The Economics of Consanguinity*

Quy-Toan Do† Sriya Iyer‡ Shareen Joshi§

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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, and that close-kin marriages are more prevalent at both extremes of the wealth distribution. An empirical analysis using data from Bangladesh delivers results consistent with the predictions of the model, lending strong support to our theory.

JEL Classification Code: J1, I1, O1

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†Development Economics Research Group. The World Bank. qdo@worldbank.org.

‡Corresponding author: Faculty of Economics. University of Cambridge. Sriya.Iyer@econ.cam.ac.uk

§Economics Department. University of Chicago. shareen@uchicago.edu

1 Introduction

Consanguineous marriage, or marriage between close biological relatives, is a social institution that is or has been fairly common (Bittles, 1994, Bittles et al., 1993, and Hussain and Bittles, 2000) throughout human history. 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, nearly half of all marriages are between first or second cousins (*New York Times*, Sept 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 kins are. The presumption that informal enforcement mechanisms are more likely to be avaiblable 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 severe, one family holds the other up, and may now prefer to invest in alternative opportunities.

[1] Despite the popularity of consanguinity 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).

To overcome this time-inconsistency, ex-ante transfers between families are hence viewed as the renunciation of control rights over assets in order to make investment commitments credible. 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 commitment 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 to make the payment at the time of marriage. Our model then predicts that consanguinity and dowries are substitutes as instruments to overcome or 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. Our comparative statics suggest that consanguinity will be more prevalent at the two tails of the wealth distribution. Poorer families are credit constrained, making consanguineous marriage an attractive alternative to costly dowry transfers. For wealthier families, the payment of dowries comes at a large opportunity cost of investment as more is at stake; this corresponds to the common view that consanguinity among the wealthy is often motivated by the wish to keep the land within the extended family (Bittles, 2001). We test our predictions using data from Bangladesh. Our data not only show a negative correlation between consanguinity and the payment of a dowry at the time of marriage, but also an inverted-U shaped relationship between consanguinity and wealth.[2]

Our framework shares the common property with Peters and Siow (2002) 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 respective sisters, in case 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 give dowries to daughters, while leaving bequests to sons. We instead model an *inter-familial* agency problem, in which grooms' families are principals and brides' families are agents. Becker (1991) 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 wife's bargaining power by increasing her threat point. This view however does not explain why such transfers should be taking

[2]Centerwall and Centerwall (1966), and Reddy (1993) previously observed a negative correlation between consanguinity and dowry payments.

place at the time of marriage, rather than later on during marital life. Moreover, none of the papers mentioned above explicitly address the practice of consanguinity.

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).[3] 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 (Bittles, 2001). 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). 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 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). 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).

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

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. 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).[4]

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.[5] 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, though it has shown declines elsewhere in South India, is still widespread in Karnataka, Tamil Nadu and Andhra Pradesh (IIPS and ORC 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.[6] The practice also seems to vary by religion. In India, 23.3 percent of all Muslim marriages which 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).[7]

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

[5]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.

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

[7]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).

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 and La Ferrara, 2003). On the other hand, shorter social distance makes ex-ante contracting between families easier. Close kins 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 $k \in \{i, j\}$ has an initial endowment of wealth w_k, and a pair (i, j) is characterized by social distance $d_{ij} \in [0, 1]$. We assume that brides and grooms are in equal number and have identical wealth distribution. The support of the wealth distribution is the interval $[0, w_{\max}]$. 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 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 2π) as depicted on Figure 1.

The timing of the economy is as follows:
- $T = 0$: Each individual chooses a prospective spouse. Couples (i, j) form when two individuals have chosen each other. A marriage contract is then signed between the respective families. A marriage contract consists of a net transfer from j to i, D_{ij} to be completed at signature of the contract, and an investment commitment (z_i, z_j) to be made in the following period.
- $T = 1$: investments are made, output is realized and consumption takes place

We make the assumptions that (i) marriage is always preferred to remaining single, and (ii) at $T = 1$, separation is too costly to be considered.

Investment and Preferences

Once married, both parties invest in a common production function $R(K_i + K_j, d_{ij})$, where K_i and K_j are investments made by i and j respectively. $R(.)$ is continuously differentiable over $[0, +\infty[\times [0, 1]$, $R(.)$ is increasing convex with respect to K with $\partial R/\partial K(.) > 1$, while increasing and concave with respect to d. Furthermore $\frac{\partial^2}{\partial K \partial d} R(.) = 0$. First, the marginal product of capital is assumed to be increasing, making investment between brides and grooms strategic complement. Second, the positive dependence on d captures the idea that when spouses are further away, they can diversify genes, hedge risks, or integrate their social networks, etc. Finally, more for simplicity than by necessity, separability between K and d is assumed. Besides, individuals have access to a storage technology with returns normalized to 1.

We now depart from symmetry between the two spouses. We assume that brides and grooms (or their families) value investment opportunities – investment in $R(.)$ versus storage – differently. To simplify our analysis as much as possible, we suppose that since a bride migrates to her husband's home at the time of marriage, the bride's family does not capture the entire outcome $R(K_i + K_j, d_{ij})$, but only an exogenously fixed fraction α such that $\alpha \frac{\partial}{\partial K} R(.) < 1$ on the interval $[0, w_{\max}] \times [0, 1]$.[8] Grooms $i \in I$ enjoy the following utility $U_i(K_i, K_j, d_{ij}) = R(K_i + K_j, d_{ij}) + w_i - K_i$, while brides $j \in J$ seek to maximize $U_j(K_j, K_i, d_{ij}) = \alpha R(K_i + K_j, d_{ij}) + w_j - K_j$.

Marriage Contracts and the Cost of Equity

A marriage contract specifies an investment commitment (z_i, z_j) and a dowry D_{ij}. When an investment commitment is made, it is binding. However, due to contract incompleteness, spouses cannot commit beyond the amount $(1 - d_{ij}) w_j$ where we recall that d_{ij} is the social distance between i and j. Such assumption captures the idea that depending on social distance, wealth in family j can be more difficult to observe by family i, hence more difficult to pledge. An alternate interpretation is that $(1 - d_{ij})$ measures a form of social capital. Thus, for each couple (i, j), a *feasible* marriage contract (z_i, z_j, D_{ij}) must satisfy for $k \in \{i, j\}$,

$$\begin{cases} z_k \in [0, (1 - d_{ij}) w_k] \\ z_i + D_{ij} \in [0, w_i] \text{ and } z_j - D_{ij} \in [0, w_j] \end{cases} \tag{1}$$

We also assume that the payment of dowries is costly. If an amount D is transferred by bride j, $\gamma(w_j) D$ is lost in the transaction. $\gamma(.)$ is a decreasing function of wealth w_j of bride j. We further assume that such function is continuously differentiable and convex, and $\lim_{w \to 0} w\gamma'(w) > 0$. We can think of $\gamma(w_j)$ as the interest rate charged when borrowing money to pay for the dowry. Richer families can pledge collateral more easily, hence enjoy lower interest rates (see e.g. Banerjee and Newman, 1993). We suppose that $[1 - \gamma(.)] \frac{\partial R}{\partial K}(.) \geq 1$, so that borrowing at high interest rates is always worthwhile.

First-Best, Constrained First-Best, and Equilibrium Outcome

The intuition underlying the first-best outcome, which maximizes aggregate payoffs, is quite straightforward. For each couple (i, j), the convexity of the production function implies that positive assortative mating will take place (see e.g. Kremer, 1993). Every "first-best" couple (i, j) is characterized by $w_i = w_j$ and, as dowry transfers are costly, $D_{ij}^{FB} = 0$ and $z_i^{FB} = z_j^{FB} = w_i = w_j$. If we instead restrict ourselves to feasible marriage contracts defined by (1), as $\gamma(.)$ is decreasing, positive assortative mating is still optimal, but dowry levels are now positive, and such that for every "constrained first-best" couple (i, j) with wealth w, the optimal contract is of the form $\{z_i, z_j, D_{ij}\} = \{[1 - d(w)] w, [1 - d(w)] w, d(w) w\}$ where $d(w)$ maximizes $R[2w - \gamma(w) dw, d]$ and

[8] Making α a function of the social distance between spouses will introduce additional interesting dynamics from which we will abstract for the moment.

thus satisfies first-order condition

$$\frac{\partial}{\partial d} R\left[2w - \gamma(w)\, d(w)\, w, d(w)\right] = \gamma(w)\, w \frac{\partial}{\partial K} R\left[2w - \gamma(w)\, d(w)\, w, d(w)\right]. \tag{2}$$

The second-order condition is then

$$\frac{\partial^2}{\partial d^2} R\left[2w - \gamma(w)\, d(w)\, w, d(w)\right] + \left[\gamma(w)\, w\right]^2 \frac{\partial^2}{\partial K^2} R\left[2w - \gamma(w)\, d(w)\, w, d(w)\right] \leq 0.$$

The solution is interior and the second-order condition is satisfied if $R(.)$ is concave enough in d, which we henceforth assume.

We now want to look at the decentralized equilibrium outcome of the marriage market. While we require equilibrium outcomes to be subgame perfect, we make the additional requirement that a couple $(i,j) \in I \times J$ is an equilibrium match if no third person is willing to offer a feasible contract to either i or j that strictly dominates the equilibrium contract. This refinement thus allows bilateral deviations. We now state the first result. Proofs and a more formal definition of the game and equilibrium concept are collected in the appendix.

Proposition 1: Any marriage market outcome characterized by $w_i = w_j$ and a social distance d_{ij} verifying (2) for any couple (i,j) is an equilibrium.■

We now dig more deeply into the intuition underlying the equilibrium of the marriage market. We will first argue that the institution of dowries mitigates an agency problem that arises between bride and groom, or alternatively between their respective families. Then, we demonstrate how consanguinity, by directly addressing the agency problem, acts as a substitute for dowries. Finally, we undertake some comparative statics with respect to the wealth of the spouses.

3.2 Time-Inconsistency and the Rationale for Dowries

We will show that there exists one equilibrium of the marriage market which is *as if* each bride j faced a matching function $W_j(x)$ where $W_j(x)$ is the pre-marriage endowment level of $j's$ bride, when j contributes a total of x into the relationship. Contribution x is divided between a commitment z, and a dowry D. We will show that such equilibrium exists, but for now, we just assume it does. 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 $x_j = w_j$.[9]

At the beginning of time $T = 1$, once the dowry has been transferred, each couple (i,j) is endowed with wealth $(w_i + D_{ij}, w_j - D_{ij})$ and assumptions made on parameter values imply that optimal investment levels are corner solutions: $(x_i, x_j) = (w_i + D_{ij}, z_j)$. For the groom, maximum

[9] $W_j(.)$ is generally not differentiable, but the proof of Proposition 2 in the appendix shows that the argument discussed here is still valid.

investment in the relationship is always privately optimal. However, on the bride's side, investment is willingly made if and only if

$$\alpha \frac{\partial}{\partial K} R\left[x_i + x_j - \gamma\left(w_j\right) D_{ij}, d_{ij}\right] \geq 1, \tag{3}$$

and as $\alpha \frac{\partial}{\partial K} R(.) < 1$, there is no incentive to invest more than the pre-commited level z_j.

The $T = 0$ optimization problem for prospective brides is then to propose a feasible marriage contract (z_j, D_{ij}) to groom i such that

$$\{d_{ij}, z_j, D_{ij}\} \in \arg \max_{\substack{0 \leq z \leq (1-d) w_j \\ 0 \leq z + D \leq w_j \\ 0 \leq d \leq 1}} \alpha R\left[W_j(z+D) + z + D - \gamma\left(w_j\right) D, d\right] - z - D \tag{4}$$

At the equilibrium point, i.e. when $W_j(w_j) = w_j$, the first-order conditions for interior solutions is given by

$$\alpha\left[1 - \gamma\left(w_j\right) + W_j'\left(w_j\right)\right] \frac{\partial}{\partial K} R\left[2w_j - \gamma\left(w_j\right) d\left(w_j\right) w_j, d\left(w_j\right)\right] = 1. \tag{5}$$

The optimal contribution level trades the opportunity cost of storage (normalized to 1) off against the benefits from being matched with a wealthier groom.[10] The left-hand side of (5) captures such benefit. The first term $\left[1 - \gamma\left(w_j\right) + W_j'\left(w_j\right)\right]$, 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 $W_j'\left(w_j\right)$. The $1 - \gamma\left(w_j\right)$ term reflects the fact that a decrease in total contribution first starts with a decrease in the dowry. The second term $\frac{\partial}{\partial K} R(.)$ translates these benefits in terms of marginal utility gains. Under the assumption that $\alpha\left[1 - \gamma\left(w_j\right) + W_j'\left(w_j\right)\right] \geq 1$, the solution hits a corner, and brides want to pre-commit $x_j = w_j$, so that investment is constrained-optimal.

Comparing with the $T = 1$ problem, we see that the bride (or her family) would like to commit at $T = 0$ an amount that she (or her family) 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 transfer after the marriage is celebrated.[11] Note that for the groom, the time-inconsistency problem is inherently the same, but it is just not binding. We close the argument by formally establishing this result.

Proposition 2: There exists an equilibrium of the marriage market such that $w_i = w_j$ and d_{ij} verifies (2), for each equilibrium couple, and such that off-equilibrium strategies support a reduced-form game in which each prospective bride j maximizes payoffs, taking the matching function $W_j(.)$ described above as given.■

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

[11] The source of time-inconsistency comes from the initial assumption that once marriage is celebrated at $T = 0$, separation is not an option.

Though the matching function $W_j(.)$ is not generally differentiable in w_j, proposition 2 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 βh, where β is a positive constant. The tradeoff captured by (5) hence applies similarly when β is large enough.

3.3 Credit Constraints and Consanguinity

Another dimension to look at 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 (2) :

$$\underbrace{\frac{\partial}{\partial d}R\left[2w-\gamma(w)\,d(w)\,w,d(w)\right]}_{\text{marginal cost of consanguinity}}=\underbrace{\underbrace{\gamma(w)}_{\text{dowry transfer cost}}\quad\underbrace{w\frac{\partial}{\partial K}R\left[2w-\gamma(w)\,d(w)\,w,d(w)\right]}_{\text{opportunity cost of investment}}}_{\text{marginal agency cost}}. \tag{6}$$

The left-hand side of (6) measures the marginal cost of consanguinity. By construction, we assumed that marrying close kins would have a direct negative effect on payoffs because families cannot diversify genes thus increase the risk of congenital diseases, have more limited ability to hedge risks across families (Rosenzweig and Stark, 1989), or put together their social networks for better access to credit or labor markets for example (La Ferrara, 2003). The right-hand side of (6) could be called the agency cost. Wealth is imperfectly observed and thus it translates into an agency problem, in which the groom is the principal, and the bride is the agent. Increasing the distance between spouses increases the agency problem, requiring a larger dowry to be paid. Thisimplies a larger dowry transfer cost, which is not invested and thus translates into an opportunity cost of investment.

We have so far described a marriage market failure for which consanguinity and dowries were two distinct mitigating devices. 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. And (6) addressed the optimal tradeoff between the two.

3.4 Wealth and Consanguinity

One implication of the analysis conducted so far is a comparative statics exercise. If we re-examine the right-hand side of (6), the tension between costs and benefits is driven by two factors the importance of which can vary with wealth. When the cost function $\gamma(.)$ and the production function $R(.)$ have appropriate properties, the tradeoff captured in (6) delivers interesting comparative statics. At low levels of wealth, the dowry transfer cost is large because credit constraints are more stringent, while at higher levels of wealth, the *opportunity cost* of investment dominates because more is at stake. Thus, consanguinity might be more prevalent at the two extremes of the wealth distribution. To see this more formally, let's apply the implicit function theorem to (6). Given that the second-order condition holds, we can determine the slope of the correspondence between distance and wealth levels as follows:

$$sgn\left[d'(w)\right]=-sgn\left\{\frac{2-d(w)\left[\gamma+\gamma' d(w)\,w\right]}{2-\gamma d(w)}\varepsilon_R\left[2w-\gamma d(w)\,w,d(w)\right]+1-\varepsilon_\gamma(w)\right\} \tag{7}$$

where $\varepsilon_\gamma(w) = -w\frac{\gamma'(w)}{\gamma(w)}$ captures the aforementioned cost-of-equity effect, while $\varepsilon_R(K,d) = K\frac{\partial^2}{\partial K^2}R(K,d) / \frac{\partial}{\partial K}R(K,d)$ measures the opportunity-cost effect. The function $\gamma(.)$ and its derivatives are taken at w. At low levels of wealth, (7) is mostly driven by ε_γ or cost of equity: poor families face very steep losses when raising cash to pay for the dowry, and thus gains of marrying close relative are large. On the other hand, when wealth levels increase, ε_R 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. We formalize this intuition in the following proposition:

Proposition 3: Suppose that:

- $\varepsilon_\gamma(.)$ is bounded and $\lim_{w\to 0}\varepsilon_\gamma(w) > 1$.
- $\lim_{K\to 0}\varepsilon_R(K,d) = 0$ and $\lim_{K\to\infty}\varepsilon_R(K,d) = +\infty$.

Then the relationship between social distance and wealth is inverted-U shaped.■

The conditions made in Proposition 3 ensure that (i) credit constraints are sufficiently stringent at low levels of wealth, and (ii) the opportunity cost of investment is sufficiently large at high levels of wealth. For instance, $\gamma(w) = 1/w^\gamma$ with $\gamma > 1$, and $R(K,d) = e^K + \beta \ln d$ would satisfy such a requirement. Under such circumstances, (i) consanguinity prevails among the poor because credit constraints make dowries unaffordable, and (ii) close-kin marriages are favored among the wealthy for whom larger opportunity costs of investment prohibit the use of dowries. This second result provides a theoretical foundation for the often cited explanation of consanguinity among the wealthy: in societies in which women inherit land, close-kin marriage is used to keep land and other productive assets within the extended family (Goody, 1986, Agarwal, 1994, Bittles, 2001, *The New York Times,* September 23rd, 2003).

4 Empirical Evidence from Bangladesh

In this section, we use data from Bangladesh to illustrate our findings. The data are drawn from the *1996 Matlab Health and Socioeconomic Survey*, or MHSS.[12] We also use climate data on annual rainfall levels in the Matlab area for the period 1950-1996.[13] 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. Eighty-five per cent or more of the people in Matlab are Muslims and the remainder are Hindus. Though it is geographically close to Dhaka, the area is relatively isolated and inaccessible to communication and transportation other than river

[12] collaborative effort of RAND, the Harvard School of Public Health, the University of Pennsylvania, the University of Colorado at Boulder, Brown University, Mitra and Associates and the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

[13] 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/.

transport. The society is predominantly an agricultural society, though 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 cousin-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.[14] 20 percent of ever-married women report marrying a relative. 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 in this paper. 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. 662 women (11 percent of all marriages) married a first-cousin.

Our first step in exploring the determinants of 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 cousins, marriages between relatives other than 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. In other words, the differences between circumstances at marriage for these groups of individuals allows us to examine whether a reduction in social distance through geographic proximity is similar to the reduction in social distance through kinship networks.

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, though there is no difference in the age at menarche for the four types of women, those women who marry their 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 cousins and/or relatives other than first-cousins are about 10 percentage points less likely to bring a dowry at the time of marriage. Third, women who marry first-cousins, relatives other than first-cousins and women who marry non-relatives within the village have been 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.

Next, we perform the same exercise 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

[14] 15 percent of men and only about 7 percent of women report 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).

presented in Table 1, panel B. Some of the same observations that we made for the women's sample can be made here as well. Two additional observations are noteworthy. In particular, men enter cousin-marriages 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 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.

Our next step in exploring the determinants of 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. 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 either.

4.2 Dowry and Consanguinity

A first test of the theoretical model involves examining the simple correlations between the payment of dowries and 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 does not 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 D of Table 4. Note that even when control variables are added to the regression, women who marry their 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 difference. It is interesting that marriage to non-kin within a village (Table 4, 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.

The relationship between dowry and consanguinity over time can be observed in Figure 2. 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). We hope to explore this issue in future work.

4.3 Consanguinity and Wealth

An informal test of the relationship between consanguinity and wealth comes from examining the differences in either inheritances or expectations of inheritances between the various types of marriages we consider here. Since this area is predominantly Muslim and since Muslim women may inherit property, we would expect women who marry their cousins to inherit or expect to inherit property from their families. Note that in Panel A of Table 1, women who marry their cousin are 5 percentage points more likely 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 property. Again, we find that marrying within the village does not have this effect and so again, geographic proximity fails to be a substitute for kinship in inheritance patterns.

In a second test of the theoretical model, we examine whether the relationship between cousin marriage and measures of wealth is non-linear and U-shaped. We first examine the non-parametric kernel density plots of cousin-marriage and proxies of pre-marital family wealth. Since the 1996 MHSS is a cross-sectional survey, information on pre-marital wealth levels is rather limited. Our first proxy is simply father's education. To the extent that a father's education is determined before his children marry, and to the extent that education is likely to be correlated with socioeconomic status, this measure will be a good proxy for permanent income and/or socioeconomic status of a household. If however, there is only a small variation across fathers, or if schooling quality has changed substantially over time, making "years of education" an insufficient measure of actual ability, this will be a poor measure of socioeconomic status. We thus also use a measure of landholdings as measure of socioeconomic status of a household. Since land markets in rural South Asia are known to be thin (UNDP, 2000), we rely on measures of current landholdings as a proxy for past landholdings. If current landholdings are increased as a result of inheritances that are affected by marital contracts, this measure will be an imperfect measure of socioeconomic status. As a final measure of socioeconomic status, we also use the current value of all assets owned by the household in which a woman resides (i.e. her husband's household). Though current income is likely to differ significantly from income at the time of marriage, we believe that in conjunction with the two other measures being considered here, this measure may nevertheless be useful.

The relationship between cousin marriage and socioeconomic status is presented in the three panels of Figure 3. Note that the U-shaped pattern emerges very strongly in all three cases. As a further test of our model, we look at the relation between the type of marriage (cousin, other relative, non-relative in same village) and the three measures of wealth and their squared values. For the U-shaped relationship to hold, we would expect each measure of wealth to take a positive coefficient, and its corresponding squared value to take a negative coefficient. Moreover, if the relationships are robust, we would expect the effects to be statistically significant even when controls for individual characteristics, family characteristics and rainfall at the time of marriage are included in the regression. Results are presented in Table 5. The results confirm our predictions.

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.

The theoretical model, and the empirical support for the model, makes several contributions to the literature on marriages in general. First, considering the high prevalence of consanguinity in many parts of the developing world, we believe the study of consanguinity considerably enhances the study of marriage markets in these societies. Second, we believe that focussing on the economic underpinnings of consanguineous marriage explains the seeming puzzle of why consanguineous marriage continues to take place in modern times in developing countries, despite the greater knowledge (such as 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 reassessment of the welfare implications of regulating marriage markets in such contexts.

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Appendix

Before jumping into the 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.

Timing and Strategies: Each groom i announces a contract profile $\{z_i(j), D_i(j)\}_{j\in J}$, where $z_i(j)$ is the amount committed by i in the relationship with j, and $D_i(j)$ is the transfer made from i to j. Similarly j announces a contract profile $\{z_j(i), D_j(i)\}_{i\in I}$. By convention, when no offer is made, we write $\{z, D\} = \varnothing$. We furthermore restrict ourselves to feasible contracts defined by (1) only. Then i and j announce a choice $j(i)$ and $i(j)$ respectively, and a couple (i, j) forms when $i = i(j)$ and $j = j(i)$. If an individual fails to find a spouse, his or her payoff is set to $-\infty$. A marriage contract between two spouses then consist of an investment commitment (z_i, z_j) such that $z_i = z_i(j(i))$ and $z_j = z_j(i(j))$, and a net dowry $D_{ij} = D_j(i) - D_i(j)$ is transferred from j to i. To simplify, we normalize $D_i(j) = 0$ and we set $z_i = w_i$ as the commitment constraint is never binding for grooms. A marriage contract thus pins down to the pair $\{z_j, D_{ij}\}$. Payoffs for each couple (i, j) are then $U_i(w_i, z_j, D_{ij}|d_{ij}) = R[w_i + z_j + D_{ij} - \gamma(w_j) D_{ij}, d_{ij}]$ and $U_j(w_i, z_j, D_{ij}|d_{ij}) = \alpha R[w_i + z_j + D_{ij} - \gamma(w_j) D_{ij}, d_{ij}] + w_j - z_j - D_{ij}$.

Equilibrium definition: A match profile $\{(i, j)\}_{i\in I, j\in J}$ with associated marriage contract profile $\{(z_j, D_{ij})\}_{i\in I, j\in J}$ 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_j, D_{ij}) and $(z_{\hat{\jmath}}, D_{\hat{\imath}\hat{\jmath}})$, and (i) either $\hat{\imath}$ proposes to j a feasible contract $\left(\hat{z}_j, \hat{D}_{\hat{\imath}j}\right)$ such that $U_{\hat{\imath}}\left(w_{\hat{\imath}}, \hat{z}_j, \hat{D}_{\hat{\imath}j}|d_{\hat{\imath}j}\right) \geq U_{\hat{\imath}}(w_{\hat{\imath}}, z_{\hat{\jmath}}, D_{\hat{\imath}\hat{\jmath}}|d_{\hat{\imath}\hat{\jmath}})$ and $U_j\left(w_{\hat{\imath}}, \hat{z}_j, \hat{D}_{\hat{\imath}j}|d_{\hat{\imath}j}\right) \geq U_j(w_i, z_j, D_{ij}|d_{ij})$ with one inequality holding strictly, (ii) or $\hat{\jmath}$ proposes to i a feasible contract $\left(\hat{z}_{h\hat{\jmath}}, \hat{D}_{i\hat{\jmath}}\right)$ such that $U_{\hat{\jmath}}\left(w_i, \hat{z}_{\hat{\jmath}}, \hat{D}_{i\hat{\jmath}}|d_{i\hat{\jmath}}\right) \geq U_{\hat{\jmath}}(w_{\hat{\imath}}, z_{\hat{\jmath}}, D_{\hat{\imath}\hat{\jmath}}|d_{\hat{\imath}\hat{\jmath}})$ and $U_i\left(\hat{z}_i, \hat{z}_{\hat{\jmath}}, \hat{D}_{\hat{\imath}\hat{\jmath}}|d_{i\hat{\jmath}}\right) \geq U_i(z_i, z_j, D_{ij}|d_{ij})$ with one inequality holding strictly.■

In other words, the equilibrium concept allows for bilateral deviations: in equilibrium, for every couple, there is no third individual who is willing to make an offer to one of the two members and the offer is accepted. Before moving to the proof of Proposition 1, we define for each w, $d(w)$, the solution to $\max_{d\in[0,1]} R[2w - \gamma(w) dw, d]$. We know that $d(w)$ exists and is unique as the second-order conditions are assumed to hold.

Proof of Proposition 1: To prove the proposition, let's take a couple (i, j) and an individual k who is making an offer to, say, i. Note that k is paired with l such that $w_k = w_l$ and d_{kl} satisfies (2). Suppose that $w_k > w_i$. We have $R[2w_k - \gamma(w_k) d(w_k) w_k, d(w_k)] \geq R[2w_k - \gamma(w_k) d_{ik} w_k, d_{ik}]$ $> R[w_k + w_i - \gamma(w_k) d_{ik} w_k, d_{ik}]$. The first inequality is due to the optimality of $d(w_k)$, while the second comes from the convexity of $R(.)$ with respect to its first argument: there is no feasible contract that k is willing to make to i. Symmetrically, if $w_k < w_i$, then no feasible contract proposed by k will be accepted by i. Finally, if $w_k = w_i$, and $d_{ij} \neq d_{ik}$, then, given that the optimality social distance is identical for both grooms and brides, neither i nor k can be better off being paired together. The exact same argument holds if k is a bride making an offer to j.■

Proof of Proposition 2: Let's consider the following strategies. For every groom $i \in I$, i is making the following announcement $\{z_i(j), D_i(j)\} = \{(1 - d_{ij}) w_i, 0\}$ for every $j \in J$. Similarly, for every bride $j \in J$, $\{z_j(i), D_j(i)\} = \{(1 - d_{ij}) w_j, d_{ij} w_j\}$. We can easily check that such strategy

profile leads to an equilibrium mating outcome such that for each couple (i, j), $w_i = w_j$ and $d_{ij} = d(w_i) = d(w_j)$.
Now take a bride $j \in J$, with wealth w_j. Suppose that j decides to reduce her commitment by an amount $h > 0$. This reduction will be a reduction in the dowry, as it is relatively more expensive. The set of individuals who are willing to accept a match with j is given by $\Gamma_j(h) = \{i \in I, R[w_i + w_j - h - \gamma(w_j)(d_{ij}w_j - h), d_{ij}] \geq R[2w_i - \gamma(w_i) d(w_i) w_i]\}$. For any groom $i \in \Gamma_j(h)$, the net investment made by j is then equal to

$$\begin{aligned} & w_i + w_j - h - \gamma(w_j)(d_{ij}w_j - h) \\ = \; & w_i + w_j - \gamma(w_j) d_{ij} w_j - h[1 - \gamma(w_j)]. \end{aligned} \tag{8}$$

Let's now set $\beta_j = \frac{1-\gamma(w_j)}{1-\gamma(w_j)-\gamma'(w_j)w_j}$. We know that $\beta_j \leq 1$, and $\beta_j > 0$ for any $w_j \in [0, w_{\max}]$. As $[0, w_{\max}]$ is compact, we set $\beta = \inf_j \beta_j$, and $\beta > 0$. The net investment for a couple with common wealth $w_i = w_j - h\beta$ is equal to

$$\begin{aligned} & w_i + w_j - h\beta - \gamma(w_j - h\beta) d(w_i)(w_j - h\beta) \\ = \; & w_i + w_j - \gamma(w_j) d(w_i) w_j - h[1 - \gamma(w_j)] & (9) \\ & + (1-\beta) h [1 - \gamma(w_j)] - [\gamma(w_j - h\beta) - \gamma(w_j)] d(w_i) w_j + o(h) & (10) \end{aligned}$$

where $o(h)$ is a continuous function of h such that $\lim_{h \to 0} \frac{1}{h} o(h) = 0$. The definition of β implies that (10) is non-negative. Comparing (8) and (9), and given the optimality of $d(w_i)$ with respect to bride i, we hence have $W_j(w_j - h) \leq w_j - h\beta + o(h)$ .Thus, for any $h > 0$, $\frac{W_j(w_j-h)-w_j}{h} \leq -\beta + o(1)$. If $W_j(.)$ is differentiable in w_j, then we have $W_j'(w_j) \geq \beta$, and we thus require that $\alpha(1 - \gamma(0) + \beta) \geq 1$. The tradeoff captured in (2) can now be written: there exists $\varepsilon > 0$, such that for any $h > 0$, if $h < \varepsilon$, then the marginal cost of decreasing total commitment by h is bounded below by

$$\begin{aligned} & \alpha \frac{1}{-h} \max_{d_{ij}} R[W(w_j - h) + w_j - h - \gamma(w_j)(d_{ij}w_j - h), d_{ij}] - R[2w_j - \gamma(w_j)(d(w_j) w_j), d(w_j)] \\ \geq \; & \alpha \left[1 - \gamma(w_j) - \frac{W(w_j - h) - w_j}{h} \right] \frac{\partial R[2w_j - \gamma(w_j)(d(w_j) w_j), d(w_j)]}{\partial K} + o(1) \\ \geq \; & \alpha [1 - \gamma(w_j) + \beta] \frac{\partial R[2w_j - \gamma(w_j)(d(w_j) w_j), d(w_j)]}{\partial K} + o(1) \end{aligned}$$

The marginal benefit of investing h outside the relationship being equal to rate of savings normalized to 1; the assumption that $\alpha[1 - \gamma(w_j) + \beta] > 1$ for every $w_j \in [0, w_{\max}]$ implies that the optimal solution for j is to choose $h = 0$. QED.■

Proof of Proposition 3: Taking expression (7) to the limit when $w \to 0$ and it converges to $\lim_0 \varepsilon_\gamma(.) > 1$. There exists $w_l > 0$ such that for any $w < w_l$, $d'(w) > 0$. Symmetrically, we have by assumption the property that $\lim_{w \to +\infty} \varepsilon_R[2w - \gamma(w) d(w) w, d(w)] = +\infty$ while $\varepsilon_\gamma(w)$ is bounded above. There exists $w_h > w_l$, such that for any $w > w_h$, $d'(w) < 0$. We then rescale the parameters of the model to ensure that $w_h < w_{\max}$. Thus $d(w)$ is increasing in the neighborhood of zero, while decreasing in the neighborhood $w_{\max}$. QED.■

Tables and Figures

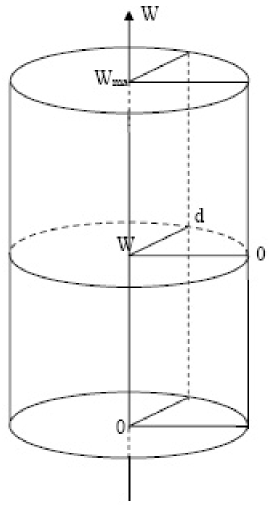

Figure 1: Distribution of Wealth and Social Distance

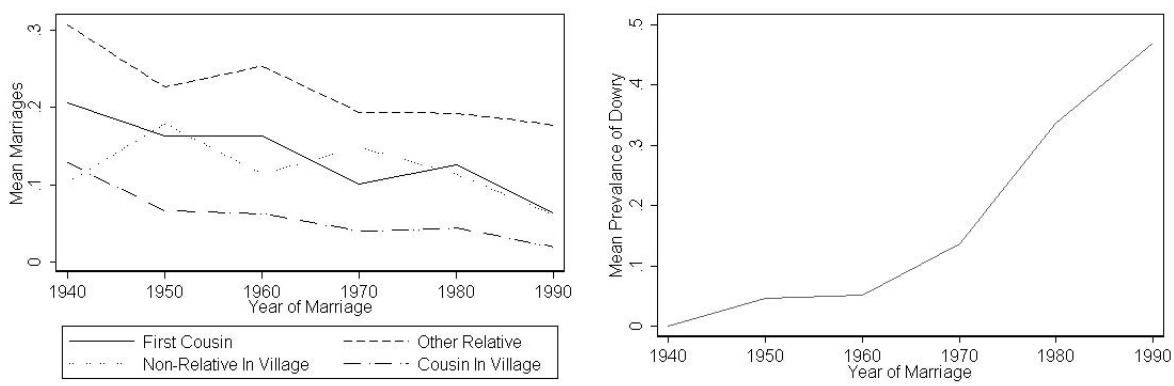

Figure 2: The prevalence of dowry, cousin-marriage, relative marriage, marriages between cousins in the same village and non-relatives in the same village. Responses are based on the sample of adult men.

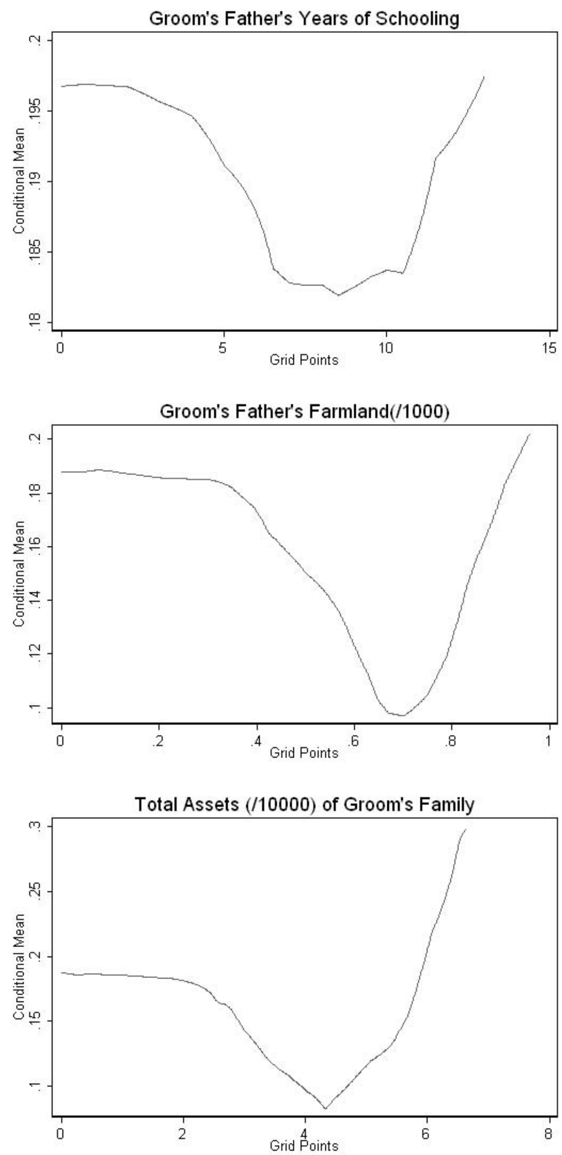

Figure 3: Test of the U-Shaped Relationship Between Cousin Marriage and Wealth.

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
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
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: Summary statistics of variables used in the regressions.

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

	Type of Marriage: Cousin	Relative	Village	CousAndVill		Type of Marriage: 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 4: 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
Panel (D): Married cousin in same village	-.0691	-.0706	-.0644	-.0629	-.0627
	(.0366)*	(.0306)**	(.0306)**	(.0306)**	(.0306)**
N	4122	4122	4122	4122	4122
R-squared	.0009	.3044	.3079	.3126	.3152
F-statistic	3.5741	300.0641	166.2595	109.786	89.8689
Control Variables for Regressions in Panels (a)—(d):					
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 4: 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 5: Test of the U-Shaped Relationship Between Cousin Marriage and Wealth

Dependent Variable: *Man Married a Relative*	(1)	(2)	(3)	(4)
Panel (a) Father's Years of Schooling:				
Father's Years of Schooling	-.1298	-.0292	-.0267	-.0281
	(.0909)	(.0923)	(.0922)	(.0923)
Father's Years of Schooling Squared	.1056	.0412	.0449	.0436
	(.1090)	(.1087)	(.1085)	(.1086)
N	2453	2453	2453	2447
R-squared	.0014	.0191	.0252	.0276
F-statistic	1.7542	7.949	6.3113	5.3044
Panel (b) Farmland ($/10^3$):				
Farmland	-.3590	-.3210	-.3185	-.3072
	(.1394)**	(.1464)**	(.1477)**	(.1491)**
Farmland Squared	.4437	.4277	.4275	.4056
	(.2184)**	(.2226)*	(.2237)*	(.2249)*
N	2436	2436	2436	2430
R-squared	.0028	.0211	.0273	.0296
F-statistic	3.4572	8.7178	6.7966	5.2683
Panel (c) Total Assets ($/10^4$):				
Total Assets	-.0725	-.0385	-.0375	-.0361
	(.0471)	(.0497)	(.0499)	(.0500)
Total Assets Squared	.0244	.0161	.0171	.0164
	(.0256)	(.0260)	(.0260)	(.0261)
N	2750	2750	2750	2747
R-squared	.0013	.0171	.0222	.023
F-statistic	1.7443	7.9685	5.6601	4.6032
Control Variables for Regressions in Panels (a)—(c):				
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 5: Tests for the hypothesis that cousin-marriage and measures of wealth have a U-shaped relationship. Notes (i)–(v) of Table 4 apply.