevalent until the 20th century, and was associated with royalty and land-owning families (Bittles, 1994). During the 19th and 20th centuries, consanguinity was practised more in the Roman Catholic countries of southern Europe than their northern European Protestant counterparts (McCollough and O'Rourke, 1986). Since the 16th century in England, marriage between first cousins has been considered legal. The Marriage Act of 1949 laid down the kinds of marriage by affinity which are considered void, and this was modified by the Marriage (Prohibited Degrees of Relationship) Act of 1986. But close-kin marriages are not always legally permitted elsewhere. For example, in the United States, different states have rulings on unions between first cousins: in some states such unions are regarded as illegal; others go so

[2] The coefficient of inbreeding is the probability that two homologous alleles in an individual are identical by descent from a recent common ancestor.

[3] In South India, until the 1950s bridewealth rather than dowry was the preferred marriage system, and in West Bengal as well this was the preferred wealth transfer at the time of marriage. We are grateful to Alan Bittles for highlighting this point to us.

far as to consider first-cousin marriage a criminal offence (Ottenheimer, 1996). Today in North America and Western Europe, only 0.6 percent of marriages occur between first cousins (Coleman, 1980; Bundey et al 1990). However this refers to white populations only. 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.[4] Although in overall terms the influence of consanguineous marriage in the world is declining over time, it 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).[5]

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. On the other hand, 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, Islam and Hinduism are important. According to the institutional requirements of Islam in the Koran and the Sunnah10, "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).[6]

Consanguineous marriage among Hindus, for example in India, has continued to occur despite the Hindu Marriage Act of 1955 which prohibited uncle-niece marriages, subsequently altered by the Hindu Code Bill of 1984 (Appaji Rao et al., 2002). One reason for this is because consanguineous marriage is tolerated by the Hindu scriptures.[7] 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). Consanguinity in South Asia has been documented in sample surveys of the population (Reddy, 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). More recent evidence of the incidence of consanguineous marriage comes from the National Family Health Survey (NFHS) 1992-93, which collected data from 25 Indian states and interviewed 89,777 ever-married women aged 13-49. The data show that 16 percent of marriages in India are consanguineous marriages, but that this varies from 6 percent in the north to 36 percent in the south (Banerjee and Roy, 2002). The evidence from NFHS also shows that consanguinity is still widespread in Karnataka, Tamil Nadu and Andhra Pradesh (IIPS and ORC

[4] We are grateful to Alan Bittles for these estimates.

[5] Dowry is widely practiced in Turkey, although some studies do highlight that such payments were higher in consanguineous marriages. In reality, this is thought to be purely symbolic as the money or property paid stayed within the natal family.

[6] The Sunnah are the deeds of the Prophet Mohammad and their application to various situations.

[7] We are grateful to Srilata Iyer for alerting us to the following examples of consanguineous marriage in Hindu mythology: In the Hindu epic poem the Mahabharata, the Hindu god Krishna's niece Sasirekha (the daughter of Krishna's brother Balarama) is given in marriage to Abhimanyu, the son of Krishna's sister Subhadra. Krishna and Subhadra themselves were offspring of Vasudeva; Subhadra was married to the warrior hero of the Mahabharata, Arjuna, whose mother Kunthi was Vasudeva'a sister. Thus, in this example from Hindu mythology, in two generations of the same family - Arjuna and Subhadra, Abhimanyu and Sasirekha - all married their first cousins. In the epic poem the Ramayana, the Hindu god Rama was married to Sita. Subsequently, Sita's father's brother's daughters Urmila, Sutakirti and Mandavi were given in marriage to Rama's three brothers, Lakshmana, Shatrugna and Bharata, evidence of more consanguineous marriages contracted in Hindu folklore.

Macro International, 1995, Bittles, et al., 1993). The rates of consanguineous marriage are as high as 52 percent in Tamil Nadu and 37 percent in Andhra Pradesh and Karnataka.[8] 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 percent of all Buddhist marriages (Bittles, 2003).[9]

# 3 The Economics of Consanguinity

In this section, we propose a model of a marriage market in which couples form, sign a marriage contract, and undertake investments after marriage. Two key assumptions lie at the starting point of our model. The first is that dowries exist and influence marriage outcomes. The second key assumption concerns the role of social distance between the families of the bride and the groom. 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 (Rosensweig and Stark, 1989; La Ferrara, 2003). On the other hand, shorter social distance makes ex-ante contracting between families easier. Close relatives have more (verifiable) information about each other or can draw on more effective enforcement mechanisms. 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 $d_{ij} \in [0, 1]$. We assume that brides and grooms's families are in equal number and have identical wealth distribution. The support of the wealth distribution is the interval $[w_{\min}, w_{\max}]$. For each individual with wealth $w$, there exists a potential match who is at distance $d$, for all $d \in [0, 1]$. Individuals and their families can be thought of as being homogeneously distributed over a cylinder, such that the vertical axis represents individuals' wealth $w$, and the angle between two individuals measures their distance (normalized by $2\pi$), as depicted on Figure 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. A marriage contract consists of immediate transfers $(D_i, D_j)$ from $i$ to $j$ and $j$ to $i$ respectively to be completed at signature of the contract, and a transfer commitment $(z_i, z_j)$ to be made in the following period.
- $T = 1$ : Families invest $(K_i, K_j)$ in the "marital production function", output is realized and consumption takes place.

[8] The exception though is Kerala, where a predominantally Christian population do not practice consanguineous marriage.

[9] There are, however, strong regional differences between religions, for example in southern India, consanguinity is more common among Hindus whereas in the western and northern areas, consanguinity is more common among Muslims (Banerjee and Roy 2002, Bittles 2003).

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. This last assumption is crucial to this paper. Before completing the description of the marriage economy, here is the intuition for what will be modeled subsequently. At $T = 1$, separation is too costly, so that 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. Thus, when enforcement is imperfect, a transfer commitment $z_k$ may not be credible. We therefore perceive $T = 0$ transfers as a means to mitigate the effects of the hold-up problem. The incentives to both parties to be able to commit to high levels of transfers are driven by market forces: parents want a good match for their child, and are therefore willing to pay a higher price for a better spouse.

**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:

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

where $K$ is the aggregate amount invested. We assume that the productivity parameter $A\left(w_i, w_j, d_{ij}\right)$ is continuously differentiable and increasing in $w_i$ and $w_j$ 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. Second, the positive dependence of $A\left(.\right)$ on $d$ is central to our paper, and captures 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.

**Marriage Contracts and the Cost of Equity**

A marriage contract specifies an investment commitment $\left(z_i, z_j\right)$ and prior transfers $\left(D_i, D_j\right)$ 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 $\left(1 - d_{ij}\right) w_k$ 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.

Thus, for each couple $\left(i, j\right)$, a *feasible* marriage contract $\left(z_i, z_j, D_i, D_j\right)$ must satisfy for $k \in \{i, j\}$,

$$\begin{cases} z_k \in \left[0, \left(1 - d_{ij}\right) w_k\right] \\ z_k + D_k \in \left[0, w_k\right] \end{cases} \tag{1}$$

We also assume that the payment of dowries is costly. If a positive amount $D$ is transferred by family $k$, $\gamma\left(w_k\right) D$ is lost in the transaction. $\gamma\left(.\right)$ is a decreasing function of wealth. We can think of $\gamma\left(w\right)$ 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 (see e.g. Banerjee and Newman, 1993). We can think of $\left(D_i, D_j\right)$ as mutual gift exchanges, so consider the net transfer from $j$ to $i$ :

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

that corresponds to a dowry when positive. 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

Families do not capture the same share of the project's 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 respectively. To simplify the notation, we subsequently write $\alpha_i \equiv 1 - \alpha$, and $\alpha_j \equiv \alpha$.[10] 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. 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

$$A(w_{\min}, w_{\min}, 0)[1 - \gamma(w_{\min})] > 1, \tag{2}$$

so that it is always socially optimal to invest in the marital production function.

## 3.2 Optimal and Constrained-Optimal Marriage Outcomes

In our economy, there is a potential divergence of preferences between the two families, and 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, as $A(.)$ is increasing in both $w_i$ and $w_j$, grooms' and brides' wealth levels are complementary, so that assortative mating is the first-best outcome.[11] Every "first-best" couple $(i, j)$ is characterized by $w_i = w_j$ and $d_{ij}^* = 1$.

[10] $\alpha$ is assumed independent of social distance. Relaxing this assumption will introduce additional dynamics that we for now abstract from.

[11] The result is true as long as $w_i$ and $w_j$ are not "too" substituable, i.e. $\partial^2 A/\partial w_i \partial w_j$ not "too" negative. See Becker (1973).

### 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

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

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

$$\alpha_k A(w_i, w_j, d_{ij}) \geq 1 \tag{3}$$

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 summarized in Figure 2:

- For low values of $\alpha$ (zone II), (3) holds for the groom's family but not on the bride's side so that
$$\left(K_i^{**}, K_j^{**}\right) = (w_i - D_i + D_j[1 - \gamma(w_j)], z_j), \tag{4}$$
full investment takes place for the groom, and minimum investment is undertaken by the bride's family. The groom hence invests his endowment net of transfers received and made, while the bride is not willing to go beyond the pre-committed amount.

- For high values of $\alpha$ (zone III), the reverse holds,
$$\left(K_i^{**}, K_j^{**}\right) = (z_i, w_j - D_j + D_i[1 - \gamma(w_i)]), \tag{5}$$

- For intermediate values (zone IV), neither of the two families has any incentive to invest in the marital production function:
$$\left(K_i^{**}, K_j^{**}\right) = (z_i, z_j). \tag{6}$$

Although we could analyze the three cases separately, we will assume that $\alpha$ is low enough, so that the case described by (4) prevails.[12] Similar ruptures of symmetry between husbands and wives have been made in the earlier literature. Botticini and Siow (2003) postulate that virilocality implies a divergence of daughters' preferences after marriage, while it is less so in the case of sons. Zhang and Chan (1999) also break the symmetry between husbands and wives when studying how dowries increase the bargaining power of daughters with respect to their husbands' families. Alternatively, we could allow for high values of $\alpha$ to describe societies in which bridewealth rather than dowry is the main practice of wealth transfer.

[12] Namely, $(1 - \alpha) A(w_{\min}, w_{\min}, 0) \geq 1$ and $\alpha A(w_{\max}, w_{\max}, 1) \leq 1$. The fourth case (zone I) corresponds to the situation in which $A$ is large enough for incentive compatibility constraints not to bind. We ignore this possibility.

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 $\gamma(.)$ is a decreasing function of wealth, assortative mating 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 now 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

$$\frac{\partial A(w, w, d)}{\partial d} [2 - \gamma(w) d(w)] = \gamma(w) A(w, w, d), \tag{7}$$

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

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

We will show that there exists one equilibrium of the marriage market which is *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 1 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 $\alpha \left[1 - \gamma(w_j) + W_j'(x)\right] \geq 1$ in the neighborhood of $x_j = w_j$.[13]

At $T = 0$, brides' families take $W_j(.)$, and grooms' investment strategies defined by (4) as given, and propose a feasible marriage contract $(z_j, D_j)$ to groom $i$ such that

$$\{z_j, D_j\} \in \arg\max_{\substack{0 \leq z \leq (1-d_{ij}) w_j \\ 0 \leq z + D \leq w_j}} \alpha A(W_j(z + D), w_j, d_{ij}) [W_j(z + D) + z + D - \gamma(w_j) D] - z - D \tag{8}$$

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

$$\alpha A(w_j, w_j, d(w_j)) [1 - \gamma(w_j)] + \alpha W_j'(w_j) \left[A(w_j, w_j, d(w_j)) + \frac{\partial A(w_j, w_j, d(w_j))}{\partial w_i}\right] = 1. \tag{9}$$

[13] $W_k(.)$ are generally not differentiable, but the proof of Proposition 1 in the appendix shows that the argument discussed here is still valid.

The optimal contribution level trades off the opportunity cost of storage (normalized to 1) against the benefits from being matched with a wealthier groom.[14] The left-hand side of (9) captures such benefit. The first term, $\alpha A(w_j, w_j, d(w_j))[1-\gamma(w_j)]$, is the "marginal marital product", similar to (3) at the difference that there is an extra $[1-\gamma(w_j)]$ term because the marginal dollar transferred takes the form of a dowry. The second term, absent from (3), captures 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 $\alpha W_j'(w_j) A(w_j, w_j, d(w_j))$ – a "quantity" effect, and indirect through an increased productivity coefficient $\alpha W_j'(w_j) \frac{\partial A(w_j, w_j, d(w_j))}{\partial w_i}$ – a "quality" effect. Under the assumption that $\alpha\left[1-\gamma(w_j)+W_j'(w_j)\right] \geq 1$, 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 maximizes 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 (9) hence applies similarly when $\beta$ is large enough.

The emergence of the institution of dowries responds to the need to overcome a time-inconsistency problem. Parents contribute up-front what they cannot credibly commit at a later stage. Botticini and Siow (2003) address a similar issue, but the time-inconsistency problem lies at a different level: daughters cannot commit to manage parental assets as efficiently when they live in their husbands' home. Thus, it is more efficient for altruistic parents to transfer dowries to daughters and leave bequests to sons. Our approach on the other hand considers that marital transfers reflect the price of spouses in the marriage market, but contracting problems require that price to be paid in two stages: dowries are precisely the first-stage of these transfers.

## 3.4 Credit Constraints, Wealth and Consanguinity

Another dimension that needs investigation is social distance. Proposition 1 established that there exists an equilibrium such that the social distance $d(w)$ between spouses of wealth $w$ is given by

[14]The envelope theorem implies that the effect of changes in the choice of the optimal social distance is of second-order.

(7) :

$$\underbrace{\frac{\partial A(w,w,d)}{\partial d}\left[2-\gamma(w)\,d(w)\right]}_{\text{marginal cost of consanguinity}} = \underbrace{\underbrace{\gamma(w)}_{\substack{\text{dowry}\\ \text{transfer cost}}} \quad \underbrace{A(w,w,d)}_{\substack{\text{opportunity}\\ \text{cost of investment}}}}_{\text{marginal agency cost}}. \tag{10}$$

The left-hand side of (10) 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 putting together their social networks for better access to credit or labor markets (La Ferrara, 2003). The right-hand side of (10) 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, which is not invested and which 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 devices, which 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 which directly reduces the agency problem. In so doing, we have also addressed 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 (10) shows that for every wealth level $w$, the equilibrium distance $d(w)$ verifies

$$sgn\left[\frac{\partial}{\partial\gamma(w)}d(w)\right] = -sgn\left[d(w)\frac{\partial A(w,w,d)}{\partial d} + A(w,w,d)\right] \leq 0. \tag{11}$$

The intuition underlying (11) is straightforward. When credit constraints are more stringent *ceteris paribus*, dowries are more costly relatively to close-kin marriage, so that 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 (11), our model predicts 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 (10), 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 (10):

$$sgn\left[d'(w)\right] = sgn\left\{\varepsilon_\gamma(w)\left[1+\varepsilon_A^d(w,d)\right] - \varepsilon_A^w(w,d)\right\} \tag{12}$$

where the elasticities are defined by $\varepsilon_\gamma(w) \equiv -w\frac{\gamma'(w)}{\gamma(w)}$, $\varepsilon_A^w(w,d) \equiv w\frac{\sum_{k=i,j}\frac{\partial}{\partial w_k}A(w,w,d)}{A(w,w,d)}$, and $\varepsilon_A^d(w,d) \equiv d\frac{\frac{\partial}{\partial d}A(w,w,d)}{A(w,w,d)}$. $\varepsilon_\gamma(.)$ captures the aforementioned cost-of-equity effect, while $\varepsilon_A(w,d)$ measures the opportunity-cost effect at the equilibrium point.[15]

[15] 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 $w$.

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 $\varepsilon_A^w(w,d)$ of the productivity parameter is low enough and is dominated by $\varepsilon_\gamma(w)$, then equation (12) predicts that social distance increases with wealth.[16] The intuition has been discussed at several occasions. When, as assumed, (10) is mostly driven by the dowry transfer cost, poorer people will face more stringent credit constraints, translating into 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.[17] Then, at low levels of wealth, (12) is mostly 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 relative are large. On the other hand, when wealth levels increase, $\varepsilon_A^w$ 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 (for a more detailed analysis, see an earlier version of this paper, Do, Iyer and Joshi, 2006). This last result provides a theoretical foundation for the oft-cited finding of consanguinity among the wealthy: in societies in which women inherit land, close-kin marriage 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). Put in the context of our model, this common view is explained by the observation that large landowners may favor consanguineous marriages arguably because the payment of the dowry would require them to sell the land in order to transfer assets, which would then come at a prohibitive opportunity cost of investment.

# 4 Empirical Evidence from Bangladesh

In this section, we use data from Bangladesh to test the key predictions of the theoretical model. We find very strong support for the theory, as illustrated by our findings below. The data are drawn from the *1996 Matlab Health and Socioeconomic Survey*, or MHSS.[18] We also supplement these data with that on climate data on annual rainfall levels in the Matlab area for the period 1950-1996.[19] The MHSS contains information on 4,364 households in 141 villages. 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 the remainder are Hindus.[20] Though it is geographically close to Dhaka, the area is relatively isolated and inaccessible to communication and transportation other than by river transport. The society is predominantly an agricultural

[16] A sufficient condition is for example $\varepsilon_\gamma(w) \geq \varepsilon_A^w(w,d)$ for every $w$ and $d$.

[17] Sufficient conditions could for example be that $\varepsilon_A^d(.)$ is bounded, so that there exists $(m,M)$ such that for any $w$ and $d$, $\varepsilon_A^d(.) \in [m,M]$, and (i) $\lim_{w\to 0} \frac{\varepsilon_A^w(w,d)}{\varepsilon_\gamma(w)} < m$, uniformly with respect to $d$ : the interest rate curve is relatively steeper at low levels of wealth, and (ii) $\lim_{w\to +\infty} \frac{\varepsilon_A^w(w,d)}{\varepsilon_\gamma(w)} > M$, 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.

[18] 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 (ICDDRB).

[19] This data, 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/.

[20] Most Hindus in Bangladesh belong to lower castes. As a result, the structure of the caste system in Bangladesh is much less rigid than in India, and the principles of Islam play a greater role in governing social relations.

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).

## 4.1 Preliminary Descriptive Statistics

For the purpose of understanding the incidence of consanguinous marriage in the MHSS data, we rely on the section of the survey that asked men and women retrospective information about their marriage histories. In the sample of ever-married men, information was available on 4,627 marriages and in the sample of ever-married women, information was available on 6,001 marriages. These marriages included not only current marriages, but also past marriages if applicable. We stress therefore the reliability of the marriage data in the survey which permits us to understand changes in this society over time.[21] There were 20 percent of ever-married women who reported marrying a relative (either a first-cousin or any other relative, presumably a second-cousin).[22] These included 22 percent of Muslim women, and 3 percent of Hindu women. These numbers are comparable to the estimates from the Indian NFHS which were previously discussed, and which provide a valuable comparison with Bangladesh's neighbor, India. For the sample as a whole, the most popular forms of consanguineous marriage were to first cousins on both the mother's and father's sides. There were 662 women (11 percent of all marriages) who had married a first-cousin.

Our first step in exploring the determinants of first-cousin marriage in this population involves a comparison of circumstances at marriage through simple descriptive statistics of retrospective information on socioeconomic status at the time of marriage. We examine four different types of marriages: marriages between unrelated individuals, marriages between first-cousins, marriages between relatives other than first-cousins and marriages between non-relatives in the same village. The differences between these different types of marriages can shed light on how "substitutable" different forms of social capital are, and thus help us isolate the extent to which kinship alone affects the nature of a marriage contract.

We first consider the sample of 5607 married women between the ages of 15 and 60 at the time of the survey. Table 1 Panel (A) presents information on the various determinants of the types of marriages under consideration. First, although there is no difference in the age at menarche for the four types of women, those women who marry their first-cousins tend to do so when they are on average a year *younger* than women who marry non-relatives in different villages, while women who marry relatives do so when they are on average a year *older*. Second, women who marry their first-cousins and/or relatives other than first-cousins are about 10 percentage points less likely to bring a dowry at the time of marriage. This suggests that the reduced dowry afforded by a consanguineous marriage may have been an important consideration in the decision to marry a relative (as tested further below). Third, women who marry first-cousins, relatives other than first-cousins, and women who marry non-relatives within the village, have about a third and half a year less schooling than their counterparts who marry non-relatives outside of the village. Fourth, though their fathers are slightly more likely to have attended school, they are less likely to own farmland.

[21] There were 15 percent of men and only about 7 percent of women who 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).

[22] 11 percent of all marriages were marriages to first-cousins.

Next, we perform the same investigation across the sample of married men. The sample includes 3084 married men above the age of 15. Only information on first marriages is analyzed. The results are presented in panel (B) of Table 1. Some of the same observations that we made for the women's sample can be made here as well. The significance of the lower dowry in consanguineous marriages is striking here again. However, two additional observations are also noteworthy: first, while men who enter cousin-marriages are about a year younger than their counterparts who marry non-relatives in other villages, men who marry relatives other than first-cousins however, enter these marriages two years *later*. Second, men who enter first-cousin marriages have about 1 year less of schooling, and men who enter into marriages with other relatives have about 0.5 years less of schooling.

An additional insight from Panels (A) and (B) of Table 1 relates to inheritances. Note that women who marry their cousin are 5 percentage points more likely to inherit property, or expect to inherit property, than their counterparts who do not marry their cousins. For adult men who marry their cousins however, there is no statistically significant difference in the tendency to inherit or expect to inherit property. Marrying within the village does not have this effect for either men or women. Later in this section, we will return to a discussion of the role of wealth in contracting cousin-marriages.

Our next step in exploring the determinants of first-cousin marriage in this population involves estimating reduced form regressions wherein a dummy variable describing a consanguineous match is regressed on various measures of a family's socioeconomic status at the time of marriage. The sample includes 3084 married men above the age of 15 and below the age of 60. Focussing on the men has the important advantage that information on socioeconomic status (as measured by holdings of land, or housing quality) may be used as proxies for these variables at the time of marriage too. We lack this information for women because they are no longer living in their natal homes. The independent variables are summarized in Table 2. Several results presented in Table 3 are noteworthy. Muslims are more likely to enter into consanguineous marriages, but not more likely to marry non-relatives in the same village. Attending a religious school however, has a negative and significant effect on the probability of marrying a cousin (column (1)), a relative (column (2)), a non-relative in the same village (column (3)) and cousin in the same village (column (4)): a boy with religious education is approximately 5 percent less likely to marry a first cousin and between 4–5 percent less likely to enter into the other three types of marriages considered here.

## 4.2 Dowry and Consanguinity

A first test of the theoretical model involves examining the simple correlations between the payment of dowries and first-cousin marriages, relative marriages and marriages between non-relatives. The results in Table 1 indicate that compared to women who marry non-relatives, women who marry their first-cousins are 10 percentage points less likely to bring a dowry; women who marry any relatives are 7 percentage points less likely to bring a dowry; and women who marry non-relatives from the same village are 4 percentage points less likely to bring a dowry at the time of marriage. These results are significant at the 1 percent level. We interpret these results as evidence that (i) dowry and consanguinity are closely correlated; and (ii) social capital through geographic proximity is an imperfect substitute for kinship.

In a more formal test of the theory, we regress the variable *Dowry* on the various measures of consanguinity that were considered previously and control for age, education, and socioeconomic status at the time of marriage. The results are presented in panels (A) to (C) of Table 4A. Note that even when control variables are added to the regression, women who marry their first-cousins or other relatives are 6–7 percentage points less likely to bring a dowry and the effect is generally statistically significant. 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. It is interesting that marriage to non-kin within a village (Table 4A, panel (C)) is not related to the payment of dowry in any statistically significant way. Again, we interpret this as evidence that marriage to a non-relative within the same village and marriage to a cousin are rather different. The reduction in dowry has more to do with the particular form of social capital that is associated with kinship rather than just familiarity and trust that come from residing in close proximity. In Table 4B, we use the logarithm of the dowry values as an alternate dependent variable and obtain similar results as in Table 4A. After controlling for time fixed-effects, and other individual characteristics, the results show 20 percent lower dowry values among consanguineous unions.

The relationship between dowry and consanguinity over time can be observed in Figure 3. Note that dowries in Matlab have been increasing, but the practice of consanguinity has been falling. The rise in dowries can be explained by our model: in a setting where improvements in transportation and communication allow individuals to search over greater distances for matches with higher social distances (than consanguineous marriages or same-village marriages), the problem of ex-ante commitment becomes greater and is solved by the payment of higher levels of dowry. This is also a possible explanation for the rise in the prevalence of dowry in India (Tambiah, 1973; Rao, 1993).[23] We hope to explore this issue in future work. In any event, the vital importance of a reduced dowry in the context of a consanguineous marriage emerges from the formal tests of our theoretical model.

## 4.3 Consanguinity, Dowries and Wealth

To understand the role of wealth and credit constraints in contracting consanguinous marriages, we begin by examining the bivariate relationships between consanguinous marriage, dowry and measures of wealth at the time of marriage. Since the 1996 MHSS is a cross-sectional survey, information on pre-marital wealth levels is rather limited. Our first 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. If current landholdings are affected by marital contracts, this measure will be an imperfect measure of socio-economic status. To deal with this issue, we also consider a meaure of father's education. To the extent that a father's education is determined before his children marry, this measure will be a good proxy for permanent income and/or socio-economic status of a household. In some places we simply consider a dummy variable that indicates whether a father completed primary school.

Bivariate kernel density estimates for consanguinous marriage (as defined by being married to a first-cousin or another relative) and measures of wealth are presented in Figure 4. Note that the relationship is non-monotonic: the practice of consanguinous marriage is higher at the two extremes of the wealth distribution than in the middle, as predicted by our theoretical model. The robustness of this relationship is econometrically explored in Table 5A. Note that the incidence of consanguinous

[23] The demographic transition may have been an additional factor that may have contributed to the decrease in first-cousin marriage and the rising popularity of dowry. The reduction in family size in conjunction with prescribed spousal age differences, could have resulted in the non-availability of first-cousin spouses. We are grateful to Alan Bittles for alerting us to this possibility.

marriage decreases with the increase in the value of father's farmland (the results are statistically significant at the 10 percent level), confirming that consanguinous marriages are more common among poorer households. The estimates also confirm that the relationship between farmland and consanguinity may be non-linear. We turn now to an examination of the relationship between dowry and wealth. Figure 5 shows that the relationship between dowry and wealth is also non-monotonic and that as the theory predicts, is the exact inverse of the relationship between consanguinity and wealth: as wealth levels rise, dowries first increase, reach a peak and then decrease. Table 5B explores the relationship between dowry and wealth econometrically. Panel (A) regresses the log of dowry values on father's farmland value and its squared term, and Panel (B) regresses dowry values on a dummy variable indicating father's completion of primary school. The coefficients are statistically significant even with the inclusion of individual, household, rainfall and decade of marriage controls. Standardization of the coefficients from the farmland regression indicate that a 1 percent increase in the value of farmland causes the dowry paid to increase by approximately 35 percent. Similarly, a father's completion of primary school increases the value of the dowry by about 500 taka, which is about 25 percent of the average value of a dowry in this sample. The estimates for the squared term of farmland are also statistically significant, confirming the non-linearities that are predicted by the theoretical model.

Taken together, the results of Table 5A and Table 5B 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 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 show 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 consanguinous marriages. Our results confirm this finding but also raise the additional possibility that the relationship is non-linear. At very high levels of wealth for example, households may once again prefer to contract marriages within the kinship network and resist the transfer of wealth to unrelated individuals through either dowries or future inheritances.

As an additional test of the hypothesis of credit constraints, we explore the relationship between cousin marriage, dowry and age at marriage. As noted earlier in this section, marriages to first-cousins take place at younger ages than marriages to unrelated individuals. The results in Table 6B suggest that the relationship between dowry and age at marriage is positive. In particular, the estimates from column (4) suggest that a one standard deviation delay in the age at marriage (i.e. almost 3 years) increases the value of the dowry by 0.7 standard deviations, or approximately 2800 taka. The specification where the value of the dowry is regressed on the age at marriage suffers from a possible endogeneity problem. It is possible for example, that the age at marriage is in fact an *outcome* rather than a determinant of a household's ability to pay a dowry. We deal with this issue by instrumenting the age at marriage with the age at menarche. Since most marriages in rural Bangladesh are contracted at, or just after, the time of the onset of puberty, we assume that this variable will be highly correlated with the age at marriage. We thus assume that the age at menarche affects parental credit constraints only through the the time of a woman's marriage. This exclusion restriction is motivated by the observation that in rural Bangladesh, as in much of South Asia, the age at menarche is a *lower* bound on the age at which marriages are contracted, with the lag between the onset of menarche and the contracting of a marriage increasing steadily over time (Iyer 2002).[24] We concede, however, that our exclusion restriction relies on the assumption that

[24]In our dataset, women aged 35 and younger married at an average age of 17. Only 103 marriages (out of 6294

socio-economic status, hence nutritional status, does not significantly affect the age at menarche. While this issue is open for discussion, empirical evidence from the Matlab data seems to confirm the absence of such correlation. We also control for various measures of socio-economic status, without this affecting both first and second stages. The results of the IV estimation are presented in Column (5) and (6) of Table 7. Note that the second stage estimates of the coefficient for the age at marriage are very close to the estimates obtained from the OLS specification and that the coefficient is still significant at the 5 percent level. We interpret this as evidence in support of the existence of credit constraints. In other words, we believe firmly that a family may well delay a girl's marriage in order to build up and to consolidate the equity that is required to pay her dowry at the time of marriage.

# 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 a 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 corroborates 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 greater knowledge (from the medical and biological sciences) that such marriages may lead to a greater likelihood of congenital birth defects. By providing a rationale for consanguinity that does not rely on an exogenous preference argument, we encourage a reappraisal of the welfare implications of regulating marriage markets in such contexts.

women) appear to be 'child' marriages, i.e. cases of marriage where the age at marriage was less than 11.

# References


1. Appaji Rao N, HS Savithri and AH Bittles (2002), "A genetic perspective on the South Indian tradition of consanguineous marriage" In *Austral-Asian Encounters* (eds. C Vanden Driesen and S Nandan), 326-341. Prestige Books: New Delhi.

2. Banerjee A and A Newman (1993), "Occupational Choice and the Process of Development", *Journal of Political Economy* 101(2): 274-98.

3. Banerjee SK and TK Roy (2002), "Parental consanguinity and offspring mortality: The search for possible linkage in the Indian context", *Asia-Pacific Population Journal* 17 (1): 17-38.

4. Becker, G (1973) "A Theory of Marriage: Part I", *Journal of Political Economy* 81(4): 813-46.

5. Becker, G (1981) *A Treatise on the Family.* Cambridge: Harvard University Press.

6. Bergh, AE ed. (1907) *The Writings of Thomas Jefferson, Vol. XII*, The Thomas Jefferson Memorial Association of the United States, Washington DC.

7. Berham J., and M. Rosenzweig (2006), "Parental Wealth and Adult Children'sWelfare in Marriage", *Review of Economics and Statistics,* 88 (3): 496-509.

8. Bittles AH (2003), "Endogamy, consanguinity and community genetics", Centre for Human Genetics Working Paper, Edith Cowan University, Perth.

9. Bittles AH (2001), "Consanguinity and its relevance to clinical genetics", *Clinical Genetics,* 60: 89-98.

10. Bittles, AH (1994), "The Role and Significance of Consanguinity as a Demographic Variable", *Population and Development Review*, 561-584.

11. Bittles AH, JM Cobles and N Appaji Rao (1993), "Trends in consanguineous marriage in Karnataka, South India, 1980-1989", *Journal of Biosocial Science* 25(1): 111-116.

12. Bittles AH, WM Mason, J Greene and N Appaji Rao (1993), "Reproductive behaviour and health in consanguineous marriages", *Science New Series* 252(5007): 789-794.

13. Bloch, F and V Rao (2002), "Terror as a Bargaining Instrument: A Case Study of Dowry Violence in Rural India", *The American Economic Review* 92(4): 1029-1043.

14. Botticini M, and A Siow (2003), "Why Dowries?", *The American Economic Review* 93(4): 1385-98.

15. Caldwell JC, PH Reddy and P Caldwell (1983), "The causes of marriage change in South India", *Population Studies* 37(3): 343-361.

16. Centerwall WR and SA Centerwall (1966), "Consanguinity and congenital anomalies in South India: A pilot study", *Indian Journal of Medical Research* 54: 1160-67.

17. Coleman, DA (1980), "A note on the frequency of consanguineous marriages in Reading, England in 1972-73", *Human Heredity* 30(5): 278-285.

18. Do, QT, S Iyer and S Joshi (2006), "The Economics of Consanguinity", Cambridge Working Papers in Economics 06-53. Faculty of Economics, University of Cambridge.

19. Dronamaraju, KR and P. Meera Khan (1963), "The frequency and effects of consanguineous marriages in Andhra Pradesh", *Journal of Genetics* 58:387-401.

20. Hussain, R (1999) "Community perceptions of reasons for preference for consanguineous marriages in Pakistan", *Journal of Biosocial Science* 31: 449-461.

21. Hussain, R and AH Bittles (2000), "Sociodemographic correlates of consanguineous marriage in the Muslim population of India", *Journal of Biosocial Science* 32: 433-442.

22. International Institute of Population Sciences, Mumbai, and ORC Macro International (1995) *National Family Health Survey 1992-93.* Mumbai: IIPS

23. Iyer, S (2002), *Demography and Religion in India.* Delhi, Oxford and New York: Oxford University Press.

24. Jacoby, H and G Mansuri (2006), "Watta Satta: Exchange Marriage and Women's Welfare in Rural Pakistan", manuscript, The World Bank.

25. Joshi, S (2004) "Female Household-Headship in Rural Bangladesh: Incidence, Determinants and Impact on Children's Schooling" Growth Center Discussion Paper #94, Yale University.

26. La Ferrara, E (2003) "Kin Groups and Reciprocity: A Model of Credit Transactions in Ghana", *The American Economic Review* 93(5): 1730-51.

27. Maian A and R Mushtaq (1994), "Consanguinity in population of Quetta (Pakistan): A preliminary study", *Journal of Human Ecology* 5: 49-53.

28. McCullough JM and O'Rourke DH (1986), "Geographic distribution of consanguinity in Europe", *Annals of Human Biology* 13: 359-368.

29. Modell, B (1991) "Social and genetic implications of customary consanguineous marriage among British Pakistanis", *Journal of Medical Genetics* 28: 720-723.

30. Mobarak, A. M., R Kuhn and C Peters (2006), "Marriage Market Effects of a Wealth Shock in Bangladesh", manuscript, Yale University.

31. Ottenheimer, M (1996), *Forbidden relatives – the American Myth of Cousin Marriage.* Chicago: University of Illinois Press.

32. Peters M, and A Siow (2002), "Competing Premarital Investments", *Journal of Political Economy* 110(3): 592-608.

33. Rao, V (1993), "The Rising Price of Husbands: A Hedonic Analysis of Dowry Increase in Rural India", *Journal of Political Economy* 101(3): 666-77.

34. Rao, PSS and SG Inbaraj (1977), "Inbreeding in Tamil Nadu, South India", *Social Biology* 24: 281-288.

35. Reddy, PG (1993), *Marriage practices in South India*, Madras: University of Madras.

36. Rosenzweig, M and O Stark, "Consumption Smoothing, Migration, and Marriage: Evidence from Rural India", *Journal of Political Economy* 97(4): 905-26.

37. Schull WJ (1959), "Inbreeding effects on man", *Eugenics Quarterly* 6:102-109.

38. United Nations Development Program (2000), *Poverty and Distribution of Land*, by Keith Griffin, Azizur Rahman Khanand Amy Ickowitz.

39. Zhang J and W Chan (1999), "Dowry and Wife's Welfare: A Theoretical and Empirical Analysis", *Journal of Political Economy* 107(4): 786-808.

# 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 $\{z, D\} = \varnothing$. 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

$$U_i(z_i, z_j, D_i, D_j|d_{ij}, w_i, w_j) = \alpha_i A(w_i, w_j, d_{ij})[w_i + z_j + D_j(1-\gamma(w_j)) - D_i], \quad (13)$$

and

$$\begin{aligned} U_j(z_i, z_j, D_i, D_j|d_{ij}, w_i, w_j) &= \alpha_j A(w_i, w_j, d_{ij})[w_i + z_j + D_j(1-\gamma(w_j)) - D_i] \\ &\quad + D_i[1-\gamma(w_i)] + (w_j - z_j - D_j). \end{aligned} \quad (14)$$

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 is no pair of couples $(i, j)$ and $(\hat{\imath}, \hat{\jmath})$ respectively characterized by wealth endowments $(w_i, w_j)$ and $(w_{\hat{\imath}}, w_{\hat{\jmath}})$, social distance $d_{ij}$ and. $d_{\hat{\imath}\hat{\jmath}}$, who signed a feasible contract $\{(z_k, D_k)\}_{k=i,j}$ and $\left\{\left(z_{\hat{k}}, D_{\hat{k}}\right)\right\}_{\hat{k}=\hat{\imath},\hat{\jmath}}$, and (i) either $\hat{\imath}$ proposes to $j$ a feasible contract $\left\{\left(\hat{z}_k, \hat{D}_k\right)\right\}_{k=\hat{\imath},j}$ such that

$$U_{\hat{\imath}}\left(\hat{z}_{\hat{\imath}}, \hat{z}_j, \hat{D}_{\hat{\imath}}, \hat{D}_j|d_{\hat{\imath}j}, w_{\hat{\imath}}, w_j\right) \geq U_{\hat{\imath}}(z_{\hat{\imath}}, z_{\hat{\jmath}}, D_{\hat{\imath}}, D_{\hat{\jmath}}|d_{\hat{\imath}\hat{\jmath}}, w_{\hat{\imath}}, w_{\hat{\jmath}})$$

and

$$U_j\left(\hat{z}_{\hat{\imath}}, \hat{z}_j, \hat{D}_{\hat{\imath}}, \hat{D}_j|d_{\hat{\imath}j}, w_{\hat{\imath}}, w_j\right) \geq U_j(z_i, z_j, D_i, D_j|d_{ij}, w_i, w_j)$$

with one inequality holding strictly, (ii) or the reverse: $\hat{\jmath}$ proposes $i$ a feasible contract that does not make any them worse-off, while making one of the two strictly better-off.

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 (7). 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 (7) 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

$$\Gamma_i(x) \subseteq \Gamma_i(x') \text{ if and only if } x \leq x'$$

so that $W_i(x)$ is non-decreasing. Furthermore, we have $W_i(w_i) = w_i$. The maximization of (13) 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 $h > 0$, so that her contribution is now $x = w_j - h$. 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

$$w_i + w_j - \gamma(w_j) d_{ij} w_j - h[1 - \gamma(w_j)]. \tag{15}$$

We want to determine $\beta$ such that groom $i$ with wealth $w_i = w_j - \beta h$ will refuse an offer from $j$. 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

$$A^{eq}(w_j, \beta, h) = A(w_j - \beta h, w_j - \beta h, d(w_j - \beta h))$$
$$\text{and } K^{eq} = 2w_j - 2\beta h - \gamma(w_j - \beta h) d(w_j - \beta h)(w_j - \beta h),$$

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

$$A^{dev}(w_j, \beta, h) = A(w_j - \beta h, w_j, d(w_j, \beta, h))$$
$$\text{and } K^{dev}(w_j, \beta, h) = 2w_j - \beta h - h - \gamma(w_j)(d(w_j, \beta, h) w_j - h),$$

in which $d(w_j, \beta, h)$ is the optimal distance between $i$ and $j$. A Taylor expansion around $w_j$ gives

$$\begin{aligned} K^{eq}(w_j, \beta, h) &= K^{dev}(w_j, \beta, h) \\ &\quad + h[1 - \beta - \gamma(w_j)(1 - \beta d(w_j - \beta h)) + \beta \gamma'(w_j) d(w_j - \beta h) w_j] \\ &\quad + o(h) \end{aligned}$$

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

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

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

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

Thus,

$$U^{eq}(w_j,\beta,h)>U^{dev}(w_j,\beta,h)$$

if and only if

$$\beta<\beta_j\equiv\frac{1-\gamma(w_j)}{w\frac{\frac{\partial A(w_j,w_j,d(w_j))}{\partial w_j}}{A(w_j,w_j,d(w_j))}(2-\gamma(w_j)w_j)+1-\gamma(w_j)d(w_j)-\gamma'(w_j)d(w_j)w_j}.$$

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 $j\in J$. The tradeoff captured in (9) can now be written given that the bride's family chooses $h$ to maximize (14) so that

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

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 that for every $j\in J$, $\alpha\left[1-\gamma(w_j)+\beta_j\right]>1$, which implies that the optimal solution for $j$ is to choose $h=0$. QED.■

# Tables and Figures

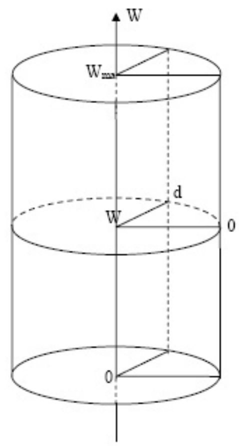


Figure 1: Distribution of Wealth and Social Distance

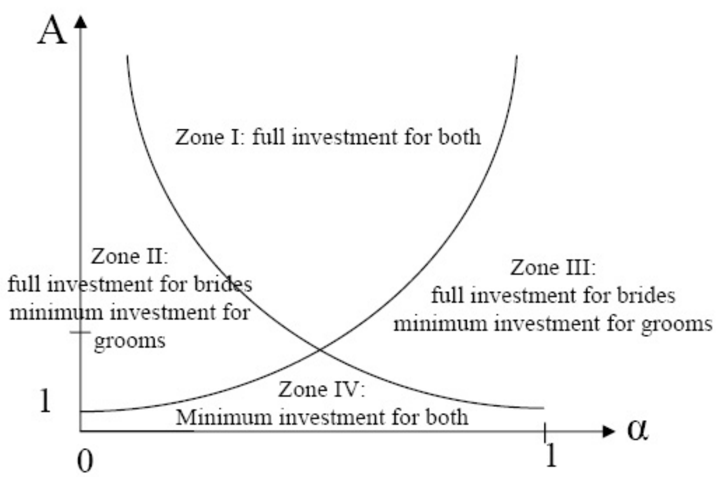


Figure 2: InvestmentPatterns

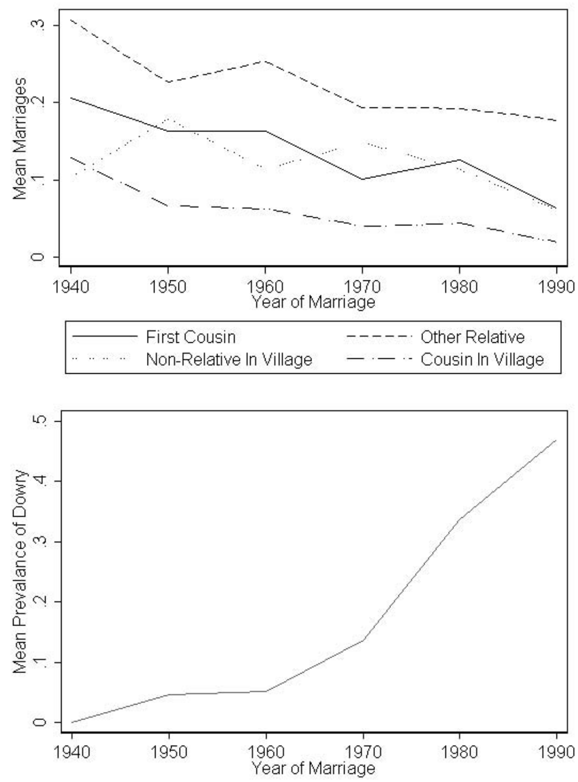


Figure 3: The prevalence of dowry, cousin-marriage, relative marriage, marriages between cousins in the same village and non-relatives in the same village. Responses are based on the sample of adult men.

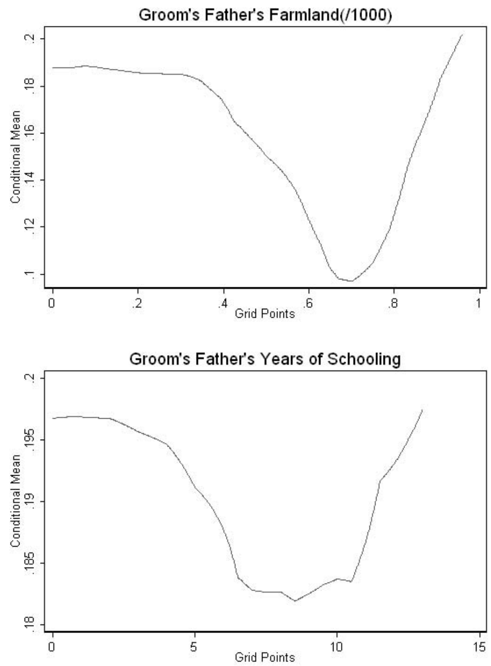


Figure 4: Test of the relationship between cousin marriage and wealth.

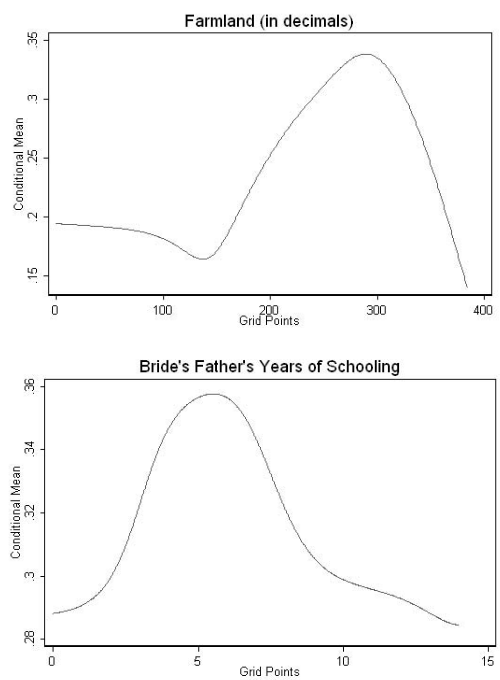


Figure 5: Test of the relationship between the payment of dowry and a woman's father's years of schooling.

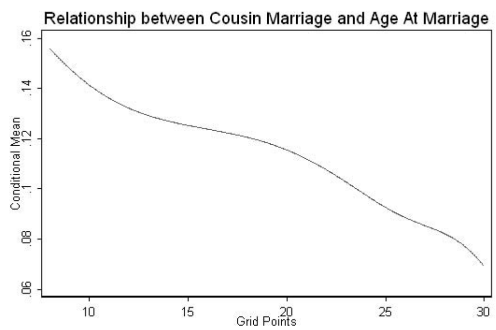


Figure 6: Test of the relationship between the payment of dowry and a woman's father's years of schooling.

**Table 1: Differences in circumstances at marriage for the following types of marriages: (a) first-cousins, (b) relatives other than first-cousins, (c) non-relatives in the same village.**

| **Variable** | **Married between Unrelated** | **Married Cousin** | **Married Relative Individuals** | **Married Non-Relative, Same Village** | **Differences** | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (2) - (1) | (3) - (1) | (4) - (1) |
| **Panel A: Estimates from Sample of Adult Females** | | | | | | | |
| Age at menarche | 14.283 | 14.221 | 14.175 | 14.198 | -.062 | -.108 | -.085 |
| | | | | | (.070) | (.078) | (.062) |
| Age at marriage | 14.723 | 13.855 | 15.737 | 14.512 | -.868 | 1.014 | -.211 |
| | | | | | (.197)*** | (.311)*** | (.177) |
| Dowry | .367 | .258 | .294 | .327 | -.109 | -.073 | -.040 |
| | | | | | (.022)*** | (.026)*** | (.020)* |
| Years of schooling | 2.236 | 1.898 | 2.263 | 1.613 | -.338 | .027 | -.623 |
| | | | | | (.141)** | (.166) | (.127)*** |
| Number of male siblings | 2.373 | 2.252 | 2.394 | 2.521 | -.121 | .021 | .149 |
| | | | | | (.073) | (.085) | (.066)* |
| Number of female siblings | 2.129 | 2.010 | 1.935 | 2.008 | -.119 | -.194 | -.121 |
| | | | | | (.070) | (.081)* | (.063)* |
| Mother ever attended school | .012 | .015 | .024 | .003 | .003 | .012 | -.009 |
| | | | | | (.005) | (.006) | (.004)* |
| Father ever attended school | .012 | .028 | .034 | .007 | .015 | .022 | -.005 |
| | | | | | (.006)*** | (.007)*** | (.005) |
| Father owns farmland | .914 | .897 | .884 | .917 | -.017 | -.030 | .003 |
| | | | | | (.013) | (.016)* | (.012) |
| Inherit or expect to inherit property from parents | .205 | .256 | .226 | .232 | .051 | .021 | .028 |
| | | | | | (.019)*** | (.022) | (.017) |
| **Panel B: Estimates from Sample of Adult Males** | | | | | | | |
| Age at marriage | 23.543 | 22.709 | 25.438 | 22.942 | -0.834 | 1.895 | -.601 |
| | | | | | (.380)** | (.496)*** | (.315)* |
| Years of schooling | 3.781 | 2.870 | 3.314 | 3.189 | -.911 | -.467 | -.592 |
| | | | | | (.238)*** | (.259)* | (.209)*** |
| Number of male siblings | 1.915 | 1.781 | 1.892 | 1.816 | -.134 | -.023 | -.098 |
| | | | | | (.089) | (.094) | (.077) |
| Number of female siblings | 2.111 | 1.980 | 1.935 | 2.071 | -.131 | -.177 | -.041 |
| | | | | | (.086) | (.090)* | (.075) |
| Father ever attended school | .105 | .111 | .086 | .066 | .006 | -.020 | -.039 |
| | | | | | (.018) | (.019) | (.015)** |
| Father owns farmland | .696 | .675 | .693 | .738 | -.022 | -.003 | .042 |
| | | | | | (.027) | (.029) | (.023)* |
| Inherit or expect to inherit property from parents | .590 | .563 | .608 | .584 | -.027 | .018 | -.006 |
| | | | | | (.029) | (.031) | (.025) |

Table 1: Sample consists of married women (panel A) and married men (panel B) between the ages of 15 and 60. Standard errors are in parentheses, * significant at 10% level, ** significant at 5% level; *** significant at 1% level.

**Table 2: Summary statistics of variables used in the regressions.**

| Variable | Description of Variable | Mean | Std. Dev |
|---|---|---|---|
| MarrCousin | A man married his first cousin (Dummy variable) | .010 | .299 |
| MarrRelative | A man a relative other than a first cousin (Dummy variable) | .183 | .387 |
| MarrVillage | A man married a Non-Relative in the same village (Dummy variable) | .138 | .345 |
| MarrCousXVill | A man married a first cousin in the same village (Dummy variable) | .039 | .194 |
| DowryVal ($/10^4$) | Value of Dowry | .1989 | .418 |
| AgeMarried | Age at marriage (in years) | 14.497 | 2.755 |
| Age | Age (in years) | 34.290 | 13.131 |
| AgeSq | Age (in years) squared (100) | 134.823 | 95.601 |
| AttdReligSch | Attended a religious school (Dummy variable) | .020 | .1408 |
| YearsEd | Years of schooling | 4.255 | 4.081 |
| MaleSibs | Number of brothers | 1.763 | 1.455 |
| FemaleSibs | Number of sisters | 2.042 | 1.394 |
| FaAlFstMarr | Father alive at the time of marriage (Dummy variable) | .470 | .499 |
| MoAlFstMarr | Mother alive at the time of marriage (Dummy variable) | .589 | .492 |
| MoEverAttd | Mother ever attended school (Dummy variable) | .124 | .329 |
| FaEverAttd | Father ever attended school (Dummy variable) | .206 | .405 |
| FaOwnFL | Father owns farmland (Dummy variable) | .523 | .499 |
| FaPrimSch | Father completed primary school | .085 | .2796 |
| FaFarmlandVal | Value of father's farmland | .116 | .1903 |
| RainDevManYear17 | Deviation of rainfall from average rainfall when man was 17 | 2.062 | .372 |
| RainDevManYear18 | Deviation of rainfall from average rainfall when man was 18 | 2.074 | .375 |
| RainDevManYear19 | Deviation of rainfall from average rainfall when man was 19 | 2.072 | .401 |

Table 2:

**Table 3: Determinants of cousin marriage, relative marriages and marriages in the same village, with village fixed effects**

| | Type of Marriage: | | | | | Type of Marriage: | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Cousin | Relative | Village | CousAndVill | | Cousin | Relative | Village | CousAndVill |
| | (1) | (2) | (3) | (4) | | (1) | (2) | (3) | (4) |
| Age | -.0041 | -.0134 | .0052 | .0019 | AgeSq | .0005 | .0015 | -.0006 | -.0002 |
| | (.0048) | (.0062)** | (.0056) | (.0032) | | (.0006) | (.0007)** | (.0007) | (.0004) |
| Muslim | .1049 | .1557 | .0154 | .0399 | AttdReligSch | .0800 | .0090 | -.1571 | .0239 |
| | (.0225)*** | (.0292)*** | (.0263) | (.0148)*** | | (.0686) | (.0890) | (.0802)* | (.0450) |
| MeanReligSch | -.0158 | .0150 | .0308 | .0079 | YearsEd | .0004 | -.0043 | .0032 | -.0027 |
| | (.0693) | (.0899) | (.0810) | (.0454) | | (.0031) | (.0040) | (.0036) | (.0020) |
| MeanYearsEd | -.0059 | -.0005 | -.0093 | .0011 | MaleSibs | -.0044 | -.0039 | -.0033 | -.0010 |
| | (.0042) | (.0055) | (.0049)* | (.0028) | | (.0040) | (.0051) | (.0046) | (.0026) |
| FemaleSibs | -.0070 | -.0151 | .0002 | -.0005 | FaAlFstMarr | .0066 | .0062 | .0192 | -.0137 |
| | (.0041)* | (.0053)*** | (.0048) | (.0027) | | (.0129) | (.0167) | (.0150) | (.0084) |
| MoAlFstMarr | -.0150 | -.0427 | .0012 | .0007 | FaOwnFL | -.0019 | -.0103 | .0164 | -.0004 |
| | (.0174) | (.0226)* | (.0204) | (.0114) | | (.0153) | (.0199) | (.0179) | (.0101) |
| MoEverAttd | -.0320 | .0261 | -.0199 | -.0222 | FaEverAttd | .0531 | .0328 | -.0467 | .0463 |
| | (.0376) | (.0339) | (.0190) | (.0230)** | | (.0299) | (.0269)* | (.0151)*** | |
| RainDevManYear17 | .0128 | -.0119 | -.0110 | -.0050 | RainDevManYear18 | .0247 | .0384 | .0501 | .0223 |
| | (.0151) | (.0196) | (.0176) | (.0099) | | (.0154) | (.0199)* | (.0180)*** | (.0101)** |
| RainDevManYear19 | -.0238 | -.0231 | -.0076 | -.0166 | Constant | .0974 | .4132 | -.0472 | -.0287 |
| | (.0142)* | (.0184) | (.0166) | (.0093)* | | (.1189) | (.1542)*** | (.1390) | (.0780) |
| N | 3084 | 3084 | 3084 | 3084 | | | | | |
| R-sq | .0164 | .0216 | .0112 | .0104 | Rainfall F | .2889 | 1.3596 | 2.7106 | 2.0053 |
| F | 2.866 | 3.7965 | 1.9464 | 1.8009 | Rain p-val | 4.0666 | .2533 | .0436 | .1111 |

Table 3: Results from the simple regression model with standard errors clustered at the bari level. Notes: (i) The sample is based on responses of adult ever-married men. All information pertains to first marriages. (ii) The dependent variable *CousAndVillage* takes value 1 if the individual married a first cousin in the same village as he was residing in at the time of marriage. (iii) Standard errors are in parentheses, * significant at 10% level, ** significant at 5% level; *** significant at 1% level.

**Table 4A: Test of Negative Relationship Between Dowry and Social Distance**

| **Dependent Variable:** *Man Received a Dowry* | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Panel A:** Married a first-cousin | -.0939 | -.0807 | -.0779 | -.0750 | -.0733 |
| | (.0242)*** | (.0203)*** | (.0203)*** | (.0203)*** | (.0203)*** |
| N | 3799 | 3799 | 3799 | 3799 | 3799 |
| R-squared | .0039 | .3126 | .3156 | .3199 | .3218 |
| F-statistic | 15.0457 | 287.3912 | 158.7516 | 104.6165 | 85.3232 |
| **Panel B:** Married other relative | -.0860 | -.0680 | -.0638 | -.0633 | -.0627 |
| | (.0192)*** | (.0162)*** | (.0162)*** | (.0162)*** | (.0162)*** |
| N | 4122 | 4122 | 4122 | 4122 | 4122 |
| R-squared | .0048 | .3064 | .3098 | .3145 | .317 |
| F-statistic | 20.0541 | 303.0065 | 167.7139 | 110.7331 | 90.6216 |
| **Panel C**: Married non-relative in same village | -.0167 | -.0262 | -.0276 | -.0288 | -.0285 |
| | (.0216) | (.0181) | (.0181) | (.0180) | (.0180) |
| N | 4122 | 4122 | 4122 | 4122 | 4122 |
| R-squared | .0001 | .3038 | .3076 | .3123 | .3149 |
| F-statistic | .5968 | 299.2936 | 165.9858 | 109.6428 | 89.7497 |
| **Control Variables for Regressions in Panels A—C:** | | | | | |
| Controls for Individual Characteristics | No | Yes | Yes | Yes | Yes |
| Controls for Parental Characteristics | No | No | Yes | Yes | Yes |
| Controls for Household Characteristics | No | No | No | Yes | Yes |
| Controls for Rainfall at Marriageable Age | No | No | No | No | Yes |

Table 4A: Notes: (i) Controls for individual characteristics include age, age-squared, years of schooling, attendance at a religious school (dummy), and religion (dummy for muslim); (ii) Controls for parental characteristics include mother's schooling (dummy), father's schooling (dummy), father's ownership of farmland (dummy) and whether parents were alive at the time of a woman's marriage (dummy), the sex-ratio of parent's children and the number of sons alive at the time of a woman's marriage; (iii) Controls for household characteristics include whether the house has a dirt floor (dummy), a solid roof (dummy), the fraction of household members who have ever attended a religious school, the mean years of education of all household members and the mean number of cousin marriages among household members other than the woman and her husband (if applicable); (iv) Controls for Rainfall include deviations from average rainfall when the woman was of marriageable age, i.e. she was between 11 and 15 years old; (v) Standard errors are in parentheses, * significant at 10% level, ** significant at 5% level; *** significant at 1% level.

**Table 4B: Test of Negative Relationship Between Dowry Levels and Social Distance**

*Dependent Variable: Log of Value of Dowry*

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Panel A:** Married a first cousin | -.2297 | -.2332 | -.2119 | -.2156 | -.2156 |
| | (.0748)*** | (.0746)*** | (.0773)*** | (.0773)*** | (.0773)*** |
| N | 1411 | 1411 | 1411 | 1411 | 1411 |
| R-squared | .2856 | .3123 | .3413 | .3454 | .3454 |
| F-statistic | 9.4228 | 10.0115 | 6.8368 | 6.2314 | 6.2314 |
| **Panel B:** Married any relative | -.2370 | -.2286 | -.2249 | -.2319 | -.2319 |
| | (.0577)*** | (.0576)*** | (.0597)*** | (.0597)*** | (.0597)*** |
| N | 1535 | 1535 | 1535 | 1535 | 1535 |
| R-squared | .288 | .3134 | .3403 | .3444 | .3444 |
| F-statistic | 16.8634 | 11.6976 | 7.9041 | 7.1726 | 7.1726 |
| **Panel C:** Married non-relative in same village | -.1538 | -.2011 | -.1883 | -.1970 | -.1970 |
| | (.0568)*** | (.0565)*** | (.0579)*** | (.0579)*** | (.0579)*** |
| N | 1637 | 1616 | 1544 | 1543 | 1543 |
| R-squared | .2839 | .3125 | .3392 | .3431 | .3431 |
| F-statistic | 7.33 | 11.2813 | 7.6977 | 6.9699 | 6.9699 |
| **Control Variables for Regressions in Panels A—C:** | | | | | |
| Controls for Individual Characteristics | No | Yes | Yes | Yes | Yes |
| Controls for Parental Characteristics | No | No | Yes | Yes | Yes |
| Controls for Household Characteristics | No | No | No | Yes | Yes |
| Controls for Rainfall at Marriageable Age | No | No | No | No | Yes |

Table 4B: Notes: (i) All regressions included year of marriage fixed-effects; Notes (i)–(v) of Table 4A apply.

**Table 5A: Test of the Relationship Between Consanguinous Marriage and Wealth**
**Dependent Variable:** *Married a Relative*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| **Panel A: Farmland Value (/$10^6$)** | | | | |
| Farmland Value | -.2263 | -.3213 | -.2936 | -.2920 |
| | (.1463) | (.1621)** | (.1647)* | (.1633)* |
| Farmland Value Squared | .2815 | .3661 | .3393 | .3381 |
| | (.2024) | (.2169)* | (.2176) | (.2173) |
| N | 1376 | 1376 | 1376 | 1376 |
| R-squared | .0018 | .0124 | .0173 | .0182 |
| F-statistic | 1.2094 | 4.5391 | 3.2989 | 2.7313 |
| **Panel B: Father Completed Primary School** | | | | |
| Father completed primary school | .0175 | .0427 | .0420 | .0420 |
| | (.0252) | (.0253)* | (.0253)* | (.0253)* |
| N | 2910 | 2910 | 2910 | 2910 |
| R-squared | .0002 | .0176 | .0213 | .022 |
| F-statistic | .4849 | 10.4148 | 7.0201 | 5.4397 |
| **Control Variables for Regressions in Panels A and B:** | | | | |
| Controls for Individual Characteristics | No | Yes | Yes | Yes |
| Controls for Parental, Household Characteristics | No | No | Yes | Yes |
| Controls for Rainfall at Marriageable Age | No | No | No | Yes |

Table 5A: Notes (i)–(v) of Table 4A apply.

**Table 5B: Test of the Relationship Between Dowry and Wealth**
**Dependent Variable:** *Log of Value of Dowry (/$10^4$)*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| **Panel A: Father's Farmland Value (/$10^6$)** | | | | |
| Farmland Value | .1975 | .4666 | .4531 | .4642 |
| | (.2823) | (.2753)* | (.2658)* | (.2668)* |
| Farmland Value Squared | -.4560 | -.5485 | -.5297 | -.5417 |
| | (.2799) | (.2828)* | (.2844)* | (.2862)* |
| N | 1293 | 1293 | 1293 | 1293 |
| R-squared | .2839 | .3164 | .3212 | .3226 |
| F-statistic | 2.1621 | 9.133 | 6.4414 | 5.1231 |
| **Dependent Variable:** *Value of Dowry (/$10^4$)* | | | | |
| **Panel B: Father Completed Primary School** | | | | |
| Father Completed Primary School | .1522 | .1402 | .1401 | .1409 |
| | (.0674)** | (.0643)** | (.0651)** | (.0660)** |
| N | 1053 | 1053 | 1053 | 1053 |
| R-squared | .2218 | .2833 | .2855 | .2873 |
| F-statistic | 5.1023 | 6.1556 | 3.5938 | 2.8719 |
| **Control Variables for Regressions in Panels A and B** | | | | |
| Controls for Individual Characteristics | No | Yes | Yes | Yes |
| Controls for Parental, Household Characteristics | No | No | Yes | Yes |
| Controls for Rainfall at Marriageable Age | No | No | No | Yes |

Table 5B: Notes: (i) Regressions in panel B control for year of marriage fixed effects; Notes (i)–(v) of Table 4A apply.

**Table 6A: Test of the Relationship Between Cousin-Marriage and Age At Marriage**

| | Dependent Variable: *Married a Cousin* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Age at Marriage | -.0067<br>(.0024)*** | -.0059<br>(.0026)** | -.0057<br>(.0026)** | -.0056<br>(.0026)** |
| Controls for Individual Characteristics | No | Yes | Yes | Yes |
| Controls for Parental, Household Characteristics | No | No | Yes | Yes |
| Controls for Rainfall at Marriageable Age | No | No | No | Yes |
| Decade of Marriage Dummies | Yes | Yes | Yes | Yes |
| N | 2460 | 2460 | 2460 | 2460 |
| R-squared | .0031 | .0214 | .0244 | .0247 |
| F-statistic | 7.5349 | 66.0518 | 35.8306 | 26.7884 |

Table 6A: Notes: Notes (i)–(v) of Table 4A apply.

**Table 6B: Test of the Relationship Between Dowry and Age At Marriage**

| | OLS Results | | | | IV Results | |
|---|---|---|---|---|---|---|
| **Dependent Variable:** | *Value of Dowry* $(/10^4)$ | | | | Second Stage | First Stage |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Age at Menarche | | | | | | .6481<br>(.0317)*** |
| Age at Marriage | .0317<br>(.0026)*** | .0114<br>(.0027)*** | .0112<br>(.0027)*** | .0111<br>(.0027)*** | .0141<br>(.0065)** | |
| Controls for Individual Characteristics | No | Yes | Yes | Yes | Yes | Yes |
| Controls for Parental, Household Characteristics | No | No | Yes | Yes | Yes | Yes |
| Controls for Rainfall at Marriageable Age | No | No | No | Yes | Yes | Yes |
| Decade of Marriage Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 2702 | 2702 | 2702 | 2702 | 2702 | 2702 |
| R-squared | .0211 | .2893 | .2908 | .2909 | .282 | .1036 |
| F-statistic | 58.234 | 135.3083 | 75.8956 | 57.1396 | 63.8779 | 18.2484 |

Table 6B: Notes: (i) In the IV regressions, *Age at Marriage* was the instrumented variable and *Age at Menarche* was the instrument; Notes (i)–(v) of Table 4A apply;