On the Heterogeneity of Dowry Motives*

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Abstract

Dowries have been modeled as pre-mortem bequests to daughters or as groom-prices paid to in-laws. These two classes of models yield mutually exclusive predictions, but empirical tests of these predictions have been mixed. We draw from historical evidence that suggests a bifurcated marriage market, in which some households use dowries as a bequest and others use dowries as a price. The competing theories of dowry allow us to structure an exogenous switching regression that places households in the price or bequest regime. The empirical strategy allows for multiple checks on the validity of regime assignment. Using retrospective marriage data from rural Bangladesh, we find evidence of heterogeneity in dowry motives; that bequest dowries have declined in prevalence and amount over time; and that bequest households are better off compared to price households on a variety of welfare measures.

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1 Introduction

In the last decade a sharp debate has emerged over the predominance of dowry in South Asia. With the historical knowledge that dowries tend to disappear as societies modernize, the persistence of substantial bride-to-groom marriage transfers has long been a puzzle for social scientists (Anderson, 2007). Recently, in the wake of increasingly male-favored sex ratios, and with dowries in South Asia representing upwards of several multiples of a bride's family's annual income (Suran, Amin, Huq, and Chowdury, 2004; Rao, 2007), accounting for dowry has attained a new urgency for scholars and policy-makers alike. Attempts to explain this puzzle have centered on the very understanding of what dowry represents: a price or a bequest.

First formalized by Becker (1981), the price model sees dowries as transfers between families, in which brides do not directly benefit. Such transfers may be necessary for a number of reasons. Cultural factors such as hypergamy (women marrying "up" the social ladder) or tendency for brides to marry older men (in the context of population growth) may create a perpetual scarcity of grooms, such that dowry emerges to draw high-quality men into the marriage market (Rao, 1993; Anderson, 2003). Else, if rules for division of household output are inflexible, and a woman's shadow price in the marriage market exceeds her share of income, dowry will emerge as an upfront transfer to equilibriate the marriage market (Botticini and Siow, 2003). Finally, greater heterogeneity in market earnings among men than among women may produce dowry as a mechanism by which brides attract high-quality grooms (Anderson, 2004). Regardless of their differences, these explanations share one feature: they are grounded in a model of dowry as a price that clears the marriage market.

A competing set of answers to the dowry puzzle, only recently formalized in the economics literature, views dowry as bequests, in which parents transfer their inheritance to daughters at the time of marriage. If there are institutional or legal barriers to women's ability to inherit property, particularly in virilocal societies (where daughters leave their natal household at marriage), dowry may emerge as a culturally-sanctioned method of bequest (Zhang and Chan, 1999). Alternatively, in virilocal societies, a pre-mortem bequest to daughters may emerge as a method of maintaining sons' incentive to exert full effort in maintaining their parents' estate (Botticini and Siow, 2003). Finally, if such societies are marked by poor protection of women in their in-laws' households, dowry may improve brides' outside option in a bargaining setting,

and thus mitigate the incidence of domestic violence and other forms of abuse (Brown, forthcoming). All of these explanations view dowry as a transfer to the daughter, and under her control, at the time of marriage.

The policy implications of this debate are critical: if dowries are bequests, they should be protected, as they represent culturally-sanctioned access to property for women (Kishwar, 1989; Goody, 1998). More generally, dowry as bequest can improve brides' consumption within in-laws' households, thereby improving women's welfare. If dowries are a groom-price, the practice of dowry should arguably be banned, particularly in South Asia, as it increases the perceived cost of raising daughters and thus may contribute to worsening sex ratios through selective abortion, infanticide, and differential child mortality by gender. To date, bans of dowry have taken the form of largely ineffectual "paper laws," but momentum is gaining among activists and policy-makers to make the prohibition of dowries bite, by publicizing regulations, increasing the penalties for violations, and making reporting to authorities more attractive (Setalvad, 1988; Menski, 1998; Basu, 2005).

With the stakes set so high, the empirical evidence is mixed. Large-sample surveys in South Asia typically do not directly ask respondents to identify the recipient of the dowry transfer, since groom-prices are technically banned. Researchers must therefore use indirect measures to assess the function of dowry. Such indirect tests, in South Asia and elsewhere, have yielded contrary results, sometimes within the same paper (see Table 1). Meanwhile, historians and anthropologists have argued that the system of dowry in South Asia has transformed over the recent decades from bequest to price—yet these studies typically rely on village case studies and small samples (Lindenbaum, 1981; Ahmed and Naher, 1987; Sharma, 1984).

We propose a simple explanation for the mixed results in the literature: heterogeneity in dowry motives, and develop a theoretical and empirical strategy to deal with this heterogeneity. All prior large-sample studies take a particular model of dowry as given, regress dowry amounts on bride, groom and marriage market characteristics, and infer support for the model from the sign of estimated coefficients on theoretically "important" variables. In the presence of heterogeneity, however, such a strategy is misguided, precisely because average coefficients are uninformative as to the actual functioning of dowry. By acknowledging instead that both models may hold—for different subsets of the population—we use their theoretical predictions to structure a switching regression model with unknown sample separation to sort the

marriage market into "bequest households" and "price households." More precisely, we use the theories to help predict households' probability of regime membership and estimate a probability-weighted dowry function for each regime.

There are four central findings. First, using retrospective data from the 1996 Matlab Health and Socioeconomic Survey, we find evidence of two dowry regimes in rural Bangladesh. Of marriages from 1920 to the present in which a dowry was given, more than a quarter used dowry as bequest. Second, the function mapping bride household, groom household, and marriage market characteristics to dowry amounts (the dowry function) differs significantly between regimes. Third, dowries increasingly serve as a groom-price, and while bequest dowries are falling in size, price dowries are rising. We fail, however, to find evidence of a "marriage squeeze" driving dowry inflation. Finally, bequest households are considerably better off—in schooling, assets, and other measures of welfare—than price households.

Beyond the relevance to dowry, our paper presents a methodology that may be fruitfully adopted in other settings where there is more than one model and no clear victor. Our strategy builds on studies which tackle potential sources of heterogeneity by using theory to structure an empirical switching regression framework.[1] However, rather than rely on a single characteristic as the predictor of regime membership, we utilize a number of predictions from the competing theories, thus enabling each estimate to serve as a validity check on the others. We also utilize a novel type of prediction of regime membership: a "non"-membership prediction, indicating the likelihood that an observation does *not* fall within a given regime. This technique may prove useful in other settings—such as the study of separability of household production from consumption—where economic models readily generate predictions of non-membership in a regime. Finally, employing non-membership predictions (in the switching equation) as well as predictions regarding regime specifications (in the regime equations) allows for multiple robustness checks as different assumptions are relaxed.

[1]Recent examples of this approach include Kopczuk and Lupton (2007), which investigates heterogeneity in bequest motives of the elderly; Vakis, Sadoulet, de Janvry, and Cafiero (2004), which looks at heterogeneity in the separability of household consumption from production; and Guo (2008), which considers heterogeneity in constraints affecting financial market participation.

2 Two Theories of Dowry

To structure the empirical analysis, we extract predictions from the two models of dowry: dowry as price and dowry as bequest.

2.1 Price Model

Since Becker's (1981) first formal statement of the price model, a number of authors have developed various theoretical predictions for aspects and effects of dowries (Rao, 1993; Grossbard-Shechtman, 1993; Sen, 1998; Mukherjee, 2003; Dasgupta and Mukherjee, 2003; Anderson, 2003, 2004; Dalmia, 2004; Tertilt, 2005; Mukherjee and Mondal, 2006). We consider Rao's (1993) simple version of the price model, which displays many shared properties of this class of models while generating a number of useful predictions which we take to the data. The critical feature of price models, for our purposes, is that the dowry is transferred from the bride's family to the groom's family to equilibriate the marriage market. As such, the price theory of dowry yields a dowry function that maps characteristics of the bride, groom, and their respective families, as well as underlying features of the marriage market, to a dowry amount.

Marriage decisions are made by the parents (the "family") of each spouse. Each family chooses a spouse for their child to maximize utility. The groom's family (indexed by G) has utility $U_G = U_G(c_G, w_S, w_D)$, where c_G is parental consumption and w_S is the son's wealth. The groom's parents choose w_D, the wealth of their desired daughter-in-law, to maximize utility subject to the budget constraint $c_G = w_G + \tau(w_D; w_S, R)$, taking w_G (the groom's parents' pre-transfer wealth), w_S, R, and $\tau(\cdot)$ as given. R is a shifter of the dowry function that is not related to the individual bride or groom's household (for example, sex ratio, year of marriage, region, etc.). Here, $\tau(\cdot)$ is a function mapping each prospective bride to a transfer that sustains the match, given w_S and R. The solution to this problem yields a schedule of transfers, D_G, that sustain each bride-groom pairing acceptable to the groom's parents (analogous to an inverse demand function): $D_G = D_G(w_D, w_S, w_G, R)$. The bride's family (indexed by P) faces a similar problem, except that they pay the transfer. They choose w_S to maximize their utility $U_P = U_P(c_P, w_D, w_S)$ subject to the budget constraint $c_P = w_P - \tau(w_S; w_D, R)$, taking w_P, w_D, R and $\tau(\cdot)$ as given. Again, the solution yields a schedule of transfers that sustain each bride-groom pairing acceptable to the bride's parents: $D_P = D_P(w_D, w_S, w_P, R)$.

In equilibrium, the marginal utility of the spouse traits to consumption, for both bride and groom families, will be equal:

$$\frac{\frac{\partial U_G}{\partial w_D}}{\frac{\partial U_G}{\partial c_G}} = \frac{\frac{\partial U_P}{\partial w_S}}{\frac{\partial U_P}{\partial c_P}}$$

At any value of R, a bride-groom pairing can only be sustained in equilibrium when $D_G = D_P$. This yields a dowry function—a schedule mapping each bride-groom pair to an equilibrium transfer: $D^* = D^*(w_D, w_S, w_P, w_G, R)$. In this setting, every bride-groom combination is feasible given the appropriate dowry, since we have not restricted transfers to be non-negative.

The price model gives us four key predictions that we take to the data. The first two predictions allow us to predict regime membership. First, the dowry that sustains any particular couple is determined by the characteristics of the bride and her family (a vector W), the groom and his family (a vector H), and a vector R of parameters such as sex ratio that "shift" the dowry function. In reduced form, we can write:

$$D_\Pi = g_\Pi(H, W, R) \tag{1}$$

where D is dowry amount, $g(\cdot)$ is the dowry function, and Π indexes the price regime.

Second, we should expect that no dowry is transferred in a love (or "self-arranged") marriage. This prediction has a long history in the literature on marriage transfers, going back to Goode (1963) and Becker (1981) and recently discussed by Dasgupta and Mukherjee (2003) and Edlund and Lagerlöf (2004). Most simply, in a love marriage the selection of the spouse is made by bride and groom, not by their parents, as the price model requires. Furthermore, such a marriage will not be under the same market pressures present in the implicit dowry market. That is, the price model views dowry as a tool whereby parents of daughters secure alliances with high-quality in-laws. Love marriages, where parents are not the decision-makers, should see no dowry transferred. This second prediction is a non-membership prediction, in the sense that if we observe a positive dowry being transferred, we should think it less likely to be in the price regime.

The third prediction refers to salient features of the dowry function itself. Rather than utilizing it in assigning regime membership, we will consider this prediction as we assess the empirical validity of our empirical results. The third prediction

from the price model is that ceteris paribus, dowry amount moves inversely with bride's "positive" characteristics (or "quality") and positively with groom's "positive" characteristics. These features may include human capital attainment, ability to make economic contributions to groom's household (Becker, 1981; Behrman, Foster, Rosenzweig, and Vashishtha, 1999), and non-economic characteristics such as caste (Anderson, 2003). In short, attributes substitute for dowry amount.

2.2 Bequest Model

The bequest theory does not merely view dowry as an intergenerational transfer—the idea is that in dowry-giving societies, inheritance is given to a son at the time of parents' death but to a daughter upon her marriage. Key to such a model is the notion that some friction prevents daughters from inheriting upon their parents' death. Most scholars stress the combination of virilocality and poor property rights: since women face barriers to inheriting after moving to their in-laws' household, they must receive their inheritance at marriage.[2]

While the bequest explanation has a long tradition in anthropology (Tambiah, 1973, for example), only recently have economists developed the notion that dowry functions as pre-mortem inheritance into models that can be estimated (Zhang and Chan, 1999; Edlund, 2001; Botticini and Siow, 2003; Suen, Chan, and Zhang, 2003; Brown, forthcoming). Of these papers, only Botticini and Siow (2003) nests the model of dowry as bequest within a marriage market, so that a premarital transfer to the daughter automatically improves the groom she attracts. We draw from this insight in developing the model below.

Using subscripts P for bride's parents, D for the bride, and S for the son-in-law, the bride's parents derive utility U_P from her marriage such that: $U_P = U(c_P, c_D, c_S)$, a function increasing and concave in all arguments. Here, c_P is consumption of the parents; c_D is the "marital wealth" of the daughter (the wealth that she brings into her marriage), and c_S is the marital wealth of the son-in-law. Parents maximize utility by choosing the size of the dowry transfer τ, which is made to the daughter. The parental budget constraint is: $c_P = w_P - \tau$, where w_P is the parent's pre-transfer

[2]Botticini and Siow (2003) also stress virilocality's centrality to the existence of bequest dowry, but posit that parents' imperfect monitoring of their *son's* effort forces an inefficient pre-mortem bequest to their *daughter* in order to properly incentivize the son's management of the household.

wealth, and τ is constrained to be non-negative.[3]

Turning to the daughter, the first key feature of the model is the assumption, following Lam (1988); Peters and Siow (2002) and Botticini and Siow (2003), that a bride's characteristics, such as age, education, and number of siblings, are exogenously mapped by the marriage market to a scalar which we call "pre-marital wealth". That is, we can write: $w_D = f(X_D)$, where w_D is her pre-marital wealth and X_D is a vector of characteristics. This mapping allows us to state the "marital wealth" c_D that the daughter brings into her marriage as: $c_D = w_D + \tau$.

Next, we consider the groom. The second key feature of the bequest model is the choice of dowry amount must be nested within a assortative matching framework. Since brides and grooms can be ranked by marital wealth, each woman of marital wealth c_D attracts a groom of marital wealth $c_S = h(c_D)$, where the existence of the weakly-monotonic mapping $h(\cdot)$ follows from assortative mating.[4] Substituting, the bride's parents choose τ to maximize: $U_P = U(w_P - \tau, w_D + \tau, h(w_D + \tau))$. In the interior, the optimal τ^* gives:

$$\frac{\partial U}{\partial(w_P - \tau^*)} = \frac{\partial U}{\partial(w_D + \tau^*)} = \frac{\partial U}{\partial(h(w_D + \tau^*))} \tag{2}$$

In addition, the non-negativity constraint on τ yields a possible corner solution $\tau^* = 0$.

By the monotonicity of $h(\cdot)$, equation (2) identifies τ^*. In other words, since son-in-law's marital wealth is simply a function of the daughter's marital wealth, the choice of dowry amount will not depend on the son-in-law's wealth. We can thus write a schedule of optimal dowry amounts τ^* as a function only of parents' and daughter's pre-marital wealth: $\tau^*(w_P, w_D) = \tau^*(w_P, f(X_D))$. In this setting, unlike in the price model, bequest dowry cannot substitute for groom's characteristics. An attempt by the bride's parents to secure a superior son-in-law can only occur by improving the daughter's marital wealth.

This result gives us a valuable "reduced-form restriction" which we use in the estimation:

$$D_B = g_B(W) \tag{3}$$

[3]While we do not formally model the source of the non-negativity constraint on bequests, it arises naturally out of capital market imperfections which prevent daughters from borrowing before marriage. Baland and Robinson (2000) make this point in a different context.

[4]Existence of equilibrium in wealth matching models is shown in Peters and Siow (2002).

where B indexes the bequest regime and $g_B(\bullet)$ is the dowry function. That is, the dowry amount in the bequest regime depends solely on W, the vector of characteristics of the bride and her family (including X_D and w_P).

Furthermore, the logic of the bequest theory yields a number of non-membership predictions that describe the characteristics of marriages in which no dowry should be observed. First, no dowry should be observed if the bride remains within the household after marriage, since virilocality combined with the cessation of daughters' ability to inherit drive the inefficient pre-mortem bequest. Second, if the bride's parents have died before her marriage, we should see no dowry at marriage; since daughters face no barriers to inheritance before moving away, they will have already inherited. Third, if the bride has been previously married, since she will have received her bequest at the time of her first marriage. Finally, the Botticini and Siow (2003) model offers an additional prediction: no dowry will be given to a bride who has no brothers of the age of majority at the time of marriage.[5]

The bequest theory also offers a prediction about the nature of the dowry function: ceteris paribus, dowry amount moves inversely with the bride's number of brothers of the age of majority. In the bequest theory, sons do not "attract" dowry from their in-laws—thus, each brother represents another drain on the inheritance pool.

While we have focused on the differences between the two classes of models, Botticini and Siow's (2003) insight that bequest dowry will affect assortation demonstrates an important commonality: in both the price and bequest framework, ceteris paribus a higher dowry will be observed in matches with higher quality grooms. This prediction in turn renders problematic previous attempts to test the bequest model. Such attempts have adopted a "welfare" approach; under the assumption that only bequest dowries will serve to increase wife's welfare, the empirical strategy has been to regress measures of bride's welfare on dowry amount and a number of controls (Zhang and Chan, 1999; Suran, Amin, Huq, and Chowdury, 2004; Esteve-Volart, 2004; Brown, forthcoming).[6] However, this is not a viable test of the bequest model.

[5]If a bride has no brothers (or if her brothers are below the age of majority at the time of her marriage), the incentive problem that forces an inefficient pre-mortem bequest is vitiated. Any bequest will be given upon her parents' death or at the time when any brother reaches the age of majority and assumes responsibility for managing the parents' estate.

[6]The reasoning, although not always explicitly stated, is that dowry improves the bride's welfare by increasing the overall amount of resources available to her (new) family, as well as by improving her threat point or bargaining position within the marriage. Zhang and Chan (1999) uses whether a husband helped with the chores as a measure of wife's welfare; Brown (forthcoming) expands the

If, for example, we accept Zhang and Chan's (1999) hypothesis that characteristics such as husbands' willingness to help with the chores are valued by brides' families, then such measures would also increase the price of a groom in the price model. As such, a confirmation of the bequest model using the "welfare" approach is no more than a confirmation that *either* the price or bequest theory holds. Our approach is therefore to avoid direct measures of welfare, instead focusing on the aspects of the theories in which their predictions diverge.

3 Heterogeneity of Dowry Motives

We argue in this section that the bulk of the historical and anthropological evidence points toward two models of dowry: bequest *and* price. More precisely, we argue that the existing evidence motivates a model of a bifurcated marriage market, in which some unknown fraction of households only use dowries as bequests (the "bequest regime"), and the rest use dowries as a price (the "price regime"). The theoretical predictions drawn from the two models of dowry allow us to structure the empirical framework in the following section.

3.1 Historical and Anthropological Evidence

The earliest reference to dowry in South Asia dates almost two millenia ago—when Manu decreed *stridhan* [dowry] to represent the "sixfold property of a woman" (Oldenburg, 2002). The origins of dowry in South Asia almost certainly lie in a system of premortem inheritance, but most scholars document a gradual transformation of dowry from bequest to price beginning sometime in the late nineteenth century (Tambiah, 1973; Srinivas, 1984; Banerjee, 1999).[7] At any given point in time, however, there is evidence of heterogeneity of opinion about dowry. Some nineteenth century observers viewed dowry as an unambiguous bequest: "[I]f the daughter receives something at the time of her marriage," a Bengali defender of dowry wrote in 1887, "then

indices of welfare to include household consumption of women's goods; Esteve-Volart (2004) tests Becker's (1981, pg. 28) observation that one function of dowry is to protect women from divorce; and Suran, Amin, Huq, and Chowdury (2004) looks at levels of reported domestic violence.

[7]Considerable evidence from other dowry-giving societies around the world similarly points to the coexistence of bequest and price dowries, and the transformation from bequest dowries to price dowries over time (Kaplan, 1985; Nazzari, 1991).

is that not a good thing? When the father is compelled to spend money for his daughter, and that sum accrues to the in-laws or to the bridegroom, in the ultimate analysis the daughter is the principal beneficiary" (cited in Majumdar (2004, pgs. 445-446)). In precisely the same period, critiques of dowry began to proliferate, particularly in Calcutta, all citing the language of the marketplace to describe the increasing "price" of grooms (Majumdar, 2004).

Anthropologists' accounts, generally drawing from long-term fieldwork in a small number of villages, likewise reflect considerable heterogeneity in dowry motives, both in the assessment of scholars and in the views of their informants. One anthropologist who conducted fieldwork in Himachal Pradesh and Punjab during the late 1970s reported that her informants (mostly Hindu) saw dowry as a pre-mortem inheritance to daughters, yet her own observations led her to conclude that dowry amounts moved as a price in a marriage market (Sharma, 1984, pg. 351). Another, conducting fieldwork in the 1980s among urban Protestants in Madras, found that respondents overwhelmingly perceived dowry as a groom-price, noting that dowry amounts fell with aspects of a bride's perceived quality (Caplan, 1984).[8] As with the historical evidence, anthropological accounts almost universally document a transformation of dowry from bequest to price. This trend is evident in Comilla, the district of Bangladesh from which our survey data comes. As early as the 1950s, a new form of marriage transfer emerged in which potential grooms detailed the list of items they would accept in exchange for marriage—these payments were often called by the English word "demand," reflecting the price motive of the dowry (Lindenbaum, 1981; Kabeer, 2001).

Concomitant with the transition in the function of dowry, anthropological work indicates a change in the form of payment. As bequest dowry declined in prevalence, dowries increasingly began to be paid in cash, over which brides rarely exercised control in their in-laws' household (Sharma, 1984; Caplan, 1984). While the data we use does not include information about respondents' control over different types of dowry, survey data from elsewhere in South Asia support this generalization.[9]

[8]Such discussions abound in South Asian literature. For instance, early in Kamala Markandaya's 1954 *Nectar in a Sieve*, a South Indian mother assesses potential grooms for her daughter: "At last we found one who seemed to fulfill our requirements: he was young and well favoured, the only son of his father from whom he would one day inherit a good portion of land.

'They will expect a large dowry,' I said regretfully. 'One hundred rupees will not win such a husband, we have no more.'

'She is endowed with beauty,' Old Granny said. 'It will make up for a small dowry—in this case.' " (New York, John Day, pgs. 39-40).

[9]The Survey on the Status of Women and Fertility in Uttar Pradesh and Tamil Nadu (Smith,

In sum, a survey of the historical and anthropological evidence on dowry points not only to heterogeneity of dowry motives, but establishes that there are two (and only two) predominant explanations for the function of dowry, which correspond to our price and bequest models. Furthermore, the literature provides two claims we use as checks to the validity of our empirical results. First, dowry as bequest has been declining in prevalence over time. Second, dowries as bequests are less likely to be cash-only, since cash is not a resource over which brides exercise control within the in-laws' household.

3.2 Marriage Market Heterogeneity

The historical and anthropological evidence points to a simple model of a bifurcated marriage market in which a fraction α of households only give dowry as a bequest to brides. In this group, the dowry of each household is given by the function $g_B(\bullet)$ given in equation (3), which maps the household's characteristics to a dowry amount. The rest of the households, fraction $1-\alpha$, never give a bequest to the daughter at the time of marriage—among these households, if dowry is given, it serves as a transfer that equilibriates the marriage market. The function $g_\Pi(\bullet)$ given in equation (1) maps the characteristics of both sides, and of the marriage market as a whole, to a dowry amount. Without knowledge of "regime membership", any estimate of the dowry function will be biased—indeed, the estimated coefficient on any given regressor may lie outside the range of true coefficients in *both* regimes (Morduch and Stern, 1997).

There are two important restrictions placed by this simple framework. First, there are only two dowry functions. Here, we note that the price and bequest models represent the only major theories of dowry in the anthropological, historical, and economics literature—furthermore, these two explanations subsume all explanations given by participants in the dowry system. Dowries cannot simply be explained as traditional behavior, since dowry amounts fluctuate dramatically over time, and since in many places (including Matlab, as noted above) dowry is a recent phenomenon, emerging only in this century. Likewise, unlike wedding celebrations (Bloch, Rao, and

Ghuman, Lee, and Mason, 2000) asked randomly-sampled brides about the control they exercise over different forms of dowry. In marriages where cash dowry was given as dowry, fewer than 10% of respondents reported that they had the "major say" in how the cash was spent, and more than 70% reported that they had no say at all. In marriages where jewelry, gold, or silver was given, more than 47% of respondents reported that they had the major say in how it was used or whether it could be sold, while fewer than 25% reported that they had no say at all.

Desai, 2004), in rural Bangladesh dowry transactions are made privately and amounts are often kept fairly secret (Suran, Amin, Huq, and Chowdury, 2004), so that status is an unlikely candidate to explain dowry amounts.

Second, we restrict any given marriage to fall within one regime, and do not allow households to choose regimes. This decision is based on the historical evidence, which points to the function of dowry as culturally-given to families at any given time. The underlying idea is that any individual household at a point in time exists within a given dowry system. In this sense, unlike union membership for example, the dowry system is no more "chosen" by families than they "choose" to be liquidity constrained (Garcia, Lusardi, and Ng, 1997). Theoretically, it also makes sense to consider the regimes as distinct. The key theoretical difference between the price and bequest models is that households in the latter face a constraint in securing property of inheritance for daughters. Empirically, we would think that a similar problem would emerge if a bequest household attempted to arrange a match with a price household—how would bequest parents be assured that the part of the dowry earmarked as bequest is not expropriated? Under the reasonable assumption that in-laws discuss dowry before the match, bequest parents will take care to match with other households in the bequest regime. The threat of social sanctions in the context of a rural marriage market lends weight to the claim that bequest dowries were not "transformed" into price dowries by the groom's family.[10]

4 Empirical Strategy

The goal of our empirical strategy is to answer four questions regarding heterogeneity in dowry motives. First, are there both bequest and price households in the data? Second, how many households use dowry as bequest versus as price? Third, what characteristics can identify whether a given household uses dowry as bequest versus as price? Fourth, what are the dowry functions, which map characteristics to dowry amounts, in each regime?

The econometric model we employ is an exogenous switching regression with unknown sample separation. Switching regressions were introduced to economics by

[10]There is some evidence of a rise in post-marital extortion of dowry beginning around the late 1990s—after our 1996 survey (Suran, Amin, Huq, and Chowdury, 2004), a practice which may have spread from India (Bloch and Rao, 2002).

Quandt (1958) and have been refined subsequently (Goldfeld and Quandt, 1976; Dickens and Lang, 1985; Lee and Porter, 1984). First, in the presence of heterogeneity, testing each theory's predictions about the specific nature of the dowry function is only feasible once regime membership has been determined. If subsets of the data are produced by distinct but unknown data generating processes, switching regressions are used to classify the observations into their respective regime. We write a three-equation system that involves two regime equations (one for bequest and one for price), and a switching equation that assigns to each household a probability of being in each regime. The system is solved using a maximum likelihood procedure.

Ultimately, the switching regression approach allows us to address our central empirical questions. First, the estimated coefficients in the switching equation identify characteristics that place households in each regime. Second, we use the estimated probability of regime membership to slice the sample into "more likely bequest" and "more likely price" households and then compare their characteristics. Finally, the estimated coefficients in the regime equations identify a dowry function for each regime, using all observations in the sample (where each observation is weighted by its estimated probability of membership in that regime).

Two recent papers share our concern for considering heterogeneity of dowry motives, but attack the problem differently: both posit historical reasons for taking the sample separation as known (Anderson, 2004; Esteve-Volart, 2004).[11] We view our contribution as complementary but methodologically distinct. First, our framework allows us to test for the very existence of two dowry functions, by comparing the two-regime specification to one in which all households are pooled. Second, our placement of marriages into regimes is grounded in theory, rather than in historical evidence, allowing us to use historical predictions as separate validity checks on our results. Third, by sorting households based on observed behavior, we can examine the characteristics of households in each regime, rather than assigning households to regimes by construction. This allows us to test, for example, the claim of opponents to dowry bans that bequest households are poorer than price households.

[11] Anderson (2004) separates the sample of Pakistani households into rural and urban; Esteve-Volart (2004), using the same dataset as the one used in our paper, separates the sample into Hindu and Muslim. Both papers estimate separate dowry functions by subsample, and conclude on the basis of parameter estimates that dowry indeed functions differently in the groups.

4.1 Specification

An advantage of the plenitude of predictions given by the theoretical models is that we can use several separate predictions at once, thereby simultaneously estimating the model and assessing the validity of regime placement. In so doing, we hope to address a common skepticism levied at switching regressions as asking too much of the data when sample separation is unknown (Jappelli, Pischke, and Souleles, 1998). The main specification draws on the most information from theory. We restrict the sample to positive dowries, which justifies including the non-membership prediction variables in the switching equation. Simultaneously, we draw from the reduced form theoretical result that, in bequest households, marriage market and groom-side variables do not affect the dowry amount. Marriage market as well as bride and groom characteristics (as well as characteristics of their families) enter the switching and price equations, but only bride family characteristics enter the bequest equation. We check our results against the historical and anthropological predictions that bequest dowries are on the decline and are less likely to be given as cash-only. Finally, we relax the theoretical restrictions to gauge the robustness of the results.

We represent dowry amount in the price regime as D_Π and in the bequest regime as D_B. The vector $x \equiv \{H, W, R\}$ contains all characteristics of the marriage that are theorized to affect dowry amount: characteristics of the bride and her family (W); characteristics of the groom and his family (H); and features of the marriage market at the time of marriage (R). The econometric model is a three-equation system:

$$\begin{aligned} \text{Price regime:} \quad & D_\Pi = x_\Pi \beta_\Pi + \epsilon_\Pi \\ \text{Bequest regime:} \quad & D_B = x_B \beta_B + \epsilon_B \\ \text{Switching equation:} \quad & \lambda^* = z\beta_\lambda + \epsilon_\lambda \end{aligned}$$

The parameter vectors of interest are β_Π, β_B, and β_λ. Here, D_Π, D_B, and λ^* are latent. Only the dowry amount D is observed, given by:

$$D = \begin{cases} D_\Pi & \text{if} \quad \lambda^* < 0 \\ D_B & \text{if} \quad \lambda^* \geq 0 \end{cases}$$

We will turn to the identification of the model in a moment. First, let us consider the variables that enter each equation. In the price regime, groom-side, bride-side,

and marriage market characteristics enter the dowry function. However, using the reduced-form restrictions derived from theory, we constrain the bequest regime equation to include only bride-side variables. Once the bride's characteristics and the dowry amount are known, the knowledge of groom's characteristics do not add any additional information, and should be excluded from the estimation. This approach of applying theoretical constraints to one regime mirrors the empirical strategy adopted by Vakis, Sadoulet, de Janvry, and Cafiero (2004). This gives:

$$\begin{aligned} x_{\Pi} &= \{H, W, R\} = x \\ x_{B} &= \{W\} \end{aligned}$$

Moving to the switching equation, in addition to the variables in x, we include the non-membership variables K in the switching equation, to exploit the non-membership predictions. In form, this strategy resembles that of Kopczuk and Lupton (2007), with one key difference: our switching equation identifies the *non*-membership of marriages within a regime given their existence in the restricted sample of strictly positive dowries. The idea is that certain households should not be observed giving dowry if the predictions of one of the theories holds. Thus, if the household is observed giving dowry, it is more likely to be in the *other* regime. In essence, we are identifying household regime by drawing from theoretical predictions about specific households' *non*-participation in the dowry system, due to their *participation* in the dowry system.

The logic behind the strategy is as follows. In the theoretical section, we generated predictions about who will *not* pay dowries in each regime. Specifically, positive dowries will not be observed in the "price regime" in a love marriage. As such, if we observe a love marriage with a dowry, theory would tell us that this is *not* a price dowry.[12] Similarly, positive dowries will not be observed in the "bequest regime" in a number of cases: if the bride has no brothers, if a bride marries within the household, or if a bride's parents have died. Thus we have:

$$z = \{H, W, R, K\}$$

where K represents variables that identify regime membership but are uncorrelated with the errors in the regime equations. From the theoretical predictions, we have

[12]More precisely, throughout, we assume that such marriages in which positive dowry is given *more likely* to be in the other regime.

a number of such variables: (1) whether the bride had male siblings of the age of majority at the time of marriage; (2) whether the bride's parents were alive at the time of marriage; (3) whether the marriage was self-arranged (a love marriage); and (4) whether the bride married within the household. Including these variables in the switching equation allows us to infer (ex post) from the sign of the estimated coefficients which regime is which. This in turn gives us an instant validity check on the outcome of the regression: if the signs of the estimated coefficients "disagree"—in the sense that if the sign on "bride had brothers of the age of majority at marriage" points to the second regime as being the bequest regime, while the sign on "bride married within household" points to the first as being the bequest regime, we will not be able to identify the regimes.

Is it plausible to exclude all of these variables from the regime equations? The number of brothers should directly affect a family's ability to pay a high dowry, particularly in the price regime, where each brother brings in an amount that may be used for his sister's marriage. To deal with this issue, we include the *number* of brothers in both the switching and regime equations. Our reasoning here is that the dummy variable "no brothers" captures the absence of bequest motive, while the number of brothers will capture the income effect that enters the dowry equation in both regimes. Similarly, the dowry function remains unchanged in either regime regardless of whether the bride's parents are alive at the time of marriage or whether the bride marries within the household—theory predicts only that the variables capture the absence of bequest motive. Finally, "love marriage" is only relevant insofar as it eliminates the recipient of the transfer in the price regime, and thus a positive dowry should only be observed in love match if the household is in the bequest regime.

To identify the model, we must place some restrictions on the error terms (Maddala, 1983). We assume that ϵ_Π, ϵ_B, and ϵ_λ are i.i.d. normal, mean-zero disturbances with variances σ^2_Π, σ^2_B, and σ^2_λ respectively, and we normalize $\sigma_\lambda = 1$. A randomly-selected marriage i has probability $1-\lambda = \Phi(-x_i\beta_\lambda)$ of belonging to the price regime, and probability λ of being in the bequest regime. The probability density function of observed dowry amounts is therefore a mixture of two distributions:

$$f(D_i) = (1-\lambda)\phi_\Pi(D_i - x_{\Pi i}\beta_\Pi) + \lambda\phi_B(D_i - x_{Bi}\beta_B)$$

Here, ϕ_Π and ϕ_B are the probability distributions of ϵ_Π and ϵ_B. For a sample of N marriages, the likelihood function becomes:

$$L(\beta_\Pi, \beta_B, \beta_\lambda, \sigma_\Pi, \sigma_B) = \prod_{i=1}^{N} f(D_i)$$

There are two points of note about this function. First, if $\phi_\Pi = \phi_B$ and $\beta_\Pi = \beta_B$, then $\epsilon_\Pi = \epsilon_B$ so that the likelihood function reduces to the standard normal density. Thus, the whole sample specification (no sample separation) is nested in the unknown sample separation specification, and the log-likelihoods of the two can be directly compared using a likelihood ratio test (Dickens and Lang, 1985). Second, the log-likelihood function contains the log of the sum of likelihoods rather than the sum of log-likelihoods; this additive inseparability renders the problem analytically intractable. Fortunately, the parameters can be estimated by maximum likelihood using the expectation-maximization (EM) algorithm (Dempster, Laird, and Rubin, 1977; Hartley, 1978).

5 Data and Results

We estimate the model using data from 1996 Matlab Health and Socioeconomic Survey (MHSS) in rural Bangladesh.[13] We have 5,328 marriages in this dataset in which year of marriage is reported (or can be constructed from age and age at marriage) and a total of 1,869 marriages in which dowry was reported. To deflate dowries, we follow Khan and Hossain (1989) and Amin and Cain (1998) and use the price of rice. Examining the summary statistics for the whole sample (Table 2), we observe that the data fits what we would expect given the historical and anthropological evidence: the proportion of the sample that is Hindu is relatively small, a small share of marriages are self-arranged, and the majority of husbands and wives have no formal schooling. There is a significant age differential between husbands and wives—the mean age at marriage for women is almost ten years younger than for men.[14]

Before turning to the empirical results, we assess our restriction to positive dowries. Should positive-dowry-giving marriages be considered within the same model as all marriages? A priori, we have no sense of whether this should be the case. Our marriage market model is completely general—yet dowry is an institution that most

[13] Further discussion of the data construction is in the Data Appendix.

[14] For this reason, we use the eligible sex ratio to test Rao's (1993) "marriage squeeze" hypothesis. See the Appendix for details of the construction of the series.

households in the world do not adopt, so that we might think that even within a dowry-giving society, households which use dowry are different in kind from those which do not. We report kernal density estimates of the probability density function for dowries in Figure 1, where "no dowry given" is coded as zero dowry. As the figure shows, there is no left censoring of dowries—furthermore, there are very few households that give small dowries. Thus, the distribution of dowries in itself justifies treating non-dowry households separately from dowry-giving households, both in theory and in empirical estimation.

We now turn to the estimation results. With our specification, we present results for the pooled regression, where we estimate a dowry function analogous to the existing empirical scholarship. In terms of our simple model, this is equivalent to restricting α, the fraction of bequest households, to be either 1 or 0.[15] While the central claim of this paper is that the results from such a regression are misspecified, we reproduce them for three reasons: first, to check whether our data resembles that used in other studies; second, to serve as a point of departure for the two-regime results; and third, we use the estimated coefficients from the whole sample regression as starting values for coefficients in the regime equations in the EM procedure.

5.1 Empirical Estimates of Dowry Heterogeneity

Table 3 reports the estimation results. The dependent variable in the switching equation (Column 2) is the probability of being in the first regime (Column 3). Here, since we have restricted the second regime (Column 4) to exclude groom-side and marriage market variables, this means that the first regime is by construction the price regime, and the second is the bequest regime, as labeled in the table. We begin by comparing the switching regression results to those of the pooled regression. This is our first check on the validity of the results: does our model capture the data better than the pooled model? The brief answer is yes: at any conventional significance level, a conservative log-likelihood test indicates that the distribution is indeed a mixture.[16]

[15] This is the empirical strategy implicitly adopted by Rao (1993); Edlund (2001) and Brown (forthcoming). In Rao's case, α is set to 0, while Edlund and Brown both set α to 1.

[16] The log-likelihood from the pooled regression is -1690, while the log-likelihood from the switching regression is -1560. Twice the difference between log-likelihood for the pooled and mixture models is 260. As discussed in the previous section, a comparison of log-likelihoods is feasible because the pooled specification is nested in the likelihood function for the mixture. However, when the switching model is constrained to yield the pooled model—that is, when the regime parameters are restricted to be equal—several parameters are unidentified. Monte Carlo results indicate that a conservative

Recall that this specification uses two types of theoretical restrictions to improve the sorting of households into regimes. An especially attractive feature of this framework is that the restrictions can be checked against each other: the reduced form restrictions require the second regime to be the bequest regime, but the coefficients on the non-membership predictions—the K variables in Column 2—are not constrained to match. Thus, we have a validity check on the quality of sorting—if the coefficients on the non-membership variables point to the "wrong" regime as the bequest regime, we cannot trust that the procedure is correctly placing marriages, or more precisely we cannot be assured that the regimes that have been identified correspond to a price and a bequest regime.

We find that this is not the case. Examining the coefficients on the K variables in the switching equation: "wife has no brothers over 15 at marriage"; "love marriage"; "husband from same household"; and "wife's parents died before marriage," we find that all are statistically significant and correspond with Column 4 being the bequest regime. In the theoretical section, we found that if a bride has no brothers over 15 at the time of marriage, and yet a dowry is exchanged, the household is more likely to be in the price regime. The coefficient on this variable in the switching equation is positive (0.126), which points to the first regime (Column 3) as the price regime. The same logic applies to the estimated coefficients on "husband from the same household" (0.931) and "wife's parents died before marriage" (0.176): both are positive and significant. Likewise, we found that if the marriage is a love marriage, and yet a dowry is exchanged, it is more likely to be in the bequest regime. The coefficient on love marriage is negative (-1.121), which points to the second regime (Column 4) as the bequest regime. The signs on the four variables in the switching equation therefore identify the first regime as the price regime, and the second regime as the bequest regime—independent of the reduced-form restriction. That is, the coefficients all "agree" in the sense that each sign points to the second regime being the bequest regime, and yet this is not by construction. This is heartening evidence that the switching regression is correctly identifying regimes.

Second, examining the coefficients on the switching equation (Column 2), we see that more recent marriages are more likely to be in the price regime (the coefficient

likelihood ratio test can be constructed by using the χ^2 distribution and setting the degrees of freedom equal to the number of unidentified parameters plus the number of constraints (Goldfeld and Quandt, 1976). For this specification, we have 67 degrees of freedom; at 1% significance level this yields a critical value of 96.83, well below our likelihood ratio statistic.

on year of marriage is positive and statistically different from zero). We can be even more precise; controlling for other variables, each year corresponds to an additional 4.5% probability of being in the price regime. Again, this finding is in accordance with the overwhelming anthropological and historical evidence of a shift in dowry motive from bequest to price over the last few decades. We find that Hindu marriages are more likely to be in the bequest regime, a finding that corresponds to the historical evidence. Relative to being nonliterate, we find that women with some literacy or some primary education are more likely to be in the price regime, but that more educated women are more likely to be in the bequest regime. Polygynous marriages are more likely to use dowry as price.

Third, the coefficients in the regime equations give two separate dowry functions. The dependent variable in the regime equations is log real dowry. Controlling for other variables, we see that dowries are rising by 4.5% a year in the price regime, but are falling by 5.3% a year in the bequest regime. Controlling for other variables, the older a woman is at the age of marriage, the lower the dowry amount in the price regime. In contrast, a woman's age at marriage does not affect the amount of her dowry in the bequest regime. In the price regime, the coefficient on the number of the wife's brothers is positive and marginally significant; this accords with the notion that households that use dowry as price see sons as an asset—a woman's brothers bring in dowries, which then can be used to pay higher dowries in her marriage. In the bequest regime, in contrast, the number of a woman's brothers significantly decreases her bequest amount: as parents divide their bequest among their children, having more brothers results in a smaller bequest. Finally, the coefficient on the eligible sex ratio in Column 3 is positive and not significant. Since this variable is measured as the fraction of eligible men to women, a negative coefficient would indicate evidence of a marriage squeeze. Although we are wary of over-interpreting the point estimate due to lack of precision, this result corroborates Edlund (2000); Rao (2000); Dalmia (2004) and Esteve-Volart (2004) in finding no evidence of a marriage squeeze driving dowry amounts.

We now split the sample by the estimated probability of membership in the bequest regime to compare the characteristics of households in each regime. First, as reported in Table 4, we find that 29% (355 of 1220) of positive-dowry marriages use dowries as bequests.[17] This is in accordance with the bulk of evidence discussed

[17]Here, we are following Hartley (1978) in assigning regime membership using the cutoff probability

above, which identifies considerable heterogeneity in dowry motive. Examining Table 4 further, we see that real dowries are substantially higher in the bequest regime (as seen in Figure 2). The mean year of marriage is 1975 in the bequest regime, and 1985 in the price regime—a more straightforward way of seeing this is in Figure 3. More educated individuals (both the bride and groom and their parents) use dowries as bequests. Bequest households also tend to be wealthier (as measured by value of total assets) and live in better-off circumstances (as measured by whether the village is electrified and the number of rooms in the household). The general finding, therefore, is that poorer, less-educated households are the ones using dowries as a price.

Finally, we compare our results to the historical evidence on bequest vs. price dowries. One advantage of using the predictions of the theoretical model, rather than claims grounded in historical evidence (as in Esteve-Volart (2004) and Anderson (2004)) to sort marriages into regimes is precisely that we can now compare our results to claims in the historical literature. Figure 3 demonstrates the first claim, that dowry as bequest is on the decline. The second claim, that dowries as bequest are less likely to be cash-only, is supported by Figure 4, which clearly recovers the pattern in Figure 2. More precisely, under 16% of bequest households used cash-only dowries, while over 30% of price households used cash-only dowries; this difference is statistically significant at the 1% level.

In sum, our results confirm that there is considerable heterogeneity of dowry motives. The multiple theoretical predictions all agree in assigning regime membership, evidence that we are properly sorting households into regimes. Consistent with the theory, the dowry functions of the two regimes differ in important ways, and the average characteristics of price and bequest households indicate that bequest households are better off than price households. Finally, our findings confirm the claims in the historical and anthropological literature: bequest dowries are declining in prevalence over time, and bequest dowries are much less likely to be cash-only.

5.2 Robustness: Relaxing the Theoretical Restrictions

Our main specification used two types of theoretical predictions to identify regimes. Both types yielded restrictions, about characteristics that predict the non-membership of a household in a given regime conditional on a positive dowry being given, or about

of 0.5. That is, bequest regime households are those 355 of 1220 households that have a probability of greater than 0.5 of being in the bequest regime.

which variables influence the amount of a bequest dowry. Our robustness checks assess the sensitivity of our results to these predictions, by using strictly less information to identify regimes than that given by theory. We relax both restrictions in turn: the first check relaxes the non-membership predictions, so that regimes are identifed solely by their dowry functions, and the second check relaxes the reduced form restrictions on the dowry function, so that regimes are identified solely by the information in the switching equation.

5.2.1 Removing the Non-Membership Predictions

In removing the non-membership predictions from the switching equation, regimes are identified using only the reduced form restrictions on the dowry functions. An advantage of this specification is that it does not require excludability of additional variables in the switching equation. A disadvantage is that we have no independent verification of the validity of the sorting. Our system becomes:

$$\begin{aligned} \text{Price regime:} \quad & D_\Pi = x\beta_\Pi + \epsilon_\Pi \\ \text{Bequest regime:} \quad & D_B = x\beta_B + \epsilon_B \\ \text{Switching equation:} \quad & \lambda^* = z\beta_\lambda + \epsilon_\lambda \end{aligned}$$

Again, D_Π, D_B, and λ^* are latent. Only the dowry amount D is observed, given by:

$$D = \begin{cases} D_\Pi & \text{if} \quad \lambda^* < 0 \\ D_B & \text{if} \quad \lambda^* \geq 0 \end{cases}$$

Here, we have:

$$\begin{aligned} x_\Pi &= \{H, W, R\} = x \\ x_B &= \{W\} \\ z &= \{H, W, R\} = x \end{aligned}$$

Table 5 reports the estimation results. Identification is given by the dowry functions—as before, Column 4 is by construction the bequest regime, which contains only bride-side characteristics. Overall, the results agree with the main specification. The sign and magnitude of almost all estimated coefficients in the regime equations are similar to those in the main specification. Also, the regime assignment remains

very similar: the correlation of the estimated switch point between the two specifications is .958. again a pooled specification is rejected at conventional significance levels, corroborating the existence of heterogeneity of dowry motives; .

5.2.2 Relaxing the Reduced Form Restriction

The second robustness check drops the reduced form restriction, so that both dowry functions include the same variables, but maintains the non-membership predictions in the switching equation. Here, the only method of identifying the regimes is by examining the sign of the variables K, which are excluded from the regime equations.In essense, here we are assessing the robustness of our results to a breakdown of the assortative matching which allowed us to constrain the bequest regime. Our three-equation system becomes:

$$\begin{aligned} \text{Price regime:} \quad D_\Pi &= x\beta_\Pi + \epsilon_\Pi \\ \text{Bequest regime:} \quad D_B &= x\beta_B + \epsilon_B \\ \text{Switching equation:} \quad \lambda^* &= z\beta_\lambda + \epsilon_\lambda \end{aligned}$$

Again, D_Π, D_B, and λ^* are latent. Only the dowry amount D is observed:

$$D = \begin{cases} D_\Pi & \text{if} \quad \lambda^* < 0 \\ D_B & \text{if} \quad \lambda^* \geq 0 \end{cases}$$

Here, we have:

$$\begin{aligned} x_\Pi &= \{H, W, R\} = x \\ x_B &= \{H, W, R\} = x \\ z &= \{H, W, R, K\} \end{aligned}$$

Table 6 reports the estimation results. As before, the dependent variable in the switching equation (Column 2) is the probability of being in the first regime (Column 3). However, since here we impose no reduced form constraints, we must identify the regime from the coefficients on the non-membership K variables in the switching equation. In this instance, following the logic we used in the main specification, the

coefficient estimates identify the first regime (Column 3) as the bequest regime.[18] We see that the sorting remains similar: comparing the estimates to those of the original specification, we see that all are of the same sign and are again statistically significant. The sorting is not perfect, however, as seen in the non-zero coefficients on the groom variables in the bequest regime. Otherwise, the estimated coefficients in Table 6 all point to qualitatively similar results as those in the original specification. As with the previous robustness check, the correlation of the estimated switch point between the main specification and this one is again high (0.87), and the likelihood ratio test reveals that the mixture model out-performs the pooled regression. Thus, our results are robust to relaxing the reduced form restriction—we are able to identify two separate dowry regimes even though they share the same dowry function.

6 Conclusions

Is dowry a bequest or a price? We tackle this question by using the predictions of competing economic theories to investigate the existence and nature of heterogeneity in dowry motives. We find considerable evidence of heterogeneity—in every specification, we reject the null hypothesis of a single dowry function. In particular, we find that more than a quarter of marriages in the sample use dowries as bequests. We also find that each regime yields a dowry function consistent with the predictions of our model of a bifurcated marriage market. Interestingly, we find little evidence that price dowries are driven by a "marriage squeeze," a subject of recent debate among economists (Rao, 1993; Anderson, forthcoming; Maitra, 2006a,b), suggesting instead that changes in bride and groom characteristics may be more important factors in driving up price dowries over time. Our findings are consistent with broad patterns claimed by observers of the history of dowry in South Asia—in particular, our predicted bequest dowries are much less likely to involve cash-only transfers, which anthropologists have argued are rarely under the control of brides.

Underlying the empirical results in this paper is an ongoing debate between defenders of dowry as bequest against an increasingly large group of critics who see dowry as a transaction between households in which brides do not directly benefit—and who blame the dowry system for increasing the perceived cost of daughters and contributing to sex selective abortion, female infanticide and "dowry murders." Rather

[18] In Table 6 we label the regimes as "price" and "bequest" for convenience.

than enter this debate, we offer evidence indicating a broad shift in dowry motive that derives directly from the bequest theory. As women's access to inheritances improves due to stronger property rights, we should expect a decline in the prevalence and size of bequest dowries. Corroborating the wealth of anthropological and historical evidence, we find that this is indeed the case: dowry increasingly functions as a price rather than a bequest, and while price dowries reflect "dowry inflation", bequest dowries have decreased in amount over time. At the same time, we find that households that use dowry as bequest are better off as measured by a variety of socioeconomic indicators, including education and assets. While we have not attempted to generate policy implications, our results, taken together, stand against the principal claims of opponents to dowry bans.

Finally, our methodology can be applied to a broad range of economic problems where heterogeneity of theory may capture heterogeneity in the population. Our strategy of using theory to develop multiple predictions to simultaneously separate the sample and validate the separation may prove useful to empirical researchers in a broad range of settings where there are more than one model and no clear victor.

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Table 1: Some Recent Empirical Findings

For Price	Against Price	For Bequest	Against Bequest
Rao (1993), Dalmia (2004): India	Edlund (2000): India	Edlund (2001): India	
Anderson (2004): Urban Pakistan	Anderson (2004): Rural Pakistan		
		Brown (2003): Rural China	
		Zhang and Chan (1999): Taiwan	
	Esteve-Volart (2004): Rural Bangladesh	Esteve-Volart (2004): Rural Bangladesh	Suran et al. (2004): Rural Bangladesh
Botticini (1999): Tuscany 1415-1436		Botticini (1999): Tuscany 1415-1436	

Table 2: Summary statistics

Variable	Mean	Std. Dev.	N
Year of marriage (19–)	69	16.36	5703
Wife's age	42.3	14.73	5703
Wife's age at marriage	15.3	3.99	5703
Husband's age	47.87	14.23	4181
Husband's age at marriage	24.91	6.47	3758
Wife's BMI	18.71	2.85	5023
Wife is underweight	0.51	0.5	5023
Wife is normal weight	0.46	0.5	5023
Wife is overweight/obese	0.02	0.15	5703
Husband's BMI	18.61	2.44	3502
Husband is underweight	0.52	0.5	3502
Husband is normal weight	0.46	0.5	3502
Husband is overweight/obese	0.01	0.1	5703
Wife's school (years)	1.68	2.71	5616
Wife did not attend school	0.62	0.49	5703
Wife attended some primary school	0.29	0.45	5703
Wife attended some low secondary school	0.07	0.25	5703
Wife attended some high secondary school	0.02	0.16	5703
Husband's school (years)	3.22	3.82	3760
Husband did not attend school	0.64	0.48	5703
Husband attended some primary school	0.2	0.4	5703
Husband attended some low secondary school	0.09	0.28	5703
Husband some high secondary school	0.07	0.26	5703
Hindu	0.1	0.3	5703
Love marriage	0.01	0.11	5703
Wife's number of brothers of majority at marriage	1.05	1.26	5703
Wife had no brothers of majority at marriage	0.43	0.5	5703
Husband's father was richer than wife's father	0.38	0.49	5689
Wife's mother's school (years)	0.61	1.71	5703
Wife's father's school (years)	2.2	3.48	5703
Husband's mother's school (years)	0.13	0.77	5703
Husband's father's school (years)	0.88	2.26	5703
Wife's parents own land	0.25	0.43	5703
Wife's parents' land value (1996 takas)	58607.66	152758.26	5703
Husband's parents own land	0.37	0.48	5703
Husband's parents' land value (1996 takas)	81824.98	166599.15	5703
Wife was previously married	0.14	0.34	5703
Wife's parents died before her marriage	0.03	0.18	5703
Dowry given at marriage	0.3	0.46	5701
Nominal dowry (takas)	2451.73	6331.31	5685
Real dowry (rice kg)	581.27	4285.52	5685
Real dowry (rice kg, only > 0 dowries)	1939.28	7659.17	1704
Log real dowry (rice kg, only > 0 dowries)	6.62	1.12	1704

Table 3: Pooled and Switching Regression Results

	Pooled	Switching	Price	Bequest
	(1)	(2)	(3)	(4)
Year of marriage (19–)	-.022 (.004)***	.045 (.001)***	.045 (.005)***	-.053 (.005)***
Wife's age at marriage	-.017 (.011)	.089 (.004)***	-.034 (.011)***	-.029 (.014)**
Wife's BMI	.008 (.011)	.033 (.004)***	.022 (.009)**	.006 (.014)
Hindu	.767 (.081)***	-.199 (.028)***	.450 (.075)***	1.076 (.093)***
Wife is literate but did not attend school	-.356 (.259)	-1.072 (.090)***	-.040 (.239)	-.984 (.203)***
Wife attended some primary school	.093 (.066)	.473 (.023)***	.106 (.057)*	.129 (.076)*
Wife attended some low secondary school	.289 (.113)**	.122 (.040)***	.145 (.092)	.353 (.161)**
Wife attended some high secondary school	.490 (.247)**	-3.074 (.086)***	1.204 (.185)***	.701 (.188)***
Wife's parents' land value (1996 takas, '000s)	.001 (.000)**	.000 (.000)	.000 (.000)**	.001 (.000)***
Wife's mother's school (years)	.021 (.018)	-.071 (.006)***	-.002 (.022)	-.003 (.021)
Wife's father's school (years)	.004 (.010)	.032 (.003)***	-.013 (.008)	.035 (.013)***
Wife was previously married	.192 (.095)**	-.067 (.033)**	.110 (.078)	.544 (.129)***
Wife's number of brothers of majority at marriage	.008 (.021)	-.040 (.010)***	.035 (.018)*	-.080 (.025)***
Husband's age at marriage	-.011 (.005)**	-.013 (.002)***	-.016 (.004)***	
Husband's BMI	.022 (.014)	-.040 (.005)***	.012 (.013)	
Husband is literate but did not attend school	.735 (.289)**	-.963 (.100)***	.900 (.201)***	
Husband attended some primary school	.227 (.069)***	-.466 (.024)***	.126 (.057)**	
Husband attended some low secondary school	.275 (.093)***	-.575 (.032)***	.272 (.092)***	
Husband some high secondary school	.699 (.118)***	-1.568 (.041)***	1.008 (.130)***	
Husband's parents' land value (1996 takas, '000s)	.000 (.000)	.000 (.000)***	.000 (.000)	
Husband's mother's school (years)	.025 (.033)	-.374 (.011)***	-.207 (.078)***	
Husband's father's school (years)	-.014 (.012)	-.003 (.004)	-.010 (.011)	
Husband is polygynous	-.538 (.194)***	1.432 (.067)***	-.263 (.192)	
Eligible sex ratio (males/females)	.711 (.222)***	-1.460 (.077)***	.019 (.272)	
Village is electrified	.108 (.059)*	-.458 (.021)***	-.004 (.054)	
Love marriage		-1.121 (.087)***		
Husband from same household		.931 (.041)***		
Wife's parents died before her marriage		.176 (.080)**		
Wife had no brothers of majority at marriage		.126 (.028)***		
Constant	6.921 (.427)***	-2.671 (.150)***	2.036 (.470)***	10.824 (.446)***
Obs.	1220	1220	1220	1220
Log-likelihood (Pooled)	-1690.289			
Log-likelihood (Mixture)			-1559.652	
R^2	.227			
F statistic	14.049	509.848	20.256	38.363

Note: Dependent variable in columns (1), (3), and (4) is log real dowry in rice kg (sample mean is 6.165). Dependent variable in column (2) is the probability of being in column (3). Statistical significance: * 10% ; ** 5% ; *** 1%.

Table 4: Household Characteristics by Predicted Regime

Variable	Mean Price	Mean Bequest
Real dowry (rice kg, only > 0 dowries)	552.68	2238.93***
Cash-only dowry	0.30	0.17***
Year of marriage (19–)	84.79	74.73***
Wife's age at marriage	17.27	14.65***
Wife's BMI	18.94	19.06
Hindu	0.14	0.23***
Wife's school (years)	1.90	2.46***
Wife's parents' land value (1996 takas)	53122.9	66310.52
Wife's mother's school (years)	0.55	1.12***
Wife's father's school (years)	2.13	3.25***
Wife was previously married	0.11	0.11
Wife's number of brothers of majority at marriage	1.25	1.37
Husband's age at marriage	24.62	25.02
Husband's BMI	18.66	18.98**
Husband's school (years)	2.16	5.64***
Husband's parents' land value (1996 takas)	86049.96	135329.45***
Husband's mother's school (years)	0.02	0.59***
Husband's father's school (years)	1.13	1.85***
Husband is polygynous	0.03	0.01***
Village is electrified	0.30	0.50***
Rooms	2.75	3.12***
Love marriage	0.01	0.03*
Husband from same household	0.07	0.03***
Wife's parents died before her marriage	0.01	0.02
Value of all wife's assets (1996 takas)	40287.32	20290.13
Value of wife's land assets (1996 takas)	24179.53	11453.41
Value of all husband's assets (1996 takas)	80773.38	220820.64**
Value of husband's land assets (1996 takas)	65789.37	134998.54***
Obs. in Predicted Regimes	865	355

Note: Statistical significance: * 10% ; ** 5% ; *** 1%.

Table 5: Robustness Check 1: Removing the Non-Membership Predictions

	Pooled	Switching	Price	Bequest
	(1)	(2)	(3)	(4)
Year of marriage (19–)	-.022 (.004)***	.037 (.001)***	.044 (.005)***	-.059 (.005)***
Wife's age at marriage	-.017 (.011)	.099 (.004)***	-.035 (.011)***	-.020 (.014)
Wife's BMI	.008 (.011)	.024 (.004)***	.019 (.009)**	.009 (.014)
Hindu	.767 (.081)***	-.244 (.029)***	.442 (.075)***	.991 (.088)***
Wife is literate but did not attend school	-.356 (.259)	-.885 (.091)***	-.239 (.232)	-.985 (.216)***
Wife attended some primary school	.093 (.066)	.246 (.023)***	.091 (.057)	.059 (.076)
Wife attended some low secondary school	.289 (.113)**	-.096 (.040)**	.147 (.093)	.296 (.154)*
Wife attended some high secondary school	.490 (.247)**	-3.756 (.087)***	1.045 (.252)***	.644 (.192)***
Wife's parents' land value (1996 takas, '000s)	.0005 (.0002)**	-.0001 (.00007)**	.0005 (.0002)***	.0007 (.0002)***
Wife's mother's school (years)	.021 (.018)	-.042 (.006)***	-.002 (.022)	.001 (.020)
Wife's father's school (years)	.004 (.010)	.047 (.003)***	-.011 (.008)	.042 (.013)***
Wife was previously married	.192 (.095)**	-.077 (.033)**	.118 (.078)	.533 (.130)***
Wife's number of brothers of majority at marriage	.008 (.021)	.012 (.007)	.039 (.018)**	-.038 (.023)
Husband's age at marriage	-.011 (.005)**	-.013 (.002)***	-.015 (.004)***	
Husband's BMI	.022 (.014)	-.038 (.005)***	.010 (.013)	
Husband is literate but did not attend school	.735 (.289)**	-.643 (.102)***	.871 (.209)***	
Husband attended some primary school	.227 (.069)***	-.471 (.024)***	.148 (.055)***	
Husband attended some low secondary school	.275 (.093)***	-.628 (.033)***	.255 (.092)***	
Husband some high secondary school	.699 (.118)***	-1.400 (.041)***	.971 (.128)***	
Husband's parents' land value (1996 takas, '000s)	-.0002 (.0002)	.0006 (.00006)***	.00006 (.0002)	
Husband's mother's school (years)	.025 (.033)	-.364 (.012)***	-.201 (.077)***	
Husband's father's school (years)	-.014 (.012)	-.011 (.004)***	-.012 (.011)	
Husband is polygynous	-.538 (.194)***	1.222 (.068)***	-.293 (.193)	
Eligible sex ratio (males/females)	.711 (.222)***	-1.258 (.078)***	.007 (.271)	
Village is electrified	.108 (.059)*	-.290 (.021)***	.013 (.054)	
Love marriage				
Husband from same household				
Wife's parents died before her marriage				
Wife had no brothers of majority at marriage				
Constant	6.921 (.427)***	-2.153 (.150)***	2.257 (.476)***	11.088 (.435)***
Obs.	1220	1220	1220	1220
Log-likelihood (Pooled)	-1690.289			
Log-likelihood (Mixture)			-1563.822	
R^2	.227			
F statistic	14.049	483.223	12.924	38.743

Note: Dependent variable in columns (1), (3), and (4) is log real dowry in rice kg (sample mean is 6.165). Dependent variable in column (2) is the probability of being in column (3). Statistical significance: * 10% ; ** 5% ; *** 1%.

Table 6: Robustness Check 2: Relaxing the Reduced Form Restrictions

	Pooled	Switching	Bequest	Price
	(1)	(2)	(3)	(4)
Year of marriage (19–)	-.022 (.004)***	-.034 (.001)***	.046 (.006)***	-.070 (.005)***
Wife's age at marriage	-.017 (.011)	-.116 (.004)***	.007 (.015)	-.044 (.011)***
Wife's BMI	.008 (.011)	-.019 (.004)***	-.004 (.014)	.024 (.009)***
Hindu	.767 (.081)***	.335 (.028)***	.891 (.087)***	.512 (.078)***
Wife is literate but did not attend school	-.356 (.259)	.003 (.089)	-1.114 (.186)***	.017 (.266)
Wife attended some primary school	.093 (.066)	-.212 (.023)***	-.055 (.079)	.091 (.057)
Wife attended some low secondary school	.289 (.113)**	-.243 (.039)***	.497 (.129)***	.072 (.102)
Wife attended some high secondary school	.490 (.247)**	2.152 (.086)***	.621 (.182)***	-2.299 (.232)***
Wife's parents' land value (1996 takas, '000s)	.0005 (.0002)**	.0001 (.00007)**	.0007 (.0002)***	.0004 (.0002)**
Wife's mother's school (years)	.021 (.018)	.043 (.006)***	-.014 (.019)	.020 (.020)
Wife's father's school (years)	.004 (.010)	-.017 (.003)***	.039 (.014)***	-.014 (.009)
Wife was previously married	.192 (.095)**	-.126 (.033)***	.721 (.144)***	.124 (.079)
Wife's number of brothers of majority at marriage	.008 (.021)	-.469 (.010)***	.045 (.029)	.037 (.019)*
Husband's age at marriage	-.011 (.005)**	.023 (.002)***	-.027 (.005)***	-.009 (.005)*
Husband's BMI	.022 (.014)	.021 (.005)***	.049 (.015)***	.015 (.013)
Husband is literate but did not attend school	.735 (.289)**	.819 (.099)***	.346 (.254)	.789 (.199)***
Husband attended some primary school	.227 (.069)***	.318 (.024)***	.167 (.088)*	.153 (.054)***
Husband attended some low secondary school	.275 (.093)***	.508 (.032)***	.243 (.115)**	.260 (.093)***
Husband some high secondary school	.699 (.118)***	1.121 (.041)***	.414 (.118)***	.718 (.159)***
Husband's parents' land value (1996 takas, '000s)	-.0002 (.0002)	-.00007 (.00006)	-.0002 (.0002)	.00008 (.0002)
Husband's mother's school (years)	.025 (.033)	.332 (.011)***	-.025 (.029)	.009 (.048)
Husband's father's school (years)	-.014 (.012)	.054 (.004)***	-.044 (.011)***	-.002 (.012)
Husband is polygynous	-.538 (.194)***	-1.454 (.067)***	.419 (.328)	-.332 (.193)*
Eligible sex ratio (males/females)	.711 (.222)***	1.795 (.077)***	.069 (.235)	-.207 (.288)
Village is electrified	.108 (.059)*	.229 (.021)***	.089 (.069)	.011 (.054)
Love marriage		1.598 (.087)***		
Husband from same household		-.700 (.041)***		
Wife's parents died before her marriage		-.201 (.079)**		
Wife had no brothers of majority at marriage		-.751 (.028)***		
Constant	6.921 (.427)***	2.527 (.149)***	11.268 (.513)***	2.023 (.491)***
Obs.	1220	1220	1220	1220
Log-likelihood (Pooled)	-1690.289			
Log-likelihood (Mixture)			-1547.500	
R^2	.227			
F statistic	14.049	485.459	28.345	18.403

Note: Dependent variable in columns (1), (3), and (4) is log real dowry in rice kg (sample mean is 6.165). Dependent variable in column (2) is the probability of being in column (3). Statistical significance: * 10% ; ** 5% ; *** 1%.

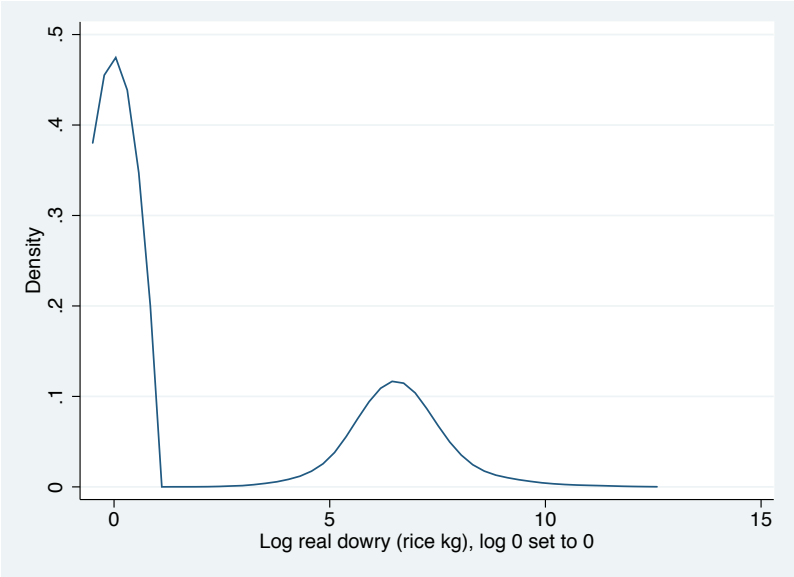

Figure 1: Kernel Density of Log Real Dowry

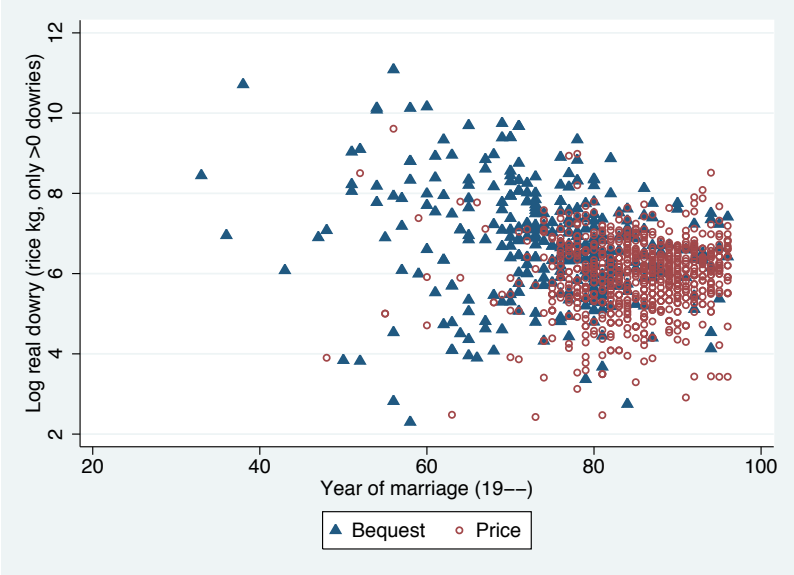

Figure 2: Log Real Dowry by Regime

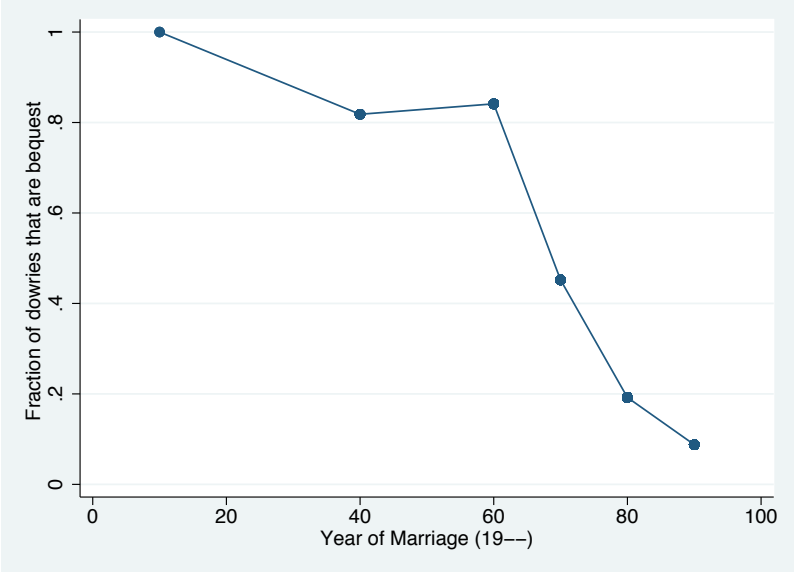

Figure 3: Bequest Dowries on the Decline

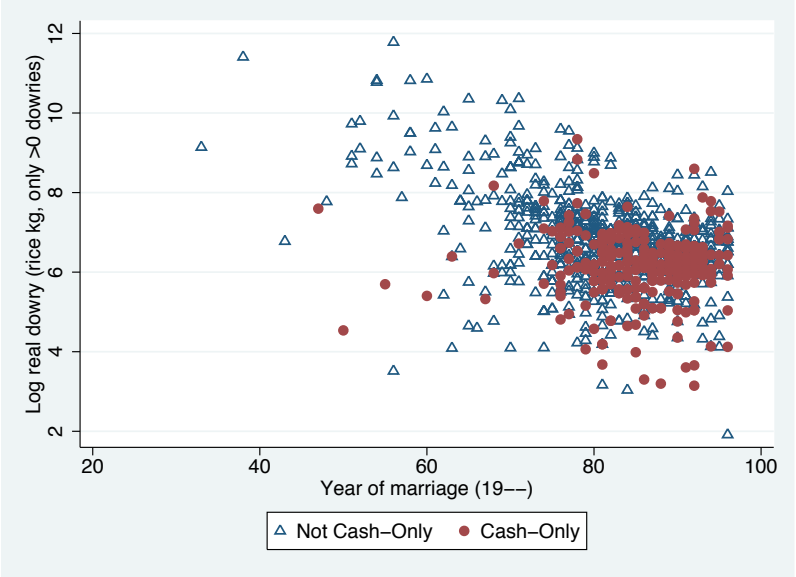

Figure 4: Cash-only vs. Non-cash-only Dowries

Data Appendix

A.1 Matlab Data

The complete dataset is described in Rahman, Menken, Foster, and Gertler (1999). There are 5312 women for whom year of marriage is reported or can be reconstructed from age and age at marriage. In addition, we have 391 previous marriages reported, giving a total of 5703 marriages. Of these, 1731 women report a positive dowry at the time of marriage. In 562 marriages, the husband confirmed that a dowry was given, and in 112 marriages, a husband reported a dowry even when the wife did not.[1] This gives a total of 1843 marriages in which dowry was reported. Of these, in 1704 marriages the wife reports the dowry amount (including the value of goods at the time of marriage). In addition, we have 663 marriages in which the husband reports the dowry amount but the wife does not. In 556 marriages we have two reports of dowry; for the results reported, we take the average of the reports.[2] All results are qualitatively similar when we exclude husbands' dowry reports. Due to other missing covariates for some marriages, the estimation sample uses 1220 marriages.

Some additional notes on variable construction:

- We use height and weight to calculate Body Mass Index (BMI) and categorize individuals as underweight, normal weight, or overweight/obese using World Health Organization guidelines. The vast majority of the sample (97% of women and 98% of men) have a BMI that is classified as normal or underweight.

- Level of school attainment (primary, low secondary, or high secondary) are assigned from the years of schooling, in accordance with Rahman, DaVanzo, and

[1] In many instances husbands were not interviewed in the survey.

[2] Reported dowry amounts between husband and wife are reasonably correlated; the Pearson correlation coefficient is 0.62.

Razzaque (2003). The omitted category in the regression results is "wife/husband did not attend school."

A.2 Rice Prices

No single source contains rice prices for the entire period, so we constructed a series using the *Statistical Abstracts for British India*[3] for the period 1910-1946; the Pakistan Central Statistical Office's *Statistical Yearbook 1955* for 1949; the Pakistan Central Statistical Office's *20 Years of Pakistan in Statistics* for 1950-1967; and the *Statistical Yearbooks of Bangladesh* for 1965-1996.[4] Duplicate observations for the years 1964 to 1967 were used to convert between takas and rupees, and overlapping medium and common rice prices for the years 1950 to 1967 are used to convert between rice qualities. We used a linear interpolation to cover the missing years (1947-1948). Real dowries are expressed in (medium quality) rice kilograms.

A.3 Sex Ratio

Constructing a sex ratio time series has proven treacherous in previous dowry work (Edlund, 2000; Rao, 2000). We adopt a simple approach that takes account of the mortality trajectory in the years between Census records. We calculate the sex ratio from the Census Records of India (1931, 1941), Pakistan (1951, 1961), and Bangladesh (1974, 1984). Where possible, we use the lowest level of geographic detail to correspond with the district in the Matlab study, although this was not possible for early years of the Census records, particularly the Indian Census records. Taking the count of males and females in the Census year, we construct the adjusted sex ratio as de-

[3]Volumes compiled before partition but published afterward are simply called *Statistical Abstract, India*.

[4]Details of the sources as well as unit conversions are given in Table A.

scribed by Rao (1993), where the adjusted sex ratio gives the number of males aged 20-29 divided by the number of females aged 10-19. We calculate the relevant ratio for each age group, from ages 10 to age 90, using the same ten year differential.

For the years between the Census years, the cohorts' age and mortality, particularly child mortality in the earlier years of our records, is pronounced, so the relevant sex ratio for each age must be adjusted for mortality each year. We use the actual number of males and females in the Census year, and then use the period lifetable constructed with the Census records to derive an estimate of survivorship to the next age ($_nq_x$). Since these values will differ for both men and women, the sex ratio will change for the years between Censuses. For example, males aged 20-29 in 1961 will be aged 25-34 in 1966, and the best available estimate for the fraction of men surviving to that age would be the period survival rate for men aged 25-34 in 1961. For the final Census we use, we create a quasi-synthetic cohort and assume that the course of mortality over the subsequent years will be the same as for the later cohorts whose mortality trajectory is recorded in the Census.

Appendix References

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Table A: Rice Price Sources

Years covered	Source	Details
1910-1929	Statistical Abstract for British India 1931	No. 300, pg. 671 [Variations in Average Annual Retail Prices Current of Food Grains in British India]. Common rice in Dacca, rupees per maund (base year: 1873= 100 rupees).
1912-1932	Statistical Abstract for British India 1934	No. 301, pgs. 764-765 [Average Annual Retail Prices Current of Food Grains in British India]. Common rice in Dacca, rupees per maund.
1930-1939	Statistical Abstract for British India 1941	No. 164, pg. 445 [Average Annual Retail Prices Current of Food Grains in British India]. Common rice in Dacca, rupees per maund.
1942-1946	Statistical Abstract, India 1949	No. 165, pg. 1238 [Average Annual Retail Prices Current of Food Grains in British India]. Common rice in Dacca, rupees per maund.
1949	Statistical Yearbook 1955, Pakistan Central Statistical Office	No. 67, pg. 105 [Average (Annual) Retail Prices of Important Articles Consumed by the Industrial Workers at Dacca]. Medium rice, rupees per seer.
1950-1967	20 Years of Pakistan in Statistics, Pakistan Central Statistical Office	Table 11.7 [Average Retail Prices of Basic Articles of Consumption in East Pakistan]. Common and medium rice in Dacca, rupees per seer.
1965-1967	Statistical Yearbook of Bangladesh 1975	Table 8.1 [Annual Average Retail Price of Selected Consumer Goods in Dacca, pg. 195]. Medium rice, takas per maund.
1968-1978	Statistical Yearbook of Bangladesh 1979	Table 10.6 [Annual Average Retail Price of Selected Consumer Goods in Dhaka, pg. 374]. Medium rice, takas per maund.
1978-1988	Statistical Yearbook of Bangladesh 1989	Table 10.16 [Annual Average Retail Price of Selected Consumer Goods in Dhaka, pg. 448]. Medium rice, takas per seer.
1987-1996	Statistical Yearbook of Bangladesh 1997	Table 10.16 [Annual Average Retail Price of Selected Consumer Goods in Dhaka, pg. 477]. Medium rice, takas per kilogram.

Unit conversions (*2000 Statistical Yearbook of Bangladesh*, pgs. 645-650):
1 kilogram = 1.071 seer = .0267 maund.