# *Watta Satta*: Bride Exchange and Women's Welfare in Rural Pakistan

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**Abstract**

Do marital institutions serve to limit inefficiency within marriage? We study the pervasive custom of *watta satta* in rural Pakistan, a bride exchange between families coupled with a mutual threat of retaliation. *Watta satta* can be seen as a mechanism for coordinating the actions of two sets of in-laws, each of whom wish to restrain their son-in-laws but who only have the ability to restrain their sons. Our empirical results corroborate this view. Marital discord, as measured by estrangement, domestic abuse, and wife's mental health, is significantly lower in *watta sattas* versus 'conventional' marriages, but only after accounting for selection bias. This beneficial effect cannot be explained by endogamy, a marriage pattern associated with *watta satta*.

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"[*Watta satta*] means that you will give a daughter and receive the same in return. It also implies that if our daughter will be in pain, we will treat your daughter the same way." (*woman from Badeen, Sindh*)[1]

# 1 Introduction

Marriage is perhaps the epitome of an incomplete contract; its terms can never be fully specified ex-ante or enforced ex-post. A vast body of literature has thus highlighted the role of post-marital bargaining in determining intrahousehold allocations (seminal papers include McElroy and Horney, 1981; Manser and Brown, 1980; and Lundberg and Pollack 1993).[2] In traditional societies, where women's formal legal rights are often weak, divorce is strongly stigmatized, and there is a high premium on female virginity, bargaining power can shift radically in favor of the man once the woman commits herself to marriage. This fact should have implications for the form of the marriage 'contract'; in particular, we would expect its ex-ante provisions to reflect the interests of the wife and her family in deterring or mitigating ex-post malfeasance on the part of the husband.

In this paper, we argue that exchange marriage in rural Pakistan can play just such a role. Bride exchange, known locally as *watta satta* (literally, 'give-take'), usually involves the simultaneous marriage of a brother-sister pair from two households. Remarkably, *watta satta* accounts for about a third of all marriages in rural Pakistan. *Watta satta* is more than just an exchange of daughters, however; it also establishes the shadow of mutual threat across the marriages. As the *watta*-bride quoted above expresses so succinctly, a husband who mistreats his wife in this arrangement can expect his brother-in-law to retaliate in-kind against his sister.

We shall show that such reciprocal threats operating across marriages can be credible and may, consequently, prevent inefficient marital outcomes. Husbands generally have coercive power over their wives, through various forms of physical and emotional intimidation. In virilocal societies, this power is heightened by the wife's residence in her in-laws' household, making it costly for her natal family to continually monitor her treatment. The exercise of coercion is not without cost either, both to the wife directly and possibly to her family. Family honor is particularly susceptible to publicly observable acts, like the temporary return of the wife to her natal home. Parents may be willing to restrain their son from such destructive (albeit privately rational) behavior, but only if they could also be assured that the in-laws of their daughter would restrain their son in the same way. *Watta satta*, we will argue, essentially solves this coordination problem.

[1] All of the quotations in this paper are from field interviews conducted as part of a structured qualitative survey undertaken in five villages randomly selected from those covered by the 2004-05 Pakistan Rural Household Survey.

[2] More recently, marital bargaining problems have begun explicitly featuring limited commitment and contractual incompleteness (see Lundberg and Pollack, 2003; Ranier, 2008; Rasul, 2008).

Exchange marriage, broadly construed, is practiced in a number of traditional societies, about as many as practice dowry.[3] Yet, while dowry has attracted a great deal of recent interest among economists (e.g., Anderson, 2003; Botticini and Siow, 2003), exchange marriage has gone largely unnoticed. Zhang and Chan (1999) are perhaps the first to suggest that the form of the marriage contract might reflect ex-post bargaining considerations. Parents, they argue, choose the size of their daughter's dowry ex-ante taking into account its effect on the value of her threatpoint, although in their setting marital bargaining always leads to efficient outcomes. This paper is concerned with institutions that emerge to deter inefficiency within marriage, thus placing it in a broader research program seeking to rationalize institutional design in light of commitment failures (see, e.g., North and Weingast, 1989; Greif, 1993; and especially Williamson, 1983, who also emphasizes the value of mutual hostage-taking). The role of the family in filling the void left by the absence of legal enforcement has also been explored in other contexts. La Ferrara (2003), for example, models how kin-groups punish deviations from a particular credit market equilibrium. While related, the enforcement mechanism we consider in this paper is quite distinct.

Our contention that a *watta satta* marriage increases deterrence relative to the alternative in this setting– which, for lack of a better term, we will call 'conventional' marriage – has a powerful empirical implication: All else equal, inefficiency is less likely to occur in *watta satta* marriages. To test this hypothesis, we have collected a large data set that provides unusual detail on marriage customs and the status of women in rural Pakistan. In particular, we examine measures of marital discord: estrangement, domestic violence, and the wife's mental health, outcomes associated with the exercise of coercion on the part of the husband. Marital strife should be sharply distinguished from the distribution of surplus within marriage. Discord unambiguously lowers the utility possibility frontier between the spouses. Therefore, insofar as *watta satta* marriage deters marital strife, it should enhance efficiency. Whether or not women in *watta satta* marriages also enjoy greater marital surplus is tangential to the argument.

The main empirical challenge is to deal with systematic selection into exchange marriages. Traditional practices like *watta satta* may be more likely to be adopted in settings where women tend to be treated poorly irrespective of marriage type. If so, the institution might appear detrimental to women, thus seeming to vindicate popular Pakistani press accounts that lump *watta satta* together with other more egregious practices like child-

[3] See Murdock's famous ethnographic atlas (1967). Murdock's classification does not, however, require a bride exchange to be contemporaneous, involve a brother-sister pair, or include mutual retaliatory threats. Contemporaneous sibling exchange marriage appears to be present in the south of India (Mencher and Goldberg, 1967; Karve, 1993; Trautmann, 1993). In the north, it is generally disapproved of, but there is some evidence that it was common among Hindus in the Punjab in the early 20th century (Rose, 1908). Outside south Asia, sibling exchange marriage has been documented in parts of China (Zhang, 2000). Early anthropological accounts of exchange marriage in west Africa (Bohannan, 1949; Meek, 1936) also mention the 'retaliatory' motive emphasized in this paper.

marriage and honor-killings. Fortunately, we have a plausible instrument. Exchange marriage opportunities are limited by the presence of age and sex appropriate siblings; a *watta*-bride normally must have an available brother, preferably an older one by not too many years. Thus, the likelihood of *watta satta* increases in the number of close older brothers a woman has and declines in the number of sisters who may be in competition with her for these brothers. Of course, the sibling sex composition of a woman's natal family may be a reflection of the degree of her parents' boy-preference, which may, in turn, be correlated with the woman's own marital outcomes. Our identification strategy, discussed below, deals with this potential correlation.

After taking into account selection bias, the empirical results conform to our theoretical prior. Women in *watta satta* marriages have substantially and significantly lower probabilities of marital estrangement, domestic abuse, and major depressive episodes. We also explore the potentially confounding effects of various dimensions of endogamy, a practice associated with exchange marriage. But, in the end, the evidence is compelling that the peculiar institution of *watta satta*, with its mutual threat of reciprocity, protects the welfare of women in rural Pakistan.

The rest of the paper is organized as follows. Section 2 provides descriptive evidence on the institution of *watta satta* in rural Pakistan and its relation to other marriage practices. Section 3 shows how *watta satta* can be viewed as an ex-post enforcement mechanism. In section 4, we describe our measures of marital discord and then use them to explore reciprocity across marriages. Section 5 lays out our strategy for testing the deterrence theory, which is followed by the empirical results in section 6. Section 7 summarizes the findings and concludes.

# 2 *Watta Satta*

## 2.1 Descriptive evidence

The data used throughout this paper are from the second round of the Pakistan Rural Household Survey (PRHS II) undertaken in 2004-05. Our main sample consists of 3,071 married women age 15-40 in households randomly sampled from 171 villages in the two most populous provinces, Punjab and Sindh (the sample is broadly representative of these provinces). Detailed modules on marriage, domestic abuse, and mental health, among many other topics, were administered to each respondent meeting the above criteria, including those very few who were divorced or separated from their husbands. Table 1 summarizes key characteristics of our sample.

Because marriage in rural Pakistan is often arranged by parents well in advance of the actual ceremony, sometimes when the principals are still children, care must be exercised in categorizing *watta satta* relationships. An intended exchange marriage may not yet be

operational at the time of the survey. In particular, if there is a sufficiently large age gap between the two couples involved in the *watta satta*, the second couple may not yet be married and, possibly, not even born! There are also cases, though very few, where the second couple is no longer married or living together at the time of the survey. We define an effective *watta satta* as one in which both of the counterpart couples are currently married; otherwise, the reciprocal threats may not yet be, or may no longer be, in force. Whereas 43% of our sample women report that their marriage involved a bride exchange, 5.5% are in *wattas* in which the counterpart couple has not yet married and 1.5% are in *wattas* in which the counterpart couple are no longer living together.[4] So, the incidence of effective *watta satta* is 36%.

The vast majority of effective *watta satta* marriages (94%) involve at least one brother-sister pair, and most (72%) involve a brother-sister pair on both sides. The second most popular *watta satta* arrangement (16%), but still far less prevalent than brother-sister, is when at least one of the households (but rarely both) contributes an uncle-niece pair. Various other combinations occur as well, though none in significant numbers.

### 2.2 Relation to endogamy

Marriage in rural Pakistan is characterized by a remarkable degree of endogamy. More than half of the women in our sample (54%) have married men from the same village. Using a broader definition of geographical endogamy, 82% of women either live in the same village as their natal family or report being able to visit it and return home in the same day (see Table 1). Even more striking is the extent of marriage within clan and caste: 77% of women in our sample have married a blood relative, mostly first-cousins with a preference for the paternal side; 13% have married someone unrelated by blood but within the same caste (*zaat*/biradari); leaving just 10% of marriages outside clan and caste. Interestingly, these two dimensions of endogamy are not as highly correlated as one might expect. For instance, only about two-thirds of women who marry a blood relative are also from the same village as their husband. And, the correlation between the variables in the fourth and fifth rows of Table 1 is only about 0.20.

We can also extend the notion of endogamy to marriage within family socioeconomic class or rank. To measure this aspect, we construct a socioeconomic distance index from information on the landownership, education, nonfarm business ownership, and official/religious position of the father and father-in-law of each woman at the time of her marriage. Letting $x_F$ be the $k$-vector of characteristics of each woman's father and $x_{FIL}$ be the corresponding vector of father-in-law characteristics, we define the distance index

[4] There is no difference in the rate of divorce or separation (around 1.5%) between the women in *watta satta* marriages and their non-*watta* counterparts.

as $DI = \sum_k \left| x^k_{FIL} - x^k_F \right|$.[5] $DI$ is inversely related to socioeconomic endogamy.

The simple mean comparisons in rows 4-6 of Table 1 show that *watta satta* marriages are characterized by greater endogamy, along all three dimensions, than non-*watta* marriages. Exchange marriage facilitates endogamy by forging a double union between two families, but this does not appear to be the sole motivation for the arrangement in rural Pakistan. For instance, 22% of women who are not married to a blood relative are still currently involved in a *watta*, and these rates do not differ dramatically among women married to nonrelatives within the same caste (24%) versus outside their caste (21%).

The other side of the coin is that exchange marriage conflicts with hypergamy (women marrying up in wealth or status), since any hypergamous woman in a *watta satta* arrangement must have a counterpart sister-in-law who married down. While hypergamy is not the norm in rural Pakistan,[6] it is indeed less pronounced in *watta satta* marriages. To see this, we define a hypergamy index

$$HI = \begin{cases} \sum_k (x^k_{FIL} - x^k_F) & if \ \sum_k (x^k_{FIL} - x^k_F) > 0 \\ 0 & otherwise \end{cases}$$

that only counts socioeconomic status differences favoring the father-in-law; when the father of the bride is of higher status overall than the father of the groom, $HI$ takes a value of zero. As was the case with the socioeconomic distance index, the hypergamy index is significantly lower on average for marriages involving *watta satta* (see the seventh row of Table 1).

### 2.3 Relation to dowry

Before turning to our main theoretical arguments, we briefly consider whether *watta satta* is motivated by the economic burden of marriage payments. Suppose that a financial transfer is required at the time of marriage, either to the bride or to the groom (or to

[5] The land and education variables are based on the categories in Table 1 and each take on values of 0, 1, or 2. The other two variables are dummies. Thus, $DI$ can have a maximum value of 6, but to ease the estimation problem later we truncate it at a value of 4. A limitation of this scalar index is that it weights characteristics equally so that if, for example, the father owned a non-farm business at the time the woman's marriage and the father-in-law held a local political office, yet they were otherwise identical, then $DI$ would take a value of zero.

[6] Our data show that 39% of women married to a blood relative had a husband from the maternal side, and these percentages are similar for women in *watta satta* and conventional marriages. This pattern is inconsistent with widespread hypergamy because, if the woman's mother married up, then the woman herself, by marrying her mother's relative, would have to be marrying down. As for marriages on the paternal side – in particular, with a paternal cousin – our data do not distinguish whether the husband was the son of the father's brother or sister. However, other evidence indicates that the former case predominates (see, e.g., Hussain, 1999; McC. Pastner, 1979; Fricke et. al., 1986). Since land is usually divided equally among male heirs in Pakistan, and land confers status in a rural society, children of the paternal uncle would be particularly well-matched in terms of both wealth and status.

their respective families). A poor household, one without collateral to raise sufficient funds, would have to delay the marriage of its daughter or son as the case may be until it accumulated enough cash to make the required transfer. In the limit, the delay could be indefinite and the child may never be married.

To focus on the scenario where an exchange marriage is feasible, consider a household with a son and a daughter. Without loss of generality, assume that a net transfer must go to the groom's side. So as to avoid delaying their daughter's marriage, a poor household could marry their son into a wealthy family and use the proceeds to pay the cost of marrying off their daughter to a different household. The daughter's husband's family could, in turn, use the dowry from their son's marriage to similarly marry off their own daughter, and so on. However, this chain of marriages can only be initiated by a rich household giving their daughter in marriage to a poor one, which may not be an equilibrium when there is positive assortative mating on wealth or when hypergamy is preferred. Exchange marriage essentially breaks this requirement by allowing such households to barter their daughters and thereby eschew financial transfers altogether.

The first problem with this story is that dowries, although universal in rural Pakistan, are relatively modest in value. In our sample, the median bride comes with a dowry amounting to just 18% of her natal family's annual income at the time of her marriage.[7] Typically, brides also receive transfers from the groom's family, called *bari*, worth about half the value of the dowry itself. Median dowry net of *bari* as a fraction of annual parental income is only about 7%. These sums do not appear to represent a great economic hardship. A second empirical concern is that *watta satta* cuts across wealth strata. Table 1 shows that landlessness, a strong correlate of poverty in rural Pakistan, is not significantly higher among fathers of *watta* brides than non-*watta* brides (a pattern confirmed below in a multivariate regression). This is not what we would expect if the poor are disproportionately burdened by marital transfer payments. A final point of dissatisfaction with this theory of *watta satta* is its silence about a key feature of the institution: the reciprocal retaliatory threat. We next present a model showing how such threats are inextricably linked to the exchange of daughters.

[7] Details of this calculation are as follows: We first take the sample of 3,116 households having complete annual consumption expenditure information in the PRHS II and regress the log of per-capita household expenditures on log household size, district dummies, and a set of characteristics of the household head, principally his level of schooling and landholdings. Next, we construct a corresponding set of characteristics for the *father* of each married women in our sample, as well as a measure of household size at the time of marriage. Assuming that the expediture regression is stable across time, we use the estimated coefficients to impute total household expenditures at the time of marriage expressed in 2004 rupees. Marriage payments are then converted into 2004 rupees based on the CPI series for Pakistan and the year of marriage. Finally, we can calculate the ratio of, e.g., dowry to imputed annual natal family income for each woman in the sample.

# 3 *Watta Satta* as an Enforcement Mechanism

In this section, we sketch a model of exchange marriage coupled with retaliatory threats that takes into account the incentives of the principal actors: husbands, wives, and their respective parents. In general, there are two potential costs of marital discord initiated by the husband, the direct cost to the wife and the external cost to the family, i.e., the disgrace. Parents care about the first cost only insofar as they are altruistic toward their daughters. Thus, to the extent that the second cost is important, altruism towards daughters is not strictly necessary to explain *watta satta*.

Nor is it necessary that brothers display altruism toward their sisters. Husbands can be made to retaliate against their own wives for their brother-in-laws' misdeeds purely out of their own self-interest, not out of any direct concern for their sisters' well-being. It is the ability to withhold transfers, broadly construed, that gives parents leverage over their son, *à la* Becker's (1981) Rotten-Kid Theorem. As we explain later, obtaining similar leverage over their son-in-law is costly.

## 3.1 The Problem

Once marriage has taken place, a husband's bargaining position *vis à vis* his wife vastly improves (in light of her virtually nonexistent exit options) and negotiations over the marital surplus are reopened. Suppose that a husband has the power to punish his wife if she does not agree to hand over an amount of surplus $B$ . Carrying out this punishment imposes a cost $C$, which may, as already noted, be shared between the wife and her family. In a world of complete information, one might think that such punishment threats would never be carried out in equilibrium, but, as the literature on sanctions, strikes and related bargaining games has shown (Eaton and Engers, 1992; Fernandez and Glazer, 1991; Busch, et al. 1998), this is not the case. Equilibria exist in which a wife, in our context, may not immediately comply with her husband's demands and he may end up punishing her. While, generally speaking, the occurrence of such inefficiency depends on the relative costs and benefits to each of the principals, and on their respective degrees of impatience, the key point from our perspective is that, ex-ante, all marriages are potentially inefficient.[8]

Consider, then, two sets of parents $i = a, b$ each with exactly one married son and one married daughter. The sons receive a transfer of size $T > B$. Let $\sigma_i = 1$ when the son of parent $i$ makes (and carries out) the punishment threat and $\sigma_i = 0$ when he does not, and let $\sigma_i'$ be the corresponding indicator for the son-in-law of parent $i$. Parents

[8] An alternative source of marital inefficiency is incomplete information. For example, the wife may not know ex-ante whether or not her husband is the 'type' who would be willing to carry out his threat. A husband may, therefore, need to punish his wife as a way of signalling his type (see Bloch and Rao, 2002, for a related model). Finally, Lundberg and Pollack (2003) consider inefficient equilibria arising from nonstationarity in the marital bargaining environment induced by commitment failure on the part of one or both spouses.

effectively control the choice of $\sigma_i$ because the son knows that his transfer will be reduced by more than $B$ if punishing his wife makes them worse off. Therefore, to analyze the wife punishment decision, it is sufficient to examine the payoff function of the parents, $V_i(\sigma_i, \sigma_i')$.

Clearly, $V_i(1,0) > V_i(0,0)$, because the son gains $B$ at no cost to himself or to his parents; the parents share in this gain by reducing transfers to the son by an amount less than $B$. Likewise, $V_i(1,1) > V_i(0,1)$. But how does $V_i(1,1)$ compare to $V_i(0,0)$? Begin with the case in which parents do not care about their daughter's utility. When $\sigma_i = \sigma_i' = 1$, there is a benefit accruing to the son, some of which is skimmed off by the parents, and a cost $C$ imposed by the son-in-law, some of which is borne by the parents. If the cost to the parents exceeds the benefit, then $V_i(0,0) > V_i(1,1)$. So, if parents are neither altruistic toward their daughters nor share in her disgrace from being punished, then they have no motive to restrain their son or son-in-law.

The situation is different when parents are altruistic toward their daughters. Suppose that at the time of her marriage, parents make transfers to their daughter (e.g., in the form of dowry) so that the parents' marginal rate of substitution between son's and daughter's utility is -1. Under $\sigma_i = \sigma_i' = 1$, the son gains $B$ ex-post but the daughter loses $B$ plus her share of $C$. Since this effectively lowers the overall amount of resources available to their children, parents must be worse off (irrespective of whether they can make compensatory transfers to their daughter once she is married). With altruism toward daughters, therefore, even if parents bear no direct cost of their son-in-laws misdeeds (i.e., their share of $C$ is zero), $V_i(0,0)$ must exceed $V_i(1,1)$.

Given the payoff ordering: $V_i(1,0) > V_i(0,0) > V_i(1,1) > V_i(0,1)$, a no-punishment equilibrium would be preferred by both sets of parents to a punishment equilibrium. The problem is how to coordinate the actions of the parents to achieve this result. In the absence of coordination, it will be in the interest of each set of parents to allow their sons to punish their wives.

### 3.2 Rationalizing *Watta Satta*

An exchange marriage solves this coordination failure by forging a strategic link between the two sets of parents. Specifically, we now have $\sigma_a = \sigma_b'$ and $\sigma_b = \sigma_a'$ because the son-in-law of parent $a$ is the son of parent $b$ and vice-versa. This fact leads to the following game between the two sets of parents in normal form

| | Parent $a$ | |
|---|---|---|
| Parent $b$ | $\sigma_a = 1$ | $\sigma_a = 0$ |
| $\sigma_b = 1$ | $V_a(1,1), V_b(1,1)$ | $V_a(0,1), V_b(1,0)$ |
| $\sigma_b = 0$ | $V_a(1,0), V_b(0,1)$ | $V_a(0,0), V_b(0,0)$ |

Given the payoff structure already discussed, this game is none other than the Prisoner's Dilemma. Since it is presumably being played repeatedly for an unknown duration, it is not unreasonable to suppose that the two sets of parents will achieve the cooperative solution $(\sigma_a, \sigma_b) = (0, 0)$. For example, we can imagine a 'tit-for-tat' equilibrium in which a deviation by one set of parents is (credibly) punished by the other set of parents temporarily 'unleashing' their own son; i.e., pressuring him using the stick of withdrawing transfers to punish his wife. A husband's malfeasance is thus deterred in equilibrium by the threat that his brother-in-law will retaliate in-kind against his sister.[9]

The difference between *watta satta* and 'conventional' marriage should now be clear. Marrying a son to a son-in-law's sister establishes reciprocity. In a non-exchange marriage, parents have no way to retaliate *in-kind* if their son-in-law punishes their daughter because their son is married to someone else's sister. This yields an empirically testable implication: Marital inefficiency or discord is less likely to occur in a *watta satta* marriage.

*Watta satta* is certainly not the only conceivable mechanism for restraining husbands, but it may be the cheapest and most reliable one in the context of rural Pakistan. One can imagine an arrangement, for example, whereby parents promise to make a lifetime stream of payments of value $B+\varepsilon$ to their son-in-law conditional on his continued good treatment of their daughter.[10] In principle, such a scheme could obviate the lack of commitment by the son-in-law not to mistreat his wife, although, in the face of uncertainty, hold-up is always a possibility and the scheme could break down. Furthermore, maintaining their son-in-law's good behavior entails a real resource cost to the parents of $B + \varepsilon$, one which is not present under *watta satta*.[11] This is not to suggest that *watta satta* is itself costless (as we emphasize in our conclusion), only that in an environment with generally low and variable incomes, lax legal enforcement, and strong codes of family honor, this institution may be the most effective means available to prevent marital discord.

[9] The fact that a husband's coercive power is curbed by *watta satta* does not necessarily imply that he is worse off. In the cooperative equilibrium, the total size of the parental pie is larger. Thus, to the extent that utility is transferable, a son can, in principle, be compensated for his loss of surplus.

[10] As an empirical matter, monetary transfers between the wife's natal family and her husband's household are rare; only 14% of women in our sample report that their parents ever provided such support during their marriage for *any* reason.

[11] The argument is actually more complicated than this because the parents are assumed to have a son in an identical situation, i.e., also receiving a payment from his in-laws. Under the assumptions of the Rotten-Kid Theorem, the parents will share these gains with their son by reducing transfers to him, effectively taxing his extra wealth at a rate $\tau$. For a given payment $P$, as soon as $(1-\tau)P$ falls below $B$, the son will no longer have an incentive to restrain himself. Thus $(1-\tau)P = B + \varepsilon$. Since each set of parents must pay out $P$ to their son-in-law while receiving $\tau P$ in 'revenue' from their own son, the net cost of the scheme to them is $(1-\tau)P$, which is $B + \varepsilon$.

# 4 Marriage and its Discontents in Rural Pakistan

## 4.1 Estrangement

As already mentioned, the vast majority of women in rural Pakistan live in close geographical proximity to their natal families. Consequently, the parents' home is, for most, a potential exile from their husband's household, albeit not a costless one.[12] In our sample, 19% of women report that they had returned to their natal home at least once during their marriage due to an estrangement from their husband. These periods of estrangement are generally short, the modal duration being less than a month.

Estrangement is probably the clearest expression of the intensity of marital discord. Given the considerable psychic penalties, it is also not a decision taken lightly:

> "Sometimes I thought of going back to my parents but then I did not want to worry them. Sometimes when my in-laws quarrel with me and bad mouth me, I think that I will not tell this to my parents. Some women go to their natal home, but they have to come back eventually or the people of the village taunt them. It degrades the women." (*woman from Mirpurkhas, Sindh*)

> "In our family, it is a tradition that women live in their husband's home and do not leave it... When I got married, my father told me that if my in-laws will be happy with me, he would consider me a wise person. The very words he used to say were that he would consider the daughter astute who would not return from her home due to any conflict. This was inculcated in our minds since childhood." (*woman from Faisalabad, Punjab*)

## 4.2 Domestic abuse

One fifth of the women in our sample report having been physically hurt by their husbands in at least one of following ways: pushed, hit, slapped, kicked, thrown, choked, burned or attacked with a weapon. This figure is in line with other data from south Asia (Fikree and Bhatti, 1999; Kumar, et al., 2005) and elsewhere (Garcia-Moreno, et al., 2008), reflecting the care with which the survey was carried out; women were interviewed in strict privacy by specially trained female enumerators.

Arguably, domestic violence as conventionally measured is a less direct indicator of marital strife than estrangement. For one thing, husbands can be physically abusive outside the context of a marital conflict, such as when intoxicated. Moreover, in a social setting where violence against women is unexceptional and, therefore, tolerated to a degree, there is likely to be a threshold level below which domestic abuse remains hidden

[12] In the Indian context studied by Bloch and Rao (2002), where village exogamy is the norm, a wife's return to her natal household is an even more drastic and unlikely course of action.

from parents, in-laws, and society at large. By contrast, discord that has precipitated an estrangement can no longer be concealed. Estrangement must, therefore, occur only after violence or emotional intimidation has become intolerable. Not surprisingly, domestic abuse and estrangement are positively related; 47% of women who report having been physically harmed by their husbands also said they had been estranged from him at some point in the marriage, as compared to just 11% for women who have never been abused.

### 4.3 Depression

Our final indicator of marital discord is whether the woman has suffered an episode of major depression (MD) in the last 12 months. We assess MD using an instrument adapted from the CIDI-SF survey of the World Health Organization with the assistance of the Institute of Psychiatry of Rawalpindi General Hospital. Overall, we find that 23% of women experienced MD, which is unremarkable by international standards.[13]

Since MD is likely to capture the cumulative effects of the whole array of emotional and/or physical intimidation deployed against the woman by her husband and his family, it may provide a fuller picture of marital discord than our measure of domestic abuse. Spousal abuse, both physical and psychological, has been found in many studies to be strongly positively correlated with mental disorders, including MD (see the citations in footnote 13). In our sample, 38% of women with major depression also reported domestic abuse, as compared to 20% of non-depressed women. By contrast, evidence for a link between MD and poverty is tenuous (see Das et al., 2007). So too in our data, where the rate of depression among women is virtually constant across household per-capita expenditure quintiles. MD is thus likely to be a much better signal of marital strife, or inefficiency, than it is of a woman's economic deprivation.

### 4.4 Reciprocity and concordance

While reciprocity appears to be a key element in Pakistani exchange marriage, it is a knife that cuts both ways. The upside is deterrence:

> "...[W]e do such marriages because if we will give our daughter without it, she might get harmed. We do *watta satta* so that our daughter remains secure." (*woman from Badeen, Sindh*)

The downside is that, when deterrence fails, violence in one marriage may spill over into the counterpart marriage:

[13] Again see Fikree and Bhatti (1999) and Kumar et al. (2005) for south Asia, as well as Cocker et al. (2002) and O'Campo et al. (2006) for the US.

> "Yes, my marriage involves *watta satta* agreement... When my husband beats me, I go and tell my mother and sister. My brother feels bad about this and then he beats his wife to take revenge... There are many fights in our family because of this... I do feel that it is the women who are being beaten in both families. (*woman from Mirpurkhas, Sindh*)

Our empirical work below will investigate whether *watta satta* averts more marital strife than it causes.

Before doing so, however, we consider a more basic question: Are mutual threats of retaliation actually carried out, as the qualitative evidence seems to indicate? To answer this question we would need data on marital discord experienced by pairs of sister-in-laws, some of which are involved in *watta satta* arrangements and some of which are in conventional marriages. We could then check whether there is a higher degree of concordance in marital discord across *watta satta* sister-in-law pairs as compared to conventional sister-in-law pairs. Such a finding would be suggestive of retaliation.

By design, our data set does include a large subsample of matched sister-in-laws. Households containing sister-in-laws (age 15-40) of all currently married women in the base sample were tracked down and interviewed as long as they resided in the same village (which is likely given the high degree of village endogamy already noted). In total, we are able to match over 500 sister-in-law pairs of whom 55% are linked by *watta satta*.[14]

To test for differences in concordance across marriage types, while controlling for variables such as the duration of marriage, we use a simple regression-based procedure. Let $y_i$ be an outcome, such as estrangement, for woman $i$ and $y_i^s$ be the same outcome for her sister-in-law. Consider a purely descriptive regression of the form

$$y_i = \lambda_0 + \lambda_1 y_i^s + \lambda_2 WS_i + \lambda_3 WS_i y_i^s + \lambda_4 \Delta m_i + \phi_i$$

where $WS_i$ is an indicator for whether the sister-in-laws are linked in a *watta satta* arrangement and $\Delta m_i$ is the difference in their number of years married. The parameter $\lambda_3$ estimates the difference in outcome covariances between *watta* and non-*watta* sister-in-laws scaled by the respective variances. Thus, the null hypothesis of equal concordance, $\lambda_3 = 0$, can be tested against the one-sided alternative of greater concordance for *watta satta* sister-in-laws, $\lambda_3 > 0$.

Table 2 reports the results of this test for different marital outcomes. For estrangement, there is strong evidence that *watta satta* sister-in-laws are more concordant than non-*watta* sister-in-laws. This finding is consistent with our field interviews: Typically,

[14] Because *watta satta* marriages tend to be more village endogamous than conventional marriages, they are over-represented in the matched sister-in-law sample relative to the full sample.

a husband in a *watta satta* marriage responds to his sister-counterpart's estrangement by sending his own wife back to her natal home. It should be emphasized that this greater degree of concordance on estrangement among *watta satta* marriages cannot simply be the mechanical outcome of the exchange marriage agreement unravelling, since estrangement very rarely leads to permanent separation or divorce.

One might also worry that this concordance test is picking up some other source of positive correlation in the outcomes of *watta satta* sister-in-law pairs that has nothing to do with retaliation. In particular, we know that *watta satta* is more prevalent among couples who are blood relatives (see subsection 2.2). When first-cousins, for example, marry in a brother-sister *watta*, the resulting sister-in-laws and their husbands are necessarily first-cousins as well. For this reason alone, their marital outcomes may be more highly correlated as compared to unrelated sister-in-laws. To check whether this is driving our results, the second row of Table 2 re-runs the concordance test controlling for whether the spouses (and by implication the sister-in-laws) are blood relatives. We do find that sister-in-laws related by blood are more concordant on estrangement than unrelated ones ($p = 0.037$), but the result of the *watta satta* concordance test is not appreciably affected, so the suggestion of a retaliatory response remains.

If estrangement of *watta satta* sister-in-laws is indeed linked by reciprocity, then the length of their most recent period of estrangement should also be more closely related than it is for conventionally married sister-in-laws. This can be examined using the sample of 50 sister-in-law pairs (30 of which are *watta satta*) wherein both women have experienced at least one episode of marital estrangement. In the third row of Table 2, we see that log estrangement duration is significantly more correlated for the *watta satta* sister-in-laws. Again, this finding is consistent with operative reciprocity among the *watta satta* marriages in our sample.

Finally, we report on the concordance results for domestic abuse and depression. Although these two marital outcomes are also more correlated among *watta satta* sister-in-laws than among conventional sister-in-laws, the differences are not statistically significant. These weak findings relative to those for estrangement can be explained by the conceptual difference between the indicators already discussed. Unlike estrangement, which is an extreme and visible act, domestic abuse is more hidden and, at the same time, is often viewed as normal or inevitable. A retaliatory response may thus be initiated only if violence exceeds a certain threshold. Similarly, mental depression is not a discrete incident that can easily be reciprocated in-kind. Nevertheless, failure to find positive evidence of reciprocity here does not imply that women in *watta satta* marriages are not better off along these dimensions, as we will shortly discover.

# 5 Empirical Strategy

## 5.1 Econometric model

Let $\theta$ represent the unobserved state of discord in the marriages of the sample women. We observe three manifestations of this latent variable – estrangement, abuse, and depression – denoted by the binary indicators $y_j$, $j = e, a$, and $d$ respectively. Thus, we have

$$y_j = 1(\beta_j \theta + X\omega_j + u_j > 0) \tag{1}$$

where $\beta_j > 0$, $X$ is a matrix containing data on the woman's exogenous characteristics, and the error terms $u_j$ are assumed i.i.d. and mutually uncorrelated with (diagonal) covariance matrix $\Omega$. Of primary interest is the relationship between marital discord and the indicator of *watta satta* marriage $WS$

$$\theta = \alpha WS + \epsilon \tag{2}$$

where $\epsilon$ is an error term with variance $\sigma_\epsilon^2$ ($X$ is left out of equation (2) without loss of generality). The empirical content of our theory is embodied in the parameter $\alpha$. Substituting (1) into (2) leads to

$$y_j = 1(\alpha_j WS + X\omega_j + \nu_j > 0) \tag{3}$$

with $\alpha_j = \beta_j \alpha$ and $\nu_j = \beta_j \epsilon + u_j$. The variance-covariance matrix of the $\nu_j$ takes the restricted form $\Omega + \sigma_\epsilon^2 \beta \prime \beta$, where $\beta = (\beta_e, \beta_a, \beta_d)$.[15] While the magnitude of $\alpha$ is not of direct interest, the null hypothesis that $\alpha = 0$ can be tested against $\alpha < 0$, the alternative implied by the theory, by looking at each of the $\alpha_j$ (since $\beta_j > 0$).[16]

The decision to undertake a *watta satta* marriage depends on each side's ability to do so (about which more will be said in the next subsection) and on its willingness to do so. Aside from the benefits already discussed, willingness is a function of a host of personal and cultural factors, some of which could be systematically related to the ultimate state of the marriage itself; i.e., to $\theta$. For example, traditional practices like *watta satta* may be more prevalent in households where women would otherwise have low status and thus be treated badly by their husbands. Parents might also be more inclined to arrange a *watta* marriage for a son prone to violence in the first place, since he could be better counted

[15] This is simply the Multiple Indicator Multiple Cause (MIMIC) model introduced in Goldberger (1972) with discrete indicators (see also Carniero, et al., 2003). In an earlier version of this paper, we estimated the three outcome equations independently of one another and obtained similar, albeit less precise, results. The identifying restrictions embodied in the facor-analytic covariance structure play a role in our robustness checks in subsection 6.3.

[16] The model supplies two additional restrictions, $\alpha_e/\alpha_a - \beta_e/\beta_a = \alpha_a/\alpha_d - \beta_a/\beta_d = 0$, linking the coefficients to the error covariances. Rather than impose these restrictions in the estimation, we test them below.

on to mete out retaliation. In short, there is likely to be selection into *watta satta* on the basis of latent marital discord.

To deal with this selection or endogeneity problem, *watta satta* choice is assumed to be governed by a 'first-stage' equation of the form

$$WS = 1(Z\gamma + \eta > 0) \tag{4}$$

where the error term, $\eta$, is allowed to depend on $\epsilon$ through $\eta = \beta_w \epsilon + \xi$. Assuming $\xi$ and the $u_j$ are mutually uncorrelated and each has unit variance gives $corr(\nu_j, \eta) = \sigma_\epsilon^2 \beta_j \beta_w / \sqrt{(1 + \sigma_\epsilon^2 \beta_j^2)(1 + \sigma_\epsilon^2 \beta_w^2)}$.

If $u_j$ and $\xi$ are normally distributed, then equations (3) and (4) are simple probits conditional on $\epsilon$. We model $\epsilon$ nonparametrically using a discrete factor approximation (e.g., Heckman and Singer, 1984, Mroz, 1999; Altonji, et al. 2005). After suitable normalization, the points of support of the finite mixture distribution, associated probabilities, factor loadings ($\beta$s), and model coefficients can all be estimated jointly by maximum likelihood.

### 5.2 Identification

To identify the econometric model, it is sufficient to have an exclusion restriction; i.e., at least one variable in $Z$ that is not also in $X$. We use information collected in PRHS II on the number, age, and sex composition of the woman's siblings at the time of her marriage. The logic is straightforward: the ability of a family to arrange a *watta satta* for their daughter depends on the available supply of counterpart grooms. As we have seen, the great majority of exchange marriages in rural Pakistan involve brothers and sisters. Although we also observe *wattas* involving other male relatives, notably uncles, these are decidedly in the minority (see subsection 2.1). A preference for brothers of the bride as counterparts over, say, uncles emerges naturally from our theory of *watta satta*: Parental control over their sons (e.g., through bequests) is likely to be greater than over other male relatives, and parents must be able to exert such control for the enforcement to be credible.

In two-child families, only those with one boy and one girl can contemplate a brother-sister *watta*. Thus, only half of all two-child families are, to borrow a term from the program evaluation literature, 'eligible' for exchange marriage. More generally, the probability of *watta satta* for a daughter is increasing in the number of sons relative to daughters, again assuming some preference for involving brothers in the exchange over other male relatives. In addition, because girls typically marry young in rural Pakistan (the median age at marriage is 17 in our sample), and grooms are generally older than brides (median age gap is 4 years), having an older brother, but not too much older, increases the likelihood of the woman entering *watta satta* relative to having any kind of brother.

Likewise, a woman's sisters, particularly older ones not too far away in age, will be in competition with her for an available brother to form a *watta*, so that the probability of such an arrangement declines as the number of close-older sisters increases.

Excluding such demographic variables from the second-stage equations (3) may be problematic to the extent that family size and sex composition is subject to parental control. While the cohort of individuals we consider were all born well before selective abortion became widespread in South Asia (albeit never in rural Pakistan), other forms of sex selection have long been available, such as fertility stopping rules and underinvestment in girls' health care and nutrition. The number of brothers and sisters a woman has may thus depend on the intensity of her parents' boy-preference. Furthermore, parents with stronger boy-preference may choose to reallocate more household resources away from (surviving) girls to boys along various dimensions; e.g., by discriminating in schooling and/or nutrition, and, more relevant to the present discussion, by expending less effort on preventing their daughter's maltreatment within her marriage. In particular, such parents might take less care in choosing a 'good' husband ex-ante or may monitor their daughter's treatment in her husband's household less assiduously ex-post.

To capture possible correlation between natal family boy-preference and marital discord, we include the total number of the woman's brothers ($NB$) and sisters ($NS$) directly in equations (3). However, we exclude the number of brothers 0-5 years older than the woman ($NB_{[0,5]}$) as well as the corresponding number of sisters ($NS_{[0,5]}$). In other words, identification is achieved off of variation in the *relative* number of brothers and sisters that fall in the five year interval preceding the birth of the woman in question.

Including $\{NB, NS\}$ in equation (3) deals with differential female mortality in that women whose parents have stronger boy-preference would, in this event, have fewer sisters. Less obviously, our strategy also handles sex-specific stopping rules. Specifically, suppose that parents continue to bear children until they have $M$ boys, where population variation in $M$ reflects heterogeneity in boy-preference. If a male is born with probability 0.5, then a woman is expected to have $2M + 1$ siblings (see Yamaguchi, 1989). Therefore, $M$ may be expressed as $0.5(NB + NS - 1)$ plus error due to the randomness of child gender. Sibling cohort size is, consequently, a good proxy for boy-preference heterogeneity.[17,18]

[17] Note that, along with $NB + NS$, we are also implicitly controlling for the proportion of boys among children in the natal family. According to the calculations of Yamaguchi (1989), however, for $M > 1$ the expected proportion of boys falls rather slowly as $M$ increases. Therefore, this proportion is likely to be a poor proxy for boy-preference in rural Pakistan.

[18] One might think that, for a given $NB + NS$, a woman having an older brother must have had parents with lower boy-preference, since they continued bearing children after having a boy. This statement is only true under the very special assumptions that (a) some families exhibit no sex-specific stopping behavior whatsoever and that (b) all families with a boy-preference have $M = 1$, in which case not stopping after a boy implies that a family is of the first type. However, under the far more plausible assumption (especially in the context of rural Pakistan) that $M > 0$ for all families, not stopping after a boy indicates a desire for even more boys. Moreover, for a woman arbitrarily chosen from the birth order, the fact of her having an older brother conveys no information about $M$, conditional on $NB + NS$.

If unobserved determinants of marital discord are uncorrelated with the natal family's fertility choices, then including $\{NB, NS\}$ in equation (3) leads to an efficiency loss. For this reason, we will test down to the most parsimonious specification of equation (3), with respect to the demographic variables, that is not rejected by the data.

# 6 Results

## 6.1 The first-stage

The first column of results in Table 3 reports what is essentially the first-stage of our simultaneous equations model – the determinants of *watta satta* marriage.[19] Focusing on instrument relevance, we see that, conditional on the *total* numbers of male and female siblings, the older-close brother and sister variables $\{NB_{[0,5]}, NS_{[0,5]}\}$ are highly jointly significant ($\chi^2_{(2)} = 24.1$; $p < 0.0000$), as are all four demographic variables taken together ($\chi^2_{(4)} = 138.5$; $p < 0.0000$). Moreover, the sign patterns of their coefficients make sense: having more brothers (sisters) raises (lowers) the probability that a woman is in a *watta satta* marriage.

Also of note is that, compared to the unschooled, fathers with a secondary education or above are significantly less likely to arrange exchange marriages for their daughters (since fewer than 4% of mothers had ever attended school, we do not include corresponding dummies for mother's education). This could mean that education inculcates values inimical to traditional practices like *watta satta*, or, alternatively, that families having such values to begin with place stronger emphasis on education. By contrast, the likelihood of *watta satta* does not significantly depend on the size of the father's landholdings at the time of the woman's marriage; landless households are no more likely to have entered this arrangement than either small or large landowners. This confirms our earlier finding after conditioning on district of residence and the other controls (including a cubic polynomial in the woman's age). So, again, *watta satta* appears to cut across wealth classes.

## 6.2 Main results

The remainder of Table 3 presents estimation results for the three marital discord indicator equations under different econometric restrictions. Model I allows for correlation across indicators, but zero correlation between the indicators and $WS$ (i.e., $\beta_w = 0 \Rightarrow corr(\nu_j, \eta) = 0$); thus, Model I ignores selection bias. Not surprisingly, the pattern of estimated error correlations reported in the third and fourth columns mirrors that found

[19] In the case of Model I of Table 3, we estimate equation (4) independently of equation (3), so this is equivalent to a univariate probit for $WS$. When we jointly estimate the $WS$ probit along with the second stage probits in Model II and III, the former's parameter estimates change, but only very slightly. For this reason, we do not report first-stage estimates for Model II and III in Table 3.

in the raw data.[20] More interestingly, none of the coefficients on $WS$ is statistically different from zero, and two of them, contrary to expection, are positive.

In Model II, we account for selection bias by freeing up the correlations between first and second stage errors as discussed in subsection 5.1. This substantially improves model fit and produces precise estimates of the three new error correlations, all of which are positive. Hence, women who would otherwise have been in less harmonious marriages to begin with were more likely to have entered into *watta satta* arrangements. As a consequence, the selectivity corrected estimates of the $\alpha_j$, the coefficients on $WS$, are all negative and highly significant, just as our theory predicts.[21]

Given the lack of significance of $\{NB, NS\}$ in the marital discord indicator equations in all but one case, we further restrict the model. Model III thus drops the total number of sisters from all three discord equations and the total number of brothers from all except the domestic abuse equation. Needless to say, the point estimates of the $\alpha_j$ and the error correlations are close to those from the otherwise identical Model II but, as would be expected with the additional identifying information, they are more precise.

Overall, then, we find strong evidence that *watta satta* reduces marital discord relative to the conventional marital alternative in this setting. Practically speaking, the effects are substantial: Model III predicts that *watta satta* reduces the odds of estrangement by 63%, domestic abuse by 74%, and major depression by 49%.[22]

### 6.3 Robustness: *Watta satta*, endogamy, and hypergamy

Earlier we saw that exchange marriage reinforces endogamy and, obversely, limits hypergamy. Insofar as the type of match influences conditions within the marriage and hence the degree of marital discord, the *watta satta* effects estimated in Table 3 may be biased.

Consider a match characteristic $M$ that is correlated with both $WS$ and $\theta$. In other words, instead of equation (2), suppose that the correct model is $\theta = \alpha WS + \pi M + \epsilon$. The omission of $M$ may lead us to falsely reject the null that $\alpha = 0$. However, match characteristics may also be endogenous with respect to marital discord for the same reason that *watta satta* is. If $M$ is indeed correlated with $\epsilon$, then including it in equation (3) without correcting for this endogeneity could invalidate our test of the *watta satta* hypothesis. To deal with this issue, we add a fifth equation to the econometric model

$$M = 1(Z\delta + \mu > 0) \tag{5}$$

[20] The correlation coefficient between the estrangement and domestic abuse indicators (0.373) is about double the correlation between estrangement and depression (0.198) and abuse and depression (0.170).

[21] We also fail to reject the pair of nonlinear restrictions discussed in footnote 16 using a joint Wald test, which lends support to the single factor structure of the econometric model.

[22] Linear probability models for the three indicators estimated independently by instrumental variables give similar predictions (-64%, -91%, and -57%). While relative precision is considerably lower, the hypotheses that each of the $\alpha_j$ is zero can still be comfortably rejected.

where $\mu = \beta_m \epsilon + \zeta$ is also assumed to follow the single-factor structure, with $\zeta$ uncorrelated with $(u_j, \xi)$. Note that if the elements of $Z$ not contained in $X$ – the various demographic variables – have zero coefficients in equation (5), then our previous identification argument holds even when $\pi_j = \beta_j \pi \neq 0$; there is no reason to control for $M$ in the second stage as it merely is another source of error uncorrelated with our excluded instruments. On the other hand, if the demographic variables do have explanatory power in equation (5) and $\pi_j \neq 0$, then our exclusion restrictions are no longer valid unless we condition on $M$ in equation (2). In this case, we must confront the potential endogeneity of $M$ as well.

Given these considerations, our strategy is to combine identification through demographic exclusion restrictions (insofar as they have power in equation (5)) with identification through the covariance restrictions inherent in the single-factor structure. To see how these covariance restrictions work, assume that equations (3)-(5) are all linear probability models, that $X = 0$, and that $Z$ has a single column; i.e., that there is exactly one exclusion restriction. Now, rearrange equation (4) to get $\epsilon = \frac{1}{\beta_w}(WS - \gamma Z - \xi)$ and substitute into, say, the $y_e$ equation to obtain

$$y_e = (\alpha_e + \frac{\beta_e}{\beta_w})WS - \frac{\gamma \beta_e}{\beta_w} Z + \pi_e M + u_e - \frac{\beta_e}{\beta_w}\xi. \tag{6}$$

While $M$ is uncorrelated with the resulting error term, which has been purged of the common component $\epsilon$, this is not true of $WS$. Due to $\xi$, $WS$ is a noisy measure of $\epsilon$. However, the second stage residuals $\nu_k = y_k - \alpha_k WS - \pi_k M$ for $k = a, d$ are also (noisy) measures of $\epsilon$; the $\nu_k$ are thus correlated with $WS$ but they are uncorrelated with the error $u_e - \frac{\beta_e}{\beta_w}\xi$. Since $\gamma$ is identified from the first-stage, it is clear that $\alpha_e$ is identified from the coefficients in equation (6) estimated using $\nu_a$ and $\nu_d$ as instruments. Proceeding in an analogous fashion for the $y_a$ and $y_d$ equations, we find that all three $\alpha_j$ are identified along with the $\pi_j$ with only the one exclusion restriction, $Z$.[23] Of course, additional exclusion restrictions can only improve efficiency.

Table 4 displays the results of our robustness tests. For each match characteristic under consideration, we estimate two models. In the first, we set $\beta_m = 0$, thus treating $M$ as exogenous, whereas, in the second, we relax this restriction. Aside from the addition of equation (5), the models are identical to Model III of Table 3, which, recall, has up to four exclusion restrictions (depending on the indicator). For the sake of brevity, we only report estimates of the relevant coefficients and error correlations. Descriptive statistics

[23] Note that the system is non-recursive because the second stage residuals used as instruments depend on the unknown parameters $\alpha_k$ and $\pi_k$. For this reason, an iterative solution via, e.g., FIML is required. See Hausman et al. (1987) for a general characterization of this type of problem and Chamberlain (1977) for the original instrumental variable interpretation of covariance restrictions in the MIMIC model (Pitt, et. al., 2003, provides a more recent exposition). The vital role of the exclusion restriction is readily apparent. Without it, the $\alpha_j$ cannot be isolated and the $\nu_k$ cannot be formed. Identification consequently breaks down regardless of the number of indicator equations at our disposal.

for the $M$ variables are presented in Table 1.

Consider, first, whether the woman and her husband are related by blood. As noted in subsection 2.2, *watta satta* is a lot more prevalent in marriages among relatives. Nevertheless, the first three columns of the top panel of Table 4 show that controlling for spousal relatedness does not diminish the estimated $WS$ coefficients. The same is true when we allow for correlation between $\mu$ and the $\nu_i$, as in the last three columns. In this case, all three additional estimated correlations are positive and significant and the coefficients on the relatedness variable all rise substantially.[24] Interestingly, marrying a relative significantly reduces the likelihood of marital discord, which may suggest a motive for consanguinity (see Do et al., 2008, for a discussion of other motives).

Next, we look at geographical endogamy. Arguably, a woman's proximity to her natal family would reduce the marital violence and intimidation visited upon her irrespective of *watta satta*. The results reported in the second panel of Table 4 show that better natal family access does indeed lessen the likelihood of domestic abuse, at least after controlling for selection. However, the inclusion of this match variable in the model does nothing to attenuate the $WS$ coefficients. Practically the same results (not reported) are obtained with the narrow definition of village endogamy based only on whether the woman's natal family resides in the same village (see discussion in subsection 2.2).

Lastly, we ask whether the seemingly beneficial effect of *watta satta* is merely a byproduct of the greater equality in status between the spouses' respective families. A woman may receive better treatment when her husband and in-laws more closely share her socioeconomic background. Alternatively, she might be treated particularly badly when she marries into a relatively higher status household (hypergamy), but not when she marries down or laterally. In the latter case, it is not the absolute difference in family status per se that matters as much as the extent to which the husband's position is more elevated than the wife's. To examine this issue, we use the two indices constructed in subsection 2.2 based on characteristics of the woman's father and father-in-law at the time of her marriage. Recall that the socioeconomic distance index, $DI$, makes no distinction as to whether the father-in-law or the father has the higher status; it is increasing in the absolute status difference. By contrast, the hypergamy index, $HI$, is zero if the father has higher status and increases in the relative status of the father-in-law. Since both indices are categorical, ranging from zero to four, we estimate equation (5) as an ordered probit, but otherwise proceed as before.

The third panel of Table 4 shows that premarital socioeconomic differences between the spouses' families do not drive marital discord, nor does $DI$ appear to be endogenous

[24] This happens to be the $M$ variable for which the four demographic instruments have by far the highest first-stage explanatory power ($\chi^2_{(4)} = 32.5$). The MIMIC structure also implies that $\alpha_e/\pi_e - \alpha_a/\pi_a = \alpha_a/\pi_a - \alpha_d/\pi_d = 0$ (see Chamberlain, 1977). Again, we do not impose these proportionality restrictions in the estimation, but rather test them ex-post. In the case of relatedness, where the $\pi_j$ estimates are the most significant, it is remarkable that a joint Wald test cannot reject proportionality.

with respect to marital discord (i.e., all the correlations are essentially zero). By contrast, the evidence in the bottom panel indicates that women in more hypergamous marriages experience *less* marital discord than women who marry their peers or downward, though this effect is much attenuated after correcting for selection bias. In results not reported, the effect is further attenuated and becomes insignificant for all discord indicators when education is removed from the hypergamy index, suggesting that it is particularly when a woman marries into a better educated household that the condition of her marriage improves. At any rate, the $WS$ coefficients are barely affected by the inclusion of any of these measures of differences in spousal family backgrounds.

# 7 Conclusion

Do marital institutions limit inefficient outcomes of spousal bargaining? This paper views a custom of bride exchange accompanied by mutual retaliatory threats as a mechanism for coordinating the actions of two sets of in-laws, each of whom wish to restrain their son-in-laws but who only have the ability to restrain their sons. Consistent with this view, we find that the likelihood of discord is substantially lower in *watta satta* marriages as compared to 'conventional' marriages. Thus, families who, because they lacked the appropriate configuration of sons and daughters, could not arrange a *watta* appear to be less able to enforce their son-in-laws' good behavior. Finally, these effects of *watta satta* cannot be attributed to the associated marriage pattern of endogamy, whether along relational, geographical, or socioeconomic lines.

Since freedom from domestic abuse and mental depression is undoubtedly a benefit, *watta satta* appears to be in women's interest, regardless of whether the practice is ultimately motivated by parents' altruism toward their daughters or by their desire to maintain family honor by eliminating public manifestations of marital strife (e.g., estrangement).[25] Whatever the motivation, the importance of our results lie in showing how informal enforcement mechanisms can, in certain contexts, fill the breach left by a weak legal system and limited commitment.

*Watta satta* is obviously not a first-best solution to the problems inherent in the incompleteness of the marriage contract. Restricting the set of spouses for a pair of siblings to come from the same family severely circumscribes the choice of mates, which may reduce average match quality.[26] This type of cost may give us a clue as to why *watta satta* is so pervasive in rural Pakistan. Given the already high degree of endogamy, by

[25] One qualification is that some of the 'rents' accruing to women whose families are able to arrange a *watta satta* marriage may be appropriated by their brothers via a reallocation of parental transfers in favor of sons. However, even if utility were perfectly transferable, which seems implausible in this context, women in *watta*-eligible familes would still share in the overall wealth effect.

[26] Constraint on choice is also a salient cost of other social institutions that otherwise benefit their participants, such as caste systems (e.g., Munshi and Rosenzweig, 2006) or religious sects (Berman, 2000).

clan, caste, village, and socioeconomic status, any further restrictions *watta satta* imposes on marital choice may have only a marginal impact on match quality.[27]

[27] The contrast between south and north India is suggestive in this regard. Sibling exchange is common in the south, where cross-cousin marriage and village/clan endogamy are also the norm, but is nearly absent in the north, where the idealized form of marrriage (*kanyadana*) strongly proscribes cross-cousin marriage and village/clan endogamy (Trautman, 1993).

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# Table 1: Descriptive Statistics

| Variable Definition | (1) All Women | (2) *Watta Satta* | (3) Non-*Watta Satta* | Difference (2) – (3) |
|---|---|---|---|---|
| Ever been estranged from husband | 0.186 | 0.202 | 0.177 | 0.024 |
| | | | | (0.016) |
| Ever been physically abused by husband | 0.199 | 0.215 | 0.189 | 0.026 |
| | | | | (0.017) |
| Major depression in last 12 months | 0.233 | 0.211 | 0.245 | -0.034** |
| | | | | (0.015) |
| Husband is blood relative | 0.769 | 0.856 | 0.720 | 0.136*** |
| | | | | (0.020) |
| Natal family within a one-day visit | 0.817 | 0.857 | 0.794 | 0.063*** |
| | | | | (0.015) |
| Socioeconomic distance index (*DI*) at time of marriage[a] | 1.505 | 1.294 | 1.624 | -0.330*** |
| | [1.162] | [1.072] | [1.193] | (0.049) |
| Hypergamy index (*HI*) at time of marriage[a] | 0.594 | 0.502 | 0.646 | -0.144** |
| | [0.926] | [0.816] | [0.978] | (0.031) |
| Age of woman | 28.2 | 28.2 | 28.2 | 0.0 |
| | [6.4] | [6.5] | [6.3] | (0.3) |
| Father of woman has no schooling | 0.683 | 0.756 | 0.643 | 0.113*** |
| | | | | (0.021) |
| Father completed primary school | 0.185 | 0.168 | 0.194 | -0.026* |
| | | | | (0.015) |
| Father completed secondary school or above | 0.132 | 0.076 | 0.163 | -0.087*** |
| | | | | (0.014) |
| Father owned no land at time of marriage | 0.470 | 0.489 | 0.459 | 0.030 |
| | | | | (0.024) |
| Father owned < 100 *kanals* of land | 0.397 | 0.371 | 0.412 | -0.040* |
| | | | | (0.022) |
| Father owned ≥ 100 *kanals* of land | 0.133 | 0.140 | 0.129 | 0.010 |
| | | | | (0.017) |
| Total number of brothers at time of marriage | 2.928 | 3.428 | 2.648 | 0.780*** |
| | [1.743] | [1.765] | [1.667] | (0.078) |
| Total number of sisters at time of marriage | 2.780 | 2.603 | 2.878 | -0.275*** |
| | [1.764] | [1.710] | [1.786] | (0.067) |
| Number of brothers ≤ 5 years older than woman | 0.910 | 1.243 | 0.723 | 0.520*** |
| | [1.120] | [1.307] | [0.951] | (0.054) |
| Number of sisters ≤ 5 years older than woman | 0.798 | 0.784 | 0.806 | -0.022 |
| | [1.013] | [1.053] | [0.991] | (0.042) |
| Number of observations | 3071 | 1101 | 1970 | |

*Notes:* Robust standard errors adjusted for village level clustering in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Standard deviations are in square brackets. Marriage is classified as a *watta satta* only if counterpart couple is also currently living together. For land variables, 1 *kanal* = 0.125 acres.

[a]See definition in subsection 2.2. Because of missing data on husband's family background, sample size is 2916 (1048 *watta satta* and 1868 non- *watta satta*).

## Table 2: Concordance Tests on Sister-in-law Pairs

| Marital Outcome | $p$-value[a] | Additional controls[b] | No. of sister-in-law pairs |
|---|---|---|---|
| Ever been estranged from husband | 0.007 | $\Delta m$, $\Delta m^2$, $\Delta m^3$ | 515 |
| Ever been estranged from husband | 0.010 | $\Delta m$, $\Delta m^2$, $\Delta m^3$, $r$, $r \times y^s$ | 515 |
| Log(months of last estrangement) | 0.005 | --- | 50 |
| Ever been physically abused by husband | 0.278 | $\Delta m$, $\Delta m^2$, $\Delta m^3$ | 518 |
| Major depression in last 12 months | 0.240 | $\Delta m$, $\Delta m^2$, $\Delta m^3$ | 521 |

[a] One-sided t-test on coefficient $\lambda_3$, as described in the text.

[b] All regressions include the sister-in-law's outcome ($y^s$), the *watta satta* indicator and the interaction between these two variables; $m$ denotes years of marriage, $\Delta$ the difference across sister-in-laws, and $r$ is a dummy for whether the husband and wife are blood relatives.

## Table 3: Marital Discord Model Estimates

| | ***Model I***[a] | | | ***Model II***[b] | | | ***Model III***[b] | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***WS*** | ***e*** | ***a*** | ***d*** | ***e*** | ***a*** | ***d*** | ***e*** | ***a*** | ***d*** |
| *Watta satta* (***WS***) | --- | 0.324 | 0.043 | -0.030 | -1.195*** | -1.749*** | -0.546*** | -1.099*** | -1.742*** | -0.538*** |
| | | (0.265) | (0.125) | (0.066) | (0.368) | (0.435) | (0.167) | (0.257) | (0.433) | (0.135) |
| No. older brothers ≤ 5 years (***NB***$_{[0,5]}$) | 0.145*** | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | (0.031) | | | | | | | | | |
| No. older sisters ≤ 5 years (***NS***$_{[0,5]}$) | -0.073** | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | (0.030) | | | | | | | | | |
| Total no. brothers (***NB***) | 0.103*** | -0.056 | 0.029 | -0.030* | 0.021 | 0.107*** | -0.010 | --- | 0.102*** | --- |
| | (0.017) | (0.047) | (0.026) | (0.017) | (0.032) | (0.037) | (0.020) | | (0.032) | |
| Total no. sisters (***NS***) | -0.066*** | 0.033 | 0.054*** | 0.022 | -0.022 | 0.004 | 0.006 | --- | --- | --- |
| | (0.016) | (0.033) | (0.020) | (0.016) | (0.029) | (0.026) | (0.017) | | | |
| Father completed primary school | -0.142* | 0.093 | 0.138 | 0.131* | 0.048 | 0.130 | 0.125* | 0.048 | 0.133 | 0.124* |
| | (0.073) | (0.140) | (0.121) | (0.076) | (0.104) | (0.140) | (0.074) | (0.102) | (0.142) | (0.074) |
| Father completed secondary or above | -0.426*** | -0.373** | -0.326* | -0.071 | -0.464** | -0.584*** | -0.120 | -0.449** | -0.589** | -0.118 |
| | (0.088) | (0.189) | (0.167) | (0.089) | (0.182) | (0.226) | (0.098) | (0.175) | (0.231) | (0.098) |
| Father's landholdings < 100 *kanals* | 0.009 | -0.088 | -0.238** | -0.004 | -0.097 | -0.276** | -0.008 | -0.091 | -0.274** | -0.007 |
| | (0.063) | (0.130) | (0.100) | (0.064) | (0.097) | (0.113) | (0.065) | (0.092) | (0.111) | (0.065) |
| Father's landholdings ≥ 100 *kanals* | 0.123 | -0.191 | -0.117 | -0.016 | -0.116 | -0.073 | 0.001 | -0.118 | -0.072 | -0.000 |
| | (0.098) | (0.185) | (0.149) | (0.100) | (0.162) | (0.176) | (0.099) | (0.158) | (0.180) | (0.099) |
| $corr(\eta, v_j) \quad j = e, a, d$ | --- | 0 | 0 | 0 | 0.429*** | 0.465*** | 0.238*** | 0.408*** | 0.451*** | 0.229*** |
| | | | | | (0.111) | (0.109) | (0.075) | (0.078) | (0.087) | (0.057) |
| $corr(v_e, v_j) \quad j = a, d$ | --- | --- | 0.619*** | 0.308*** | --- | 0.617*** | 0.316*** | --- | 0.610*** | 0.309*** |
| | | | (0.136) | (0.084) | | (0.039) | (0.050) | | (0.033) | (0.041) |
| $corr(v_a, v_d)$ | --- | --- | --- | 0.254*** | --- | --- | 0.342*** | --- | --- | 0.342*** |
| | | | | (0.076) | | | (0.046) | | | (0.042) |
| ***Log likelihood*** | -5,905.8 | | | | -5,891.8 | | | -5,893.0 | | |

*Notes:* Robust standard errors adjusted for village level clustering in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Estimation sample is 3,071 women. Joint estimation of three marital discord indicator equations -- estrangement (***e***), domestic abuse (***a***), and major depression (***d***) -- by nonparametric FIML with 3 points of support for the finite mixture distribution. All equations also include a cubic polynomial in woman's age and 12 district dummies. See Table 1 for more detail on explanatory variables.

[a]Correlations between first-stage (***WS***) and second-stage (***y***$_e$, ***y***$_a$, ***y***$_d$) equation errors restricted to zero ( $\beta_w = 0$ ).

[b]Correlations between first and second-stage equation errors allowed to be free ( $\beta_w \neq 0$ ). First-stage equation estimation results not reported.

# Table 4: Marital Discord, Endogamy, and Hypergamy

| | $\beta_m = 0$ | | | $\beta_m \neq 0$ | | |
|---|---|---|---|---|---|---|
| | ***e*** | ***a*** | ***d*** | ***e*** | ***a*** | ***d*** |
| *Watta satta* (***WS***) | -1.073*** | -1.618*** | -0.506*** | -1.287*** | -1.586*** | -0.594*** |
| | (0.207) | (0.384) | (0.109) | (0.206) | (0.296) | (0.102) |
| Husband is blood relative | -0.196* | -0.475*** | -0.133* | -0.601*** | -0.841*** | -0.263*** |
| | (0.104) | (0.130) | (0.070) | (0.184) | (0.155) | (0.081) |
| $corr(\mu, v_j) \quad j = e, a, d$ | 0 | 0 | 0 | 0.189*** | 0.194*** | 0.105*** |
| | | | | (0.054) | (0.047) | (0.030) |
| ***Log likelihood*** | | -7,390.5 | | | -7,376.6 | |
| *Watta satta* (***WS***) | -1.098*** | -1.753*** | -0.536*** | -1.162*** | -1.831*** | -0.594*** |
| | (0.276) | (0.451) | (0.139) | (0.201) | (0.342) | (0.107) |
| Natal family within a one-day visit | 0.244** | -0.076 | 0.087 | -0.129 | -0.581** | -0.044 |
| | (0.121) | (0.123) | (0.078) | (0.169) | (0.232) | (0.086) |
| $corr(\mu, v_j) \quad j = e, a, d$ | 0 | 0 | 0 | 0.179*** | 0.200*** | 0.103*** |
| | | | | (0.053) | (0.056) | (0.031) |
| ***Log likelihood*** | | -7,293.6 | | | -7,281.0 | |
| *Watta satta* (***WS***) | -1.106*** | -1.634*** | -0.533*** | -1.133*** | -1.718*** | -0.555*** |
| | (0.250) | (0.457) | (0.141) | (0.238) | (0.424) | (0.133) |
| Socioeconomic distance index (***DI***) | -0.030 | -0.071 | -0.023 | 0.001 | -0.033 | -0.012 |
| at time of marriage [a] | (0.040) | (0.045) | (0.026) | (0.051) | (0.061) | (0.027) |
| $corr(\mu, v_j) \quad j = e, a, d$ | 0 | 0 | 0 | 0.027 | 0.029 | 0.015 |
| | | | | (0.031) | (0.034) | (0.018) |
| ***Log likelihood*** | | -9,687.3 | | | -9,686.8 | |
| *Watta satta* (***WS***) | -1.093*** | -1.577*** | -0.520*** | -1.160*** | -1.718*** | -0.563*** |
| | (0.291) | (0.529) | (0.158) | (0.244) | (0.400) | (0.130) |
| Hypergamy index (***HI***) | -0.184*** | -0.287*** | -0.098*** | -0.080 | -0.166** | -0.064* |
| at time of marriage [a] | (0.050) | (0.065) | (0.033) | (0.060) | (0.075) | (0.036) |
| $corr(\mu, v_j) \quad j = e, a, d$ | 0 | 0 | 0 | 0.081** | 0.088** | 0.045** |
| | | | | (0.034) | (0.037) | (0.021) |
| ***Log likelihood*** | | -8,492.8 | | | -8,489.4 | |

*Notes:* Robust standard errors adjusted for village level clustering in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Estimation sample is 3,071 women unless otherwise noted. Joint estimation of the three marital discord indicator equations -- estrangement (***e***), domestic abuse (***a***), and major depression (***d***) – along with the ***WS*** and ***M*** equations (not reported) is by nonparametric FIML with 3 points of support for the finite mixture distribution. All models are based on Model III of Table 3, in which $\beta_w \neq 0$. $\beta_m$ controls the error correlation between the ***M*** equation and the other equations (see text); setting $\beta_m = 0$ is equivalent to treating the ***M*** variable as exogenous.

[a]Modeled as a five category ordered probit (three threshold parameters not reported). Estimation sample is reduced to 2,916 women because of missing data on husband's family background. Estimates of $\alpha_e$, $\alpha_a$, and $\alpha_d$ from Model III on this reduced sample are, respectively, -1.093 (0.239), -1.640 (0.431), and -0.532 (0.133).